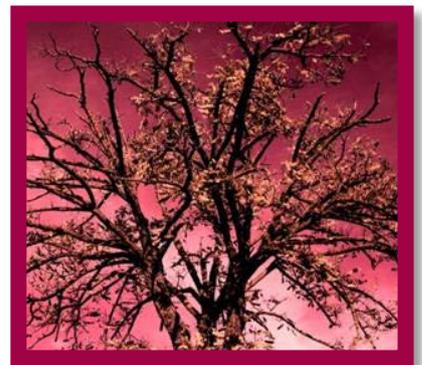
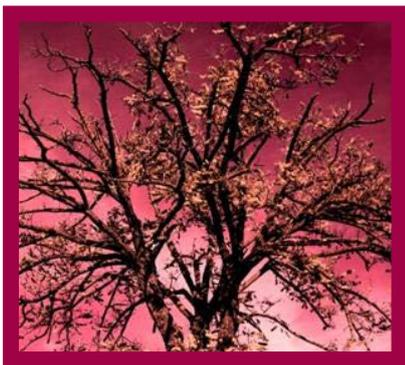


NEW RESEARCH VOICES

International Journal of Research from the Front-line

SYRIAN ACADEMICS IN EXILE



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NEW RESEARCH VOICES

International Journal of Research from the Front-line

SYRIAN ACADEMICS IN EXILE

Paul O'Keeffe and Zsuzsanna Pásztor

Editors



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Table of Contents

PART I. Introduction and opinions

Acknowledgments	6
Introduction to the Volume	7
Interview with James King -(IIE-SRF).....	10
Syrian Academics between Reality and Ambition: The Perspective of a Syrian Academic in Exile	17
Returning Before the Crisis and then Leaving Again	20

PART II. Articles and interviews with Syrian Researchers in Exile

The Role of Risk and Resilience in Access to Education: A Case Study of a Syrian Community School in Beirut Lebanon	23
Data Analytics in Citizen Cyberscience: Evaluating Participant Learning and Engagement with Analytics	46
Interview with Dr. Oula Abu-Amsha	78
Governance of Agriculture in Syria between Economics and Politics: Analysis of the Pre-Revolution Period	83
Interview with Dr. Ahmad Sadiddin	94
Algorithm and Techniques of Prediction, Data Mining, and Big Data Analysis for Healthcare, Society, Trade and Industry.....	101
Interview with Ammar Suhail Balouch.....	132
Copyright (Amidst) Chaos in Syria: One Step Forward... ..	136
Interview with Jamil Ammar.....	156
The Lesbian Subjectivity in Contemporary Arabic Literature: ‘An Absent Presence’ Disciplined by the Gaze	162

Procedural Techniques for Simulating the Growth of Plant Leaves and
Adapting Venation Patterns..... 181

PART III.

The Jamiya Project – Syrian Higher Education in Exile: Reconnecting
Students and Academics..... 198

Submission Call: Migrant Students in Exile 201

Who We Are..... 202

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The Scholars at Risk Network

Netzwerk Flüchtlingsforschung

Scholars Rescue Fund – Institute for International Education

European Universities for an Open World

Science 4 Refugees

Chomsky.info

Refugee Research Network

Independent Social Research Foundation

Emerging Scholars and Practitioners on Migration Issues Network

Humanity in Action

European Universities Association Refugees Welcome Map

The International Network for Education in Emergencies

Introduction to the Volume

The Syrian civil war has raged for the last 5 years. As things go from bad to worse, with no end in sight, 11 million people have been killed or displaced since March 2011. The war has decimated not just peoples' lives but vital services, such as education, that will be needed if the country is ever to find its way out of the current chaos. Universities in particular have felt the full force of the crisis with faculties bombed on a regular basis, students and teachers fleeing overseas and all semblance of normality lost to the on-going destruction.

In the West a different kind of war is brewing. As hundreds of thousands of Syrians seeking refuge make their way to our shores, migration systems are collapsing, border fences are shooting up and far right ideologies which demonise all migrants are gaining ground. While there is just cause for concern about capacity to welcome migrants in an economically stretched Europe, and real concerns about the integration of new comers, genuine refugees and asylum seekers are facing a backlash from ever increasingly critical societies. All across the West we see refugees being scapegoated and a growing reluctance to help those who genuinely need our help. Somewhere in the mess and confusion we are beginning to lose sight of just why so many migrants and refugees are seeking new lives in the West, more pertinently, the positives that these people bring with them.

Syrian academia is just one of the many casualties of the Syrian crisis. As the country slips further into chaos, a whole generation of education is in danger of being lost as hundreds of thousands of students and teachers flee the country and hundreds of thousands more lose out on the opportunity to avail of higher education. With universities and colleges shut or subject to daily bombings and faculties decimated by death and migration, the chances that academia can help to rebuild that country, if and when peace comes, get smaller and smaller. Some of the brightest and best Syrian academics have managed to avail of rare scholarships and fellowships overseas where they can continue their work in exile. These lucky few have the opportunity to build their knowledge in the hope that one day they can return and help their country to rebuild.

In our inaugural volume, "Researchers in Exile", we presented the work of various researchers from around the world, including the Syrian scholar, Amal Alachkar. In this specific New Research Voices volume, we present 7 academic articles from 6 Syrian academic researchers in exile in different parts of the world, together with the

stories of some of these scholars. It is intended to be a showcase of some of the Syrian academic talent that has been displaced around the world and those who have the ability to contribute to the future rehabilitation of their country.

The research topics presented in this volume include a wide range of topics from the social sciences to other scientific fields related to societal welfare. The research topics presented in this volume include: difficulties of refugee education in Lebanon, the role of agriculture in the Syrian uprising from an agri-economics point of view, intellectual property rights in Syria, sexuality and lesbian subjectivity in contemporary Arab literature, procedural techniques for plant growth, and opportunities that data analytics can provide to improve modern healthcare services and online education performance. While these topics vary greatly, their inclusion serves as a reminder of the variety of Syrian academic expertise that exists around the world and offers a window into the wide variety of research being carried out by scholars in exile, not only in the social sciences, but also in other natural and applied sciences, e.g. engineering, healthcare, philosophy and in many interdisciplinary fields.

The volume not only draws attention to the important research topics being carried out by academics while they are in exile, but also shines a light on many Syrian academics who are willing and able to help their country recover in the future. If and when peace comes, education will be key to ensuring a lasting recovery. The many thousands of Syrian academics displaced around the world, despite the many barriers placed in front of them, struggle to maintain and build on their academic skills and offer one of the best hopes for the future of Syria.

Despite the difficulties they face these scholars are striving to succeed in their academic fields, contributing to academia and are primed to be at the forefront of their country's rehabilitation. By helping their troubled peers, Western academics and academic institutions have a unique chance to play a decisive role in the process of not only preserving the cultural and scientific heritage, but also rebuilding the education system in Syria.

Before presenting the research and interviews, in order to gain a better understanding of the issues that have effected Syrian academia over the last 5 years, and to gain an appreciation of the struggles Syrian academics face, we lay out the 3 following conversations. Firstly, we present an interview NRV carried out with James King, the Assistant Director at the IIE-SRF. This interview explores the effects of the crisis on the Syrian higher education system and offers an insight into real-life difficulties Syrian professors, students and scientists face and the sterling work of the Scholar Rescue Fund in supporting many Syrian academics around the world. This is followed

by contributions from two Syrian academics on their motivation for leaving Syria. A Syrian academic, who is now in exile in Canada, shares his insight into the crisis' effect on Syrian academia. Finally, another Syrian academic in exile in the United Kingdom gives us his personal story of leaving Syrian to pursue his academic career overseas and his thoughts on the future of the country.

As a conclusion to the volume we have included an introduction to the Jamiya Project. This project aims to reconnect Syrian students with their higher education while in exile. The project is currently being developed and offers a solution for preventing the loss of an entire generation of education.

To support the research in this volume, and to give a clearer insight into the difficulties academic exiles face, we have included interviews with some of the contributors. These interviews elaborate on the researcher's work and their efforts to maintain Syrian academia in exile. In addition to being presented in this volume, most of these interviews are also available for download as podcasts on our website along with the interviews from our previous volume 'Researchers in Exile' at <http://newresearchvoices.org/interviews/>.

Due to personal reasons and the sensitivity of their research, some of the authors choose to remain anonymous or declined to be interviewed. New Research Voices is aware of the ethical considerations and sensitivity of publishing personal information about people in exile, and therefore in this unique volume we decided to accommodate these authors. All the personal information enclosed in this volume is with the permission of the authors.

New Research Voices would like to once again thank all the contributors to this volume. We hope that it goes some way towards building awareness and support for the many brave Syrian academics who shine the brightest lights for a peaceful and prosperous future for the country.

Paul O'Keeffe and Zsuzsanna Pásztor, April 2016.

Interview with James King

Assistant Director Scholar Rescue Fund - International Institute for Education



James King is the Assistant Director of the Scholar Rescue Fund at the Institute for International Education (IIE-SRF). He is the co-author on two reports published by IIE and the University of California, Davis that focus on the impact of the Syrian refugee crisis on higher education: “We Will Stop Here and Go No Further: Syrian University Students and Scholars in Turkey¹” and “The War Follows Them: Syrian University Students and Scholars in

Lebanon².”

NRV: Can you give us some background on the Syrian crisis and its impact on higher education?

Jams King: The Syrian crisis is one of the great humanitarian crises of our time. I think most people are at least aware of some of the devastation. Half the country is displaced, either internally or living as refugees. A significant portion of the country is controlled by the so-called Islamic State. Other areas are contested between the regime and various opposition groups. It has now been on-going for 5 years. What people maybe don’t realise is the impact that the conflict has had on higher education specifically.

Most people are not aware that Syria had a quite strong and accessible higher education system prior to the war. So if you look at some of the statistics from 2010/2011, about 25% of Syrian young people benefited from some post-secondary education. It was about 50/50 men and women. As a result, this has been a very different conflict for the international humanitarian and higher education communities. Places like Afghanistan or Rwanda, other sites of large-scale conflict from recent memory, didn’t necessarily involve large higher education systems. So in that regards, it’s been new for the international higher education community to

¹ http://scholarrescuefund.org/sites/default/files/pdf-articles/we-will-stop-here-and-go-no-further-syrian-university-students-and-scholars-in-turkey-002_1.pdf

² <http://scholarrescuefund.org/sites/default/files/pdf-articles/the-war-follows-them-syrian-university-students-scholars-in-lebanon.pdf>

recognise that we can play quite a big role in ameliorating some of the impact of the general crisis in Syria.

If you want to look at specific numbers to give you a sense of how the conflict has impacted higher education, amongst the 4 million Syrian refugees, we estimate that there are anywhere between 1,500 and 2,000 professors. That's a large number. Some have been able to find work, but the majority have not. What you have is a large number of university professionals, researchers, professors – individuals with vast experience in their fields or individuals who were just starting their careers. Their careers have now been put on hold indefinitely without international support. In addition, there are many students. We estimate that there is a minimum of 100,000 university qualified students – that's a low estimate – living in Turkey, Jordan, and Lebanon. Some of those students were enrolled in Syrian universities and were forced to leave. In other cases, they are secondary school students who would normally be at the university level by now but haven't been able to do so. So this is, in many ways, the hidden cost of the war. It is very true that education is the hidden cost of this war.

[As of March 1, 2016, there are over 4.8 million refugees according to the United Nations High Commissioner for Refugees.]

NRV: What is the current state of higher education/academia in the country?

James King: Within Syria, at present, a number of universities are closed. Many of the private universities have been closed. Of the 5 major universities, several of them are not operating at all or are operating at limited capacity. There are, of course, university students as well as professors doing their best to get themselves to university, in some cases risking their lives. That has become extremely challenging in some contexts, as the student dorms are now used to house internally displaced persons (IDPs) within Syria. For that reason, the universities can't house students. So the students are travelling quite far across checkpoints, dealing with concerns regarding compulsory military service.

[Additional note: Conscription in the Syrian military is mandated for all men over the age of 18, though various deferments – health, family-related, educational, etc. – have been available. All adult men are expected to have their military service booklets, which lists their service completed and/or deferments, on their person at all times, and they are required to present these booklets whenever crossing a military checkpoint. In late 2014, the Syrian government initiated a concerted effort to tighten military service

loopholes and to punish violators. This included limiting educational deferments. There are reports of the government establishing “flying checkpoints” – roaming, temporary checkpoints that aim to catch military service dodgers – outside or near university campuses. The government’s prioritization of compulsory service also impacts Syrian university professionals. It has, for example, issued a directive that higher education institutions only hire faculty who have completed their military service, and in addition, university administrations could withhold salary in order to compel an employee to report for service.]

In terms of the university professionals, there are many who have elected to remain in Syria, but many others have fled. What you see is under-qualified professors teaching courses at Syrian universities. Professors often tell us that even simple things are difficult – for instance holding a final exam that has to be rescheduled for weeks because of bombing or a percentage of the students weren’t able to make it. The odds are really against them.

NRV: As we know many academics tend to be first in the firing line when regimes are threatened. In Syria's case this has been particularly a problem in the run up to the current crisis. How does the IIE Scholar Rescue Fund assist Syrian Academics (the processes involved for applications, how many academics you help and so on).

James King: IIE-SRF was established in 2002. Since then, we have supported more than 600 scholars from 55 countries. Our work is not focused just on Syria, but since the beginning of the Syrian conflict, and especially since late 2012, our work has been dominated by the situation in Syria because it has been just so devastating for professors. We have supported more than 80 Syrian faculty, placing them at 70 different institutions in 12 countries all over the world. When a scholar applies to us-- and they can either be in Syria or have fled – and is awarded the fellowship, we arrange for them a visiting academic position with an institution outside of Syria. In some cases, this academic placement may be within the country where they have been forced to relocate to, or in other cases, we have been able to place them in universities in other countries, typically in North America or in Europe. We give them a one year visiting fellowship where they can teach, conduct research and so on. The goal is for them to be integrated as regular professors. Some of our professors are keen to talk about their situations, to educate people about what is going on in Syria. Others are not, preferring to be a scientist and just focus on their academic work. The fellowship is for one year and can be renewed then for a second year. I would say in the context

of the Syrian crisis, we have been very encouraged by the support from universities and other institutions in the U.S. and Europe in particular, which are stepping up to host scholars through our program. Of course, we are always seeking other hosts, but we are very encouraged by the response.

NRV: Is it possible to receive a scholarship if you do not have a PhD?

James King: Our programme is focused on individuals who have their PhDs and are working in research institutions. That being said, we support a number of young professors who have just received their PhDs and haven't had the opportunity to realise their full potential. We have just announced a partnership on a project with the Finnish Ministry of Education's Centre for International Mobility to support a number of young, junior Syrian and Iraqi researchers at Finnish universities. In terms of advanced students who do not qualify for our fellowship, there are some select programmes that focus on graduate students. Still, the support that is available is really a drop in the ocean.

NRV: What is the profile of the applicants that you get for the SRF. Are they people who have already made their way to the west, have existing ties with universities in the west, are they in the camps, are they still within the country?

James King: We hear from any and all. The majority are from professors within Syria, but as the conflict persists that's less and less the case. We hear from professors who are living within the camps in neighbouring countries. We do on occasion hear from professors who have already made their way to the west and for whatever reason haven't been able to resume their academic careers. We prioritise academics within Syria. They often apply with some academic connections outside the country, and when we are able to facilitate continuing their work at institutions where they have pre-existing relationships, that is the ideal scenario. But it is not always possible.

NRV: What are the main obstacles for the scholars (documentation, funding, psychological barriers etc...) who wish to apply for funding?

James King: There are many barriers. First of all, not all scholars have passports. In some cases, their dependents don't have passports. You have to remember that securing documentation isn't always possible when you are fleeing. This is an even bigger challenge for the students, who, in many cases, don't have access to their transcripts. They weren't able to go to the universities and ask for their transcripts. Imagine tomorrow if you had to flee to another country, you are not going to be able to go to your university and deal with the bureaucracy. That is a huge barrier. The next step is the visa, but once the scholars can get to their host campus, we are here to support them in whatever ways are helpful. There are issues of trauma for many of the scholars. Reintegrating into the academic community is one of the best ways to deal with this. That is tremendously important in terms of getting themselves back to the kind of lives that they would like to live. Hosts are often really helpful. Some have services like counselling readily available for them.

NRV: The idea behind this volume is to give a voice to the many talented Syrian academics who have been displaced around the world and to provide a showcase for the academic talent that will be necessary to rebuild the country. How quick has the international academic community been in coming to the assistance of Syrian scholars? What else can the international community do to assist Syrian academics in exile?

James King: We have been encouraged by the response from host partners, but the demand so far outstrips what has been provided. Some of that comes down to funding. Organisations like IIE-SRF need more funding and we need institutions to host more scholars. We would love to see more institutions making decisions to hire scholars independent of external support. I think that is something that needs to happen more. One of the real challenges is that so many of these professors are in countries neighbouring Syria. A legitimate question is what can an institution in the U.S. or, for instance, in France do to support a Syrian professor who is living in a refugee camp in Lebanon. There are ways to support that particular professor, e.g. language training, especially in Turkey and Lebanon. Without that, professors simply are not going to get jobs in the local higher education system. Institutions outside of the region that have pre-existing partnerships with institutions within the region, insofar as it is

possible, should make support for the Syrian university faculty and student population a priority. It is very difficult for institutions in the region to create programmes or raise funds to support their colleagues on their own. A place like Lebanon is already so under-resourced, Jordan as well. When universities outside the region can offer positions that is really helpful.

[Additional note: IIE estimates that there are many as 2,000 professors among the Syrian refugee population. For the front-line hosting countries, which are already dealing with scarce resources and, in many cases, saturated higher education systems, in addition to restrictive labor laws, hiring Syrian faculty is extremely difficult.]

NRV: Do you see a difference between the European and the American response?

James King: Not necessarily in terms of the higher education institutions themselves. Within the last year, we have seen European institutions become more involved in our programs. In December, the Alexander von Humboldt Foundation in Germany launched a programme for threatened scholars. IIE-SRF was one of the partners in that initiative. That was incredibly encouraging. Our partnership with the government in Finland is another example. I do think there is a growing recognition of the need for these programmes in Europe. Maybe it is because those countries are encountering the refugees in daily life. In the U.S., I think it is less likely for an institution to be impacted by the crisis, so it is our job at IIE to educate them about the situation and how we can help. For the most part, we have seen really encouraging responses. It then becomes a challenge of funding. Much more needs to be done. The problems and the crisis are snowballing. But if we compare it to two years ago, then there is a much bigger awareness of our collective responsibility to help.

NRV: Is there anything being done within the camps to help the students?

James King: There are initiatives that have been developed and are being developed, some of which involve Massive Online Open Courses (MOOC) or other e-learning platforms and some of which involve integrating the students within the national higher education systems. For example, in Jordan IIE runs a pilot initiative where we focus on students who have already got themselves enrolled at Jordanian universities. This is the biggest barrier, just getting yourself enrolled. We are working with them

and their universities to issue mini grants so they don't drop out due to financial problems. There are a few initiatives like that. UNHCR has a great higher education scholarship programme in the region and internationally for refugees – the DAFI programme. Turkey itself has taken a number of steps to support Syrian university students to continue their studies within Turkey. Again, the demand so far outstrips what opportunities are available. In Turkey, where enrollment has increased rapidly, Syrians have learned to navigate a very complex system, but of the current number of Syrian students enrolled, it is still only about 3% of the university-aged population. That is more than twice what it was the previous year, but it is still very low. Young women are affected a lot more. Syrian young men are about 3 times more likely to be attending university in exile than women.

Syrian Academics between Reality and Ambition: The Perspective of a Syrian Academic in Exile

Anonymous*

Under the shadow of the ongoing war in Syria the international community has failed to impose possible solutions to defeat terrorism, overthrow the dictatorship and work towards building a civil state that respects all its citizens regardless of their race, religion and sect. Syrian academics, in particular, are exposed to great risks in this conflict. They are faced with not just expressing their rejection to the oppressive practices of the Syrian regime against its own people and the extremist groups that operate to impose their ideas by force, but also speaking up about what is happening around them – the killing of civilians who are merely asking for their freedom and for their dignity.

In general, there are no Syrian academics in the regions where ISIS has seized control. Most have fled along with large portions of the population. In other parts of the country, where the government controls, some academics remain but live under a system that has repressed academic freedoms and savaged human rights. Under such conditions, Syrian academics have one of two bitter choices – either to remain in the governmental controlled areas under the regime suppression or flee the country.

Unsurprisingly a large number of Syrian faculty members have left the country. While there are obvious benefits for leaving the country, there are also consequences. If a faculty member leaves the country without permission from the Ministry of Education (which is virtually impossible to obtain), they lose all their entitlements and privileges, including their pensions which so many have devoted long service to contribute to.

The faculty members who have decided to stay can be classified into three categories. The first category is a group of faculty members who favor the regime and support its aggressive actions. Most of these people have graduated from universities in Eastern European countries and are staying in Syria, either to the lack of the academic qualifications or because they do not have language skills to enable them to work at Western universities. The second category comprises faculty members who find it is

* The author of this opinion piece/article has chosen to remain anonymous due to security reasons.

difficult to leave the country either because they do not have the required qualifications to compete in their academic fields internationally or they do not want to risk their lives by leaving the country. They know that life without a secure income abroad would be very difficult and fear the harsh measures the regime would take against them if they left. The third category include those who can't leave due to social and family circumstances. For those that have stayed academic life is as bad as it was before the war. The corruption, the lack of academic freedom the persecution of academics all continues.

In general, Syrian academics who have left the country can be divided into two groups – depending on when they left the country. The first group, made the decision to leave Syria in the first three years of the war. They mostly held foreign nationalities (particularly from Western countries) which helped to facilitate the departure process for them. This group also includes those who held certain political stances against the regime's policy in suppressing freedoms and human rights. Many of them were unable to secure academic jobs outside Syria but had to leave anyway due to the fear of repercussions for their stances. The second group, made the decision to depart within the last two years. The reason they left was mostly due to the difficult economic situation and their inability to afford the high living expenses (the inflation rate which increased eight times, with fixed salaries for faculty members of about 300 USD).

In light of the terrible situation some international organizations such as the Scholar Rescue Fund – Institute of International Education (SRF-IIE), Scholars at Risk Network (SAR) and Council for At-Risk Academics (CARA) have offered to many Syrian academics. Unfortunately, many more Syrian academics are not able to obtain Fellowship grants to continue their work overseas from foreign universities through these organizations support. Syrian academics abroad find themselves in a difficult situation, especially when they are for many reasons unable to secure an academic job. For many, academia is more than a job, it is a devotion.

Preserving Syrian academia is also the best hope for the future. This current situation requires a special support from international organizations to find new and innovative mechanisms to allow Syrian academics to continue their activities outside Syria so that if peace comes they can help rebuild the country. In particular, we need to strengthen international cooperation between international organizations and universities in the Middle East and North Africa – especially in Syria's neighboring counties in order to host those academics whose language skills limit their chances of securing fellowships from Western universities. Not only would this reduce the language barrier constraint, it would also be cheaper as living expenses in these

countries is much lower than in the West, thus allowing more scholars to continue their work and extend the time they receive Fellowships for.

I would like to thank all the international organizations for their efforts to support and assist Syrian academics and hope they will continue to do so in the future.

Returning Before the Crisis and then Leaving Again

Dr. Bahaa Amiri*, IIE-SRF Fellow

Introduction

The Syrian situation continues to burn unabated – a conflict which becomes consistently more entrenched, violent, embittered and bloody. After decades of dictatorship and the absence of a culture of free speech and thinking, the last few years (1995 - 2010) had begun to witness a slow improvement in education in Syria, thanks largely to the presence of young scholars educated abroad. After finishing my PhD in France I wanted to contribute to this and decided to return back to Syria. I was eager to participate in the scientific improvement in our universities. My intention was to transfer the knowledge, scientific experience and the willingness to communicate and cooperate with the rest of the world to Syrian students so I returned back to Syria before the ignition of the Arab uprising.

A few months later, the Syrian uprising started as part of the Arab spring in March 2011. Early in 2012, the Syrian universities, notably the University of Aleppo, were effectively involved in the demonstrations that were taking place. The brutal reaction of the regime's army and intelligence agencies to these demonstrations was without mercy. As a result, many of the activists (the majority were university students and staff) were killed, kidnapped, injured or arrested. I lost many of my colleagues and students. At times, I participated in the demonstrations in my area and sent some representative videos abroad to be broadcasted.

At the end of 2012, it was a new stage in life for me. Firstly, I've never thought that the situation would last such a long time. Considering the other uprisings in the region (in Tunisia, Egypt, Libya and Yemen) I thought that an international intervention would take place. Secondly, I was concerned for myself and my family (my wife and my two children), in case I would be accused or arrested regarding the known criminal reputation of the regime's agencies. Therefore, I focused my efforts on helping the activist students and working in human and health field while practicing a high degree of vigilance.

*Pseudonym

After military actions increased dramatically, as some areas were liberated and controlled by local rebels while others were still under the regime's control, the regime had started to use airplanes, barrel bombs and scud missiles. This resulted in mass destruction of cities and villages. During which time, my efforts were focused on providing human and medical aids.

Life became more and more dangerous and difficult because the bombs fell everywhere and even the University was attacked by air strikes. Consequently, the number and the rate of casualties became higher. The regime had begun to enlist help from foreign militia troops from Iran, Iraq, Lebanon, Afghanistan and other places. While the rebel groups were numerous, they were not well-organised and unprofessional – especially in ruling the region under their control. At that time, the borders were open, so many radicals and extremists sneaked through them. Moreover, the regimes (in Syria and in Iraq) released many extremists from prisons, who later formed ISIS and similar extremist groups and imposed their control on large area of Syria and Iraq.

A New Life in Exile

At the end of 2013, when the situation became catastrophic, I decided to leave the country. I applied for an SRF-IIE fellowship and I was granted it in June 2014. I moved to Lebanon to apply for the Visa after which I then travelled with my family in the UK.

It was a completely new life for all of my family. We noticed just how far we had got from a normal life in Syria during the previous years. People in the UK were so friendly and sympathetic with Syrians. The children needed about three months to adapt to their new school and to improve their English. My wife had to take exams in order to get a qualification equalization and maintain her career. For me, working in academia – one of the most competitive fields in the UK – required me to improve my qualifications and experience in order to maintain my position. In addition to these mundane necessities we also had to adapt to life in the UK. Although we feel well settled here, we think about the situation in Syria daily and one day we can return to our beloved homeland.

The Future of Syria

Even after all that has happened I keep the hope that the future of Syria will be better. I believe that the Syrian people have accumulated a very important experience of how to live, work and improve in the most difficult of situations. An important percentage of the population has relocated to advanced countries and experienced democracy, health care systems, economic and social life and so on. I think they will try to copy and mimic all that they have learned when they return home.

In my opinion the first step needed for a new Syria should be the establishment of an advanced juridical system to face the challenge of transitional justice and conflict resolutions. This juridical system will be the warden that controls and oversee the new authorities' performance. I hope that the formation of this juridical system starts from now. Then the reformulation of the political system will be the essential step to construct a state of freedom, justice and equality for all citizens.

The rebuilding of the economy is essential to regain stability in Syria. Reconstruction of cities and villages will be the priority but we also need to consider other activities such as agriculture. As one of the most important sectors in Syria, we need to start projects such as distilling water from the Mediterranean for use in agriculture and industry. Projects such as distillation of Mediterranean water, drawing water from Dejla river and refined used water for agriculture and industrial use. Gas and petrol projects on the Syrian coast also present an important for the Syrian economy. There are a lot of possibilities for the future.

Conclusion

I firmly believe that Syrians are in need of more than simple food or material support; they need help from the international community to achieve a real end to this long-lasting disaster in their country. This can only be achieved when Assad and his regime steps down. This will give way for the establishment of a new republic in which a free, united, democratic Syria will continue to be our dream.

The Role of Risk and Resilience in Access to Education: A Case Study of a Syrian Community School in Beirut Lebanon*

Oula Abu-Amsha, PhD**

Abstract

Lebanon is currently hosting over one million Syrian refugees. Despite the government granting refugees access to the public system a small proportion of school age Syrians study in Lebanese schools and many non-formal barriers to accessing education remain. Non formal learning spaces for refugee students have been established to bridge the gap. This case study considers the experiences of students in one such centre in Beirut in 2014. Using a resilience framework that focuses on those socio-ecological processes and mechanisms that help or hinder positive outcomes for at risk communities, this study qualitatively explores risks faced by the students. The findings highlight the importance of ‘hidden’ adversities that may impede upon the successful integration of the refugees within the host community education system and society. Specifically, it identifies several structural elements which appear to adversely affect access to education for young Syrians. Additionally, the study draws attention to the strengths that exist within the Syrian refugee community which could be better mobilized to support access to quality learning opportunities for Syrian refugee children. Namely, the Syrian refugee community – which includes teachers and highly motivated volunteers – appears as an important source of emotional support for the refugee children that educational programs may benefit from. The findings of this study suggest Syrian refugees would benefit from

* This article considers research conducted in spring 2014. Although the Syrian refugee schooling conditions might have changed since then with various actions that partners are taking on the ground, we believe that most of the findings of this study still apply in similar exile contexts. A full version of the article is at present under revision for publication in the Journal of Education in Emergencies.

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more holistic education approaches that include support for their parents as they transition to their new environments.

Introduction and Context of the Study

Since 2011, Syrians have fled on mass, principally into Jordan, Iraq, Turkey and Lebanon. A significant proportion of those displaced are school age children and the conflict has wreaked havoc on their access to education. In 2010 enrolment rates for Syrian primary and secondary level education stood at 118 and 72 percent respectively.³ In contrast the percentage of refugee students accessing education is substantially lower. For instance, the UNHCR mid-2014 Regional Response Plan (UNHCR, 2014a, p. 24) reveals that only 22 per cent of registered Syrian refugee children in Lebanon were enrolled in formal education (the lowest proportion of refugee enrolment among host countries). This fact persists in spite of the agency and government efforts to improve access to education for refugees.

Problems of access to education are sadly nothing new for refugees (Dryden-Peterson, 2011). In Lebanon however, a policy of refugee integration has been pursued. Host community integration has been identified as a ‘guiding concept’ in the provision of support for refugee communities, and since 2012 the Lebanese government issued a memorandum to allow Syrian students access the Lebanese system (UNICEF and Save The Children, 2012). During the 2013/14 school year, the Lebanese Ministry of Education and Higher Education (MEHE), with the support of the UNHCR, supported the enrolment, of close to 90,000 out of 400,000 school age refugee children in Lebanese public schools (UNHCR, 2014b).⁴ More positive education outcomes might therefore have been expected.

Syrian refugees in Lebanon live mostly in host communities. For political and historical reasons, the solution of founding refugee camps was excluded, but with the massive arrival of very vulnerable communities, informal settlements appeared in the rural regions and in the suburbs of big cities (Save The Children, 2014, p.17).

³UNESCO Institute for Statistics. Catalog Sources World Development Indicators: <http://data.worldbank.org/indicator/SE.PRM.ENRR> and <http://data.worldbank.org/indicator/SE.SEC.ENRR>

⁴ Thirty thousand of these children were enrolled in a specially created second-shift program to absorb the refugees. In addition, more than other 5,000 additional refugee children were being reached by non-formal education programs. A more ambitious project: “Reaching All Children with Education” (RACE) was launched in May 2014 to absorb the majority of the Syrian school-age children in Lebanon on a three-year plan (UNHCR, November, 28th 2014)

Education Challenges specifically facing Syrians in the Lebanese context are multiple and put forward in many NGO's reports (e.g. UNHCR, 2013; Unicef and al., 2013; UNICEF and Save The Children, 2012).

For instance, available literature suggests that the effective integration of Syrian refugees in Lebanese schools is challenged primarily through differences in language of instruction (Unicef and al., 2013; UNICEF and Save The Children, 2012). Lebanese schools have a long tradition of teaching significant portions of the curriculum in French or English, whereas the Syrian curriculum is taught in Arabic. Foreign languages in Syria have historically been given far less support. Since the majority of Syrians rely on public schools especially in rural areas and small cities, opportunities to develop language fluency have also differed between regions and socio-economic status. Parents in big cities and with financial means may develop their children's language skills through summer courses or by opting for private schools that offer a different language curriculum, solutions that are not necessarily widely available in the rural regions.

Additional challenges arise from the limited capacity of the Lebanese public system to absorb so many refugee students. In some schools, Syrian students outnumber their Lebanese peers. Lebanese public schools have resorted to double shifts and hiring additional contract teachers to meet the extra demand (ODI, 2014; The World Bank, 2013b). In fact, the Lebanese public system severely lacks resources and since the Lebanese civil war has suffered from declining quality standards (Zakharia, 2004). Today it accounts for only 30 percent of overall education provision (UNHCR, 2015). Private or semi-private education providers absorb the majority of Lebanese students (Le Commerce du Levant, 2013), a solution which most displaced Syrians cannot afford. Community based education has sprung up in response.

In this context, non-formal education seems to be one of the solutions that the ministry of education and the UNHCR are building upon to provide rapid access to education to Syrian refugee children (UNHCR, 2014c).

Jusoor is an NGO established by a movement of Syrian Diaspora in 2012. Since 2013 it has operated an aspiring refugee education program (Jusoor, 2014). This includes a non-formal education centre opened in mid-2013 in Beirut, and a tented school and a second school for Syrian refugees opened in spring 2014 in the Bekaa Valley, a rural region in Lebanon. This study focuses on the experiences of Syrian students and volunteers in the Beirut centre (which will be referred to as Jusoor's school from here on in).

During the school year 2013/20145, young Syrian volunteers at Jusoor's school provided Syrian children (up to 14 years) with non-formal education and after-school support. The primary objective of the school is to prepare the students to integrate into Lebanese public and private schools. Reflective of this the word Jusoor means 'bridges' in Arabic. Children also receive some food for lunch and psycho-social support. The school runs during four days per week, four-level accelerated learning program that includes Arabic, English and Maths. Children are placed according to their cognitive capacities rather than their age. Students who already are in Lebanese schools keep in contact with Jusoor's volunteers on Friday⁶ where they come to school for extra-scholar activities and help with homework. At the beginning of the school year, Jusoor staff arranged through contacts, financial aids and tuition waivers to place many children in Lebanese public and private schools. However, many of these students ended up leaving the Lebanese system within less than one semester. Instead they returned to Jusoor's school or abandoned their education completely. According to Jusoor, the students reported experiencing a range of transitional difficulties. These included the language barrier but also strained family financial resources, feeling unwelcome and even suffering from violence and mistreatment at the Lebanese schools. This study is a preliminary rigorous exploration of the educational challenges and sources of opportunity for Syrian refugee students. It is guided by the following research question:

"What are the factors and processes that help Syrian students receiving non-formal education transition to (public or private) Lebanese schools?"

Theoretical Framework

Several studies have been conducted in the context of the Syrian refugee crisis, both to evaluate the needs of the refugees and assess the conditions of the Lebanese educational system. These include the JENA assessment launched in mid-2013 (UNHCR, 2013a) as well as surveys conducted by NGOs operating on the ground (i.e. NRC, 2013; Reach, 2014). Many of these studies are premised on a risk assessment framework to capture the vulnerabilities of refugees and the deficits within the current set up. While recognising the acute adversity and tremendous needs of the refugees, this study is premised on a different perspective: one that seeks to also capture the

⁵The educational strategy of Jusoor has changed since then and hired teachers mostly to deliver the teaching.

⁶The weekend in Lebanon differs among regions and (even suburbs), it could be Saturday and Sunday, or Friday and Sunday.

strengths and assets of the refugee community in the face of these risks. Syrian stakeholders, such as those involved with Jusoor's school, speak to the resilience of the refugee community and may be able to play a more active role in shaping effective education responses.

Broadly speaking resilience is the process of adaptation and transformation in contexts of risk. Recent resilience research stresses the importance of social ecological processes in supporting resilience (Ungar, 2011; Ungar 2013; The World Bank, 2014). It considers multiple levels of risks and supports that exist across individual, community, institutional and even cultural levels. Studies on resilience within educational contexts have pointed to the importance of both sources of support – caring teachers, peer support for both academic and emotional challenges, welcoming and safe school environments (Cefai, 2008; Gizir & Aydin, 2009; The World Bank, 2013a) – as well as ethno-cultural factors such as spirituality and religion, ethno-cultural identity and belonging and cultural beliefs regarding education (Zakharia, 2013; Ungar & Liebenberg, 2013).

In keeping with the theoretical framework of the social ecology of resilience this study is premised on the following understanding of resilience: “In the context of exposure to significant adversity, resilience is both the capacity of individuals to navigate their way to the psychological, social, cultural, and physical resources that sustain their well-being and their capacity individually and collectively to negotiate for these resources to be provided and experienced in culturally meaningful ways” (Ungar, 2008).

Methodological Approach

Positioning of the Research

This study was conceived of in the context of the RES-Research program offered by the World Bank (The World Bank, 2014). The principle research question was arrived at through discussions with the staff and volunteers of Jusoor's school for whom the barriers to accessing education among Syrian students is a particular concern.

Research questions premised on a resilience framework require an appropriate methodology. While the study of resilience offers examples of qualitative, quantitative and mixed methods approaches, an especially important consideration was the question of how to ensure ethical research given the past and present risks and vulnerabilities faced by Syrian refugees. Accordingly, the study followed a

Transformative Paradigm for Research and Evaluation (Mertens, 2009b). The transformative paradigm is especially relevant for resilience studies as it prioritizes methodologies that are ethically appropriate for contexts of violence and conflict while the use of different methods of inquiry allows researchers to better capture of the complexity and the dynamic aspects of resilience (Liebenberg & Ungar, 2009; Mertens, 2009a; Mertens, 2009b). As a pilot study subject to financial and temporal resource considerations, this research set itself a humble objective: to offer an initial qualitative exploration of the situation faced by Jusoor students through an approach that prioritizes the need for community validation of the research question, approach, data collection and analysis. While limited in scope and scale its findings may nevertheless provide the foundations for additional quantitative and qualitative research (Creswell, 2009).

Participatory Action Research

Research focused on social justice objectives requires a strong focus on meaningful community participation in the research process (Mertens, 2009b; 2014). This study uses participatory action research methods (PAR) to achieve this. Also, since the situation of refugees is necessarily one of instability, grounding process within the Jusoor community may better support the sustainability of research efforts (Sanders and Munford, 2009).

To support community participation in the research a Local Advisory Committee (LAC) was established, comprised of the Education Advisor at Jusoor's school and three Syrian volunteers. The four members of the LAC had considerable experience working with the children and in depth knowledge of the context. The LAC played an essential role throughout the study ensuring the questions asked were both relevant and appropriate. The qualitative inquiry was then implemented through interviews and focus groups with teachers and students. The different interview guides were discussed with the LAC and the guides that related to the children's focus groups were piloted with two 12-year-old children studying at Jusoor (identified by the LAC) to ensure relevance. The LAC and additional volunteers were also involved in the analysis of the data collected. The findings identified from the interviews and focus groups were presented to and discussed with volunteers from Jusoor in order to stimulate recommendations within the wider education community.

Access to the Community

The researcher reached out to Jusoor's school first by email and then in person. Jusoor's team was encouraging and supportive throughout the process. Both adults and children were welcoming, freely answered questions and ready to share their experiences. During the interviews and focus groups the young coordinator took notes and following the sessions also provided clarifications and comments on some of the transcripts.

Access to Lebanese teachers was gained in a more-subtle fashion since initial consultations suggested that Lebanese schools would be hesitant to participate in research that may be critical of their approach towards Syrian students. After discussions with several members of a Lebanese host community in the near suburbs of Beirut, a Lebanese school staff was identified and kindly facilitated contact with a public school coordinator. Although that school didn't receive Jusoor's students, the interviews there provided important background information regarding the context of refugees learning in Lebanon since that school has been hosting a majority of Syrian students since the beginning of the Syrian exodus.

Data Collection Design

- Qualitative data was collected through three focus groups and three interviews: a focus group with Syrian students who have transferred to Lebanese Schools and are coping well;
- a focus group with Syrian Students who entered Lebanese schools but have returned to non-formal programs at Jusoor;
- a focus group with teachers and volunteers at Jusoor;
- three interviews with two Lebanese educators (a school coordinator and a staff member) and with a Syrian teacher (working in a private school catering to Syrian students in Beirut)⁷.

The two groups of students were included to capture the diverse education experiences within the refugee community. The inclusion of students who successfully transitioned as well as those who did not have this experience is not intended as a binary comparison but rather represents an intentional effort to find what Sanders and Munford refer to as “confirming and disconfirming cases that help to understand the circumstances under which troubled young people could find themselves able to strive

⁷Although Syrian teachers are not permitted to work in Lebanese schools they may be hired or volunteer in private institutions such as was the case here.

and thrive and under which they could be crushed” (Sanders and Munford, 2009, p. 83).

Finally, in preparing the study, discussions were also conducted with many stakeholders from International NGO’s (including REACH and NRC) as well as local community organizations, such as the Syro-Lebanese NGO “Basmeh & Zeitouneh” (meaning a smile and an olive) and several parents of Syrian children. These additional interactions were insightful and offered the researcher a supportive community of practice to refer back to and motivate the study.

Sample Selection

Jusoor’s school coordinator purposively selected the children for both focus groups to capture children who have successfully transitioned to Lebanese schools (and continue to attend Jusoor’s school for extra-curricular support on Fridays) and those for whom the transition was less successful.

A representative gender balance was sought as well as the inclusion of children that the coordinator felt would be willing and able to answer questions on their educational experiences. One of the features of Jusoor’s school is that children of different ages study together in a given level. Many Syrian children have missed substantial amounts of schooling and upon their arrival in Lebanon are not always able to follow their age cohort. The focus groups therefore included children of slightly different ages, though all children fell within the age range of 8 to 12 years.

Interestingly, the majority of the participants in the focus group with children who attended the Lebanese schools were girls (ten girls out of twelve children). In the focus group with children who abandoned the Lebanese schools, ten out of twelve children were boys. As will be duly discussed, certain findings speak to why this gender imbalance may exist.

Data Collection Implementation

The three focus groups were run at Jusoor’s school. The first focus group with children attending Lebanese schools lasted approximately 50 minutes. The children were well-behaved and keen to answer questions. Towards the end of the meeting, only one girl, the oldest in the group, recounted stories of mistreatment and discrimination at the Lebanese school. The others however did not reiterate her concerns. In the debriefing with the coordinator after the focus group, she noted that whereas in the past the children had complained a lot about mistreatment in Lebanese

schools, they were now reporting fewer incidents of abuse. During a later discussion with the coordinator, she further confirmed that these children now reported far fewer negative incidents.

The second focus group with the children who abandoned the Lebanese school, lasted only 30 minutes as the children demonstrated greater difficulty concentrating and paying attention. The children were excited and all talked at the same time. They were more emotional especially when the discussion turned to mistreatment and violence at the Lebanese school. Although this second focus group was shorter than the first one, it was also more intense and generated strong codes and many striking quotes.

The third focus group with Jusoor volunteers consisted of those volunteers who had known the children for the longest period. The group was formed of six women of different ages and one young man. Only one of the volunteers had previously been an English teacher in Syria, while the others had no prior teaching experience.

The School coordinator and an external Syrian young person were present during all the focus groups and took notes. The presence of these observers did not appear to impede the responses of either the children or the volunteers. The presence of the coordinator was important in the context of Jusoor's school which is a tight knit community: confidence and trust between students, their parents and the volunteers and staff is an essential part of the ways in which it operates. The participation of the school coordinator throughout the study greatly facilitated the data interpretation and analysis. In debriefings immediately after the focus groups and during later discussions she provided important clarifications and insightful reflections upon the data.

The additional semi-structured interviews with a Lebanese school coordinator and a staff member were also recorded and analyzed. The interviews were held at a public school in a nearby suburb of Beirut. Since the beginning of the crisis, this school hosts a majority of Syrian students. Also, the same school staff runs, in the afternoon, a non-formal education program, funded by UNICEF, for out-of-school Syrian children. Thus the interview location offered the opportunity to observe another educational environment for Syrian refugees.

Contacts in the same community allowed for an interview with a Syrian teacher who taught at a private school opened especially for Syrians in Beirut. The interview was also recorded and analyzed for its contributions to understanding the broader context within which Syrian children seek for education.

Data Interpretation and Analysis

The data was analysed through a process of coding following a systematic open-ended initial coding approach (Saldana, 2009). The preliminary coding of the qualitative data contained in the transcripts supported the identification of a list of risks and assets across different levels of the social ecology: individual, social (family, neighbourhood) and education settings (Ungar, et al., 2013). The data provided rich information regarding behavioural and relational risks, as well as difficulties experienced by refugee students in Lebanon due to their education foundations received in Syria. From this initial level of coding, the dynamic nature of resilience processes became clear during a secondary categorization of codes.

Opportunities that were identified (such as hope, purpose, socio-emotional needs, social support from volunteer youth and non-formal organizations) were also affected by adversity including violence, dysfunction in displaced families, lack of expectation regarding education, and the unpredictability and lack of sustainability of volunteer-led services. To reflect the complexity of the interactions – risks and assets – across these various sub-systems in the social context of Syrian children (Ungar, 2013), the data was organized into a third level framework that could provide a broader conceptual story, thereby synthesizing the analytical process.

In line with theories of the social ecology of resilience, the framework sought to capture interactions across sub-levels and the presence of risk and resilience among the population of interest (risks at each level, assets that protect from risks, desirable education outcomes, and assets that promote outcomes). The analysis discussed in this article reflects this organisational framework.

Ethical Considerations

Ethical considerations were given the highest of priorities in the research design and implementation. As has already been discussed many of these ethical considerations were embedded in the data collection design and implementation process, as guided by the Transformative research paradigm and more particularly PAR methods. It is important to note however that the participation of all students, volunteers and teachers was entirely voluntary. Focus groups and interviews were recorded with the permission of the interviewees however names and identifying characteristics were not noted down or reported.

Position of the Researcher

Cultural competence has been defined as “a disposition that is required to understand how to approach communities in a respectful way, to invite participation and support that participation” (Mertens 2009b, p.231). It encompasses the attitudes and behaviours of cultural sensitivity and cultural awareness, but also the strategies and resources required to translate these skills into policy and practice that is representative of, and respectful to, the needs and rights of vulnerable communities.

The fact that this study was undertaken by a Syrian researcher reflected the importance of cultural competence in research with this particular at-risk community, through the ways in which it both facilitated access to the sample population and greatly supported data analysis and interpretation. Several of the important cultural nuances that are crucial to resilience and that were identified in this paper were only possible due to the Syrian-led nature of this study. Outsiders would not necessarily be able to realize that some risks are intrinsically related to the nature of the Syrian society. In particular, some of the identified important risks were pre-existing and already incurred by vulnerable communities before the crisis. In addition, as a compatriot who had also been displaced to Lebanon the researcher was able to secure repeated contact with all the Syrian stakeholders (children, parents and volunteers). She could provide support to the participants, and work closely with Syrian volunteers to validate the findings at the community level and to generate appropriate and meaningful recommendations and solutions.

At the same time however, the fact that this study was undertaken by a Syrian researcher also had some important limitations. First, the nature of the conflict has generated significant mistrust between Syrians. The experiences of refugees at the hand of their compatriots as well as the fact that loved ones may remain in Syria leave many wary of trusting others and divulging too much information. Consequently, it was crucial to remain transparent throughout the research process and with regards to the purpose of the study. PAR methodology supported this objective since it ensured that the researcher and stakeholders were in continual dialogue throughout the process and shaped it through the articulation of shared objectives.

Second, while research on such topics is emotionally draining for any researcher this is especially so when researching the difficult experiences of one’s own community; which may compound the personal sense of loss. Learning more about experiences of Syrian refugees and the ongoing problems they face in Lebanon was both difficult and frustrating. By working in close cooperation with the students, staff and volunteers – and crucially by establishing and then focusing on the shared priority within the

refugee community to improve the educational experiences for Syrian children – the researcher was able to channel these feelings into a renewed motivation to contribute to the betterment of the lives of Syrian children.

Finally, Syrian researchers, as is the case with any researcher, need to consider sources of personal bias and prejudice. Reflecting upon one's own class, cultural belonging, gender etc. is essential. Certain of these nuances may be reduced and others heightened when conducting research within one's own community. This was managed through a process of constant critical self-awareness and active reliance on PAR methodology to question assumptions and interpretations of the data. The Syrian refugee population is far from homogenous and students and volunteers at Jusoor come from diverse backgrounds, which also differ from the background of the researcher. Therefore, a strong emphasis was placed on community validation of the data. This was achieved through the establishment of a Local Advisory Committee and on-going meetings and discussions with Jusoor stakeholders who were not only able to support the analysis of the data but also its interpretation into useful recommendations that could better support the resilience processes of the refugee children.

Most Relevant Findings

Resilience occurs only in the context of risk. Findings reveal that there are indeed plenty of risks hindering the education of the Syrian children included in this sample. What's more, these risks are not simply a function of displacement and the precarious situation of Syrian refugees in Lebanon: rather many of the risks identified originate from pre-existing risks that were present in pre-conflict Syrian society and which have transferred and transformed in the Lebanese context. At the same time however, the social ecology of resilience underlines that there are always assets and processes that future interventions might build upon or align to, in order to overcome risks. The guiding research question and interview and focus group protocols were thus designed to discover these 'assets' which were correspondingly identified and coded in the transcripts.

The overall findings are presented in the World Bank report (Abu-Amsha, 2014). The framework was organised into four sections comprising the themes related to risks, assets, desired outcomes and processes that promote resilience. The data was also classified according to different levels of the social ecology closely surrounding the

Syrian refugee children, e.g. the family, the school, the community, etc.⁸ By classifying the data in this way the environmental factors – risks and strengths – that are hindering or helping the resilience process may be more easily identified. By drawing upon the cultural knowledge of both the researcher and Jusoor stakeholders involved in this research, the important influence of Syrian society and the Syrian educational system – and their subtle interactions – was revealed. Thus the findings of this research complement and add to existing discussions of the risks facing Syrian refugee students in Lebanon by drawing attention to the hidden risks that influence the ways in which Syrian children are able to navigate the Lebanese education system.

Generally, the main problems of Syrian students in Lebanese schools seemed to be the language barrier and discrimination. However, the study revealed that children who benefited from certain supports were able to manage the language barrier successfully, and expressed a strong sense of purpose in going to school and shielding themselves from discrimination. The children who lacked certain types of parental support however were the most vulnerable to abandoning Lebanese schools.

The data analysis conducted with the contextual knowledge of the researcher and Jusoor’s volunteers of the inner Syrian society revealed new aspects that are not discussed in other studies dealing with the education of Syrian refugee children. The below selected four core themes that appear from the data analysis are discussed.

The Harmful Mix

The most compelling finding of this study is the existence of a “harmful mix” of risks – none of which need be decisive in curtailing access to education – but which cumulatively have pushed many Syrian children to drop out of Lebanese schools. Notably, parents from originally lower socio-economic classes were less able to provide support to their children. Combined with the immediacy of their situation and pre-existing attitudes towards the Syrian education system it appears that this undermines expectations regarding the importance of education for their children. In addition, these children had lived through more direct violence (including interpersonal and household violence as well as the violence of the crisis). They thus appeared more fragile and sensitive to discrimination. This combination undermined the resilience process and appears to have resulted in higher levels of school abandonment. In some cases, the conflict appears to have made visible the structural

⁸Social ecology levels could be broadened to other levels such as governmental and non-governmental bodies treating with refugees. This pilot study is limited to the social ecology that is in direct contact with the children.

inequalities that were already present in Syrian society and which have both come to a fore and transformed in exile.

The Pivotal Role of Parents

Syrian families – like the vast majority of parents around the world – want what’s best for their children. At the same time understandings of what is best and the role of education in this differ according to a variety of social factors which may be influenced by parent’s education, socio-economic status and of course the needs generated by the social realities of violent conflict and forced displacement. Attitudes towards and expectations of education are also shaped by pre-crisis Syrian realities. This study revealed that Syrian parents do have a very decisive influence on the education of their children, and in the current situation their efforts may contradict access to quality education for their children. Several of the trends that were identified appear to reproduce certain barriers to education that were already present in pre-crisis Syria. Namely:

Unsurprisingly, the choice of education service providers in Lebanon is to a large degree a function of the financial resources of families. Parents with higher education and financial resources send their children to Lebanese private schools whereas parents who were educated but had little financial resources send their children to Lebanese public schools and try to support them in non-material ways. In some cases, financial difficulties posed such a constraint that parents found themselves requiring their children to work to bring in resources for the household.

Some parents were reluctant to send their children to school for a variety of social reasons including security concerns and low expectations regarding the value of education. In addition, many harboured the hope of an imminent return to Syria where life could proceed as it had done prior to the conflict.

Parents – including those with low education levels and few financial resources – were often willing to sacrifice everything to offer their children private lessons to support educational transitions in Lebanon. At the same time children reported feeling a lot of pressure on them to do well and also reported being subject to violence at home intended to push them to work harder and succeed at school. The qualitative data suggests that this may be particularly the case for older boys who reported abandoning school owing to their inability to meet these expectations and remain within Lebanese public schools.

Low expectations regarding the value of education also manifest among families who had relatively adequate financial resources. Volunteers reported cases where children

were under pressure to work and earn money even when this seemed not really vital for the family since little value was placed on gaining a formal education.

These findings make clear that families who should be a core source of support for their children's well-being and education in turn need the right kind of support to be able to manage and sustain their children's education in the Lebanese environment.

Finally, it is also worth noting that more anecdotal discussions with Syrian parents conducted as part of this study suggest that perceptions of how Syrian students are treated in Lebanese schools differ from those put forward by Lebanese educators. Specifically, Lebanese educators reported better treatment and inclusion of Syrian refugees than was perceived to be the case by Syrian families. While these suspicions were not explored rigorously in the course of this study they represent an important avenue for further research since they speak to potentially different experiences of refugee educational integration and/or a communicative barrier to be addressed.

Violence Among Students

The problem of violence enacted by some Syrian children was raised by both Lebanese teachers and Syrian volunteers. Certainly, the traumatic lived experiences of some of the refugee students as well as their persistent vulnerability may play a role in generating violent self-expression. At the same time, the data revealed that family relations appeared to exert an influence: parents from reportedly lower socio-economic backgrounds tended to use more violence with their children. This in turn was reported – by both Syrian and Lebanese adults – as an impediment regarding the adaptation of these children in Lebanese schools. That this was most commonly reported among boys suggests that girls might have a higher locus of self-control that supports their ability to adapt in Lebanese schools. While boys reported more use of physical violence and articulated feelings of pride and the need to stand up to humiliation, girls instead reported that maintaining a low profile in Lebanese schools helped them adapt and persist.

Adults in contact with these violent children declared experiencing great difficulties in managing the violent behaviour. However, the reported reactions of Lebanese teachers and Syrian volunteers to these children violence differed profoundly. Syrian volunteers attempted to deal with the violence through compassionate approaches and activities that they felt would channel the expression of the children. Jusoor's coordinator admits that the mission is not easy but also estimates that progress is gradually being made. On the other hand, Lebanese stakeholders who dealt with the violent children in the formal education settings expressed their weariness with this

behaviour, including declaring that these children will no longer be welcome in Lebanese schools.

A Major Asset: The Socio-emotional Support of Volunteers

The study suggested that Lebanese schools are not well prepared to offer the feeling of safety that Syrian children need to navigate their difficult educational journey. Vulnerable children, who could not withstand the pressure of the Lebanese system, decided with their parents to leave the system and preferred to stay with Syrian peers at Syrian-run non-formal education centres that – according to them – better respond to their psycho-emotional needs.

Ungar (2006) qualifies this type of decision as a hidden or uncommon pattern of resilience in which reluctance to engage with the mainstream may be protective. Specifically, here, the rejection of the Lebanese school appears to constitute a protective process adopted by some Syrian refugee parents and children. Their responses also suggest that this is in large part due to the commitment of the volunteers to support the children and sometimes their parents in affective and even material ways.

Implications and Recommendations

The study is premised on the question: "What are the factors and processes that help Syrian students receiving non-formal education transition to (public or private) Lebanese schools." The identification of these factors and processes were arrived at through discussions of the findings with the stakeholders at Jusoor, and through an interpretation in reference to existing literature on the social ecology of resilience.

Compounded and Cumulative Risks Matter

This study confirms that compounded and cumulative risks matter for resilience processes (Ungar, 2011; Zimmerman, et al., 2013). In particular, while issues of language of instruction and the material and emotional impacts of experiencing violent conflict and displacement may have a detrimental impact on coping and resilience, it is also essential to recognise pre-existing structural risks within a society which do not cease but follow and transform in the refugee context. In fact, the most compelling finding of this study is that a “harmful mix” of risks leads the children to drop out of the Lebanese school. Consequently, educational interventions should

consider not only immediate and obvious effects of the crisis on access to education but also those structural risks which require longer term locally grounded interventions. These interventions should be of broader impact and include parents and potentially consider reforms of the hosting educational systems to adapt their response to the crisis.

The Dynamic Nature of Resilience

Although this study identified important risk factors that were nestled in family and household realities of the students, these risks as well as assets are not fixed but are socially constructed (Ungar, 2011). From this perspective, certain actions and behaviors that currently constitute risks may, with appropriate support and interventions, be transformed into valuable assets for the education of children. The role of the Syrian family is a clear example of this dynamic nature. If the family unit does not receive the right type of support, they will not be in a good position to in turn provide the support that their children need to successfully transition and integrate into Lebanese schools. In this way, providing sustainable education to Syrian refugees also requires looking beyond the education system to meet the basic needs of families and helping them to provide a nurturing environment for their children's transition to Lebanese schools.

Programs or projects that seek to raise parental awareness around education and the nature of the Lebanese system, may allow families to play a more promotional role. All the stakeholders involved in this research hold the strong conviction that education actions and programs must be designed to include parents in order to make them more aware of the importance of education to their children, to inform them about what to expect from the Lebanese schools, and to help them understand their role in supporting the children in the transition and integration process.

Implications for Refugee Integration

Data from this study complements that of several other studies (NRC, 2013; Harb and Saab, 2014; Save The Children, 2014, p.18), in revealing a lack of communication between Syrian and Lebanese stakeholders. Syrian children who are studying in Lebanese schools reported requiring both the pedagogical expertise of the Lebanese teachers and the psycho-emotional support of the Syrian teachers and volunteers – the kind of support that Syrian contributors are more appropriate to provide because of their shared experiences and nuanced cultural understanding. From this perspective programs that bring together Syrian and Lebanese teachers could be very helpful for

the students. This is, in fact, no easy feat, since, at present, Syrian teachers are not allowed to work in Lebanon.

Moreover, at the beginning of the study, Syrian stakeholders expressed their interest in solutions that copied the model of UNRWA schools for Palestinians (UNRWA). In fact within Jusoor's community there was less support for integration and a preference for a parallel school system for Syrian students, run by Syrian teachers teaching the Lebanese curriculum, and leading to Lebanese certifications. Beside the fact that such solutions are expensive and would be difficult to implement in the current Lebanese political environment this would also perpetuate the separation between Syrian and Lebanese communities further impeding Syrian children from adapting to the Lebanese education system.

After discussing the findings Jusoor's volunteers recognized the importance of continuing their "bridging" efforts to prepare children to enter the Lebanese school system. A more "politically correct" intervention may be to run and supervise a program overseen by Lebanese teachers who master the Lebanese curriculum, with the assistance of Syrian teachers or young volunteers who are more able to involve emotionally with the children and support their development. Volunteer involvement appeared through this study to be a huge asset that future programs should nurture and better utilise.

Creative solutions such as having Syrian classroom assistants working alongside Lebanese teachers and in-service professional development interventions that allow the two communities to learn from each other would be beneficial for students as well as teachers and could improve social cohesion (Harb and Saab, 2014) until durable solutions for the refugees are found. Such solutions may also improve intercommunity relations, and prevent Lebanese teachers from feeling threatened by Syrian competition. The findings of this study suggest that this would also help create a welcoming environment where the children could more easily adapt and positively develop.

Conclusion

Although only offering a small window into the experiences facing children in one location, the findings of this study concur with the importance of supporting the social integration of refugees. As Dryden Peterson argues, provision of education for refugees is:

“often limited to the physical aspects of service delivery and does not involve conscious attention to the social processes of living together, resulting in the marginalization of displaced children...Without social integration, possibilities for political, cultural, and economic stability are limited for displaced children and their families, both in the present and in the future” (Dryden-Peterson, 2011b, p.4).

While linguistic and material concerns certainly shape the ability of Syrian refugees to integrate, this study also reveals that for a particular (diverse) sample of students other subtler factors – which manifest as hidden risks – may play an important role. In particular parents who originated from vulnerable communities in Syria may lack the resources and knowledge to effectively support their children’s educational transitions. Compounded with other risks such as the language barrier and mistreatment at school, trauma, lack of financial resources, and continued instability, this appeared decisive in pushing students consulted in this research to drop out of the Lebanese schools. This study therefore points to the importance of considering those social and familial dynamics that were present in Syria before the crisis and which both persist and have transformed in the Lebanese context to create a differential impact on access to quality learning opportunities for children and youth.

Equally, the study sought to uncover existing and potential strengths and opportunities. In this regard the care and support of the volunteers and staff of Jusoor’s school was of paramount importance to refugee students. In this regard sensitively designed interventions that bridge not only the physical but also the social divide (as advocated in Dryden-Peterson, 2011) through cooperation and collaboration between Lebanese and Syrian educators could be instrumental in supporting the integration of Syrian students in Lebanese schools. All told, Syrians – including researchers and educators – have much to contribute towards the education of their children. This applies equally during the crisis as well as for the rebuilding of the country and its education system. As the crisis becomes more protracted, the resources and capacities within the Syrian community – such as those embodied by the Jusoor’s school – become increasingly relevant. And, while this calls for recognition of the ways in which the conflict has shaped and indeed transformed individuals and social relations, it should not preclude the contributions of Syrians to the dialogue surrounding the education of their young people. This research is thus just one example of the rich insights that can be gained from using approaches to research that mobilize the knowledge, expertise and agency that exists within the Syrian refugee community. The insights that were gained through this study confirm the willingness and capacities of Syrians to contribute to research and their commitment to supporting their young people. As with any refugee population the capacity and agency of

Syrians can and should be identified, built upon and actively used in formulating education responses.

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References

- Abu-Amsha, O., (2014). The resilience of Syrian refugee children in Lebanon: What do they need to acquire quality education? Education Resilience Approaches (ERA) program, Washington: The World Bank.
- Benard, B., (1995). Fostering Resilience in Children. ERIC Digest, August.
- Bronfenbrenner, U., (1979). Ecology of human development. Cambridge, MA: Harvard University Press.
- Bronfenbrenner, U., (2005). Making human beings human: Bioecological perspectives on human development. Thousand Oaks, CA: Sage Publications Ltd.
- Cefai, C., (2008). Promoting resilience in the classroom: a guide to developing pupils' emotional and cognitive skills. Jessica Kingsley Publishers. London and Philadelphia.
- Creswell, J. W., (2009). Research design: Qualitative, quantitative, and mixed methods approaches. 3rd ed. Sage Publications.
- Dryden-Peterson, S., (2011b). Refugee Education, A Global Review. UNHCR November 2011. Available Online: <http://www.unhcr.org/4fe317589.html>
- Dryden-Peterson, S., (2011). Conflict, Education and Displacement. Conflict & Education, Issue 4.

- Gizir, C. and Aydin, G., (2009). "Protective factors contributing to the academic resilience of students living in poverty in Turkey.". *Professional School Counseling*, 13(1).
- Harb, C. and Saab, R., (2014). *Social Cohesion and Intergroup Relations: Syrian Refugees and Lebanese Nationals in the Bekaa and Akkar*. Save The Children. <http://www.aub.edu.lb/ifi/>
- Jusoor, (2014). Jusoor's Refugee Education Program.
Retrieved from: <http://www.jusoor-sy.org/programs/academic-programs/jusoors-refugee-education-program/> (Accessed 22 June 2014).
- Le Commerce du Levant, (2013). *Education: une réputation d'excellence entachée par de nombreuses ombres au tableau*. *Le Commerce du Levant*, April, pp. 50-54.
- Liebenberg, L. and Ungar, M.,(2009). *Introduction: The challenges of researching resilience*.In: *Researching Resilience*. University of Toronto Press.
- Masten, A. S., (2001). *Ordinary magic: Resilience processes in development*. *American Psychologist*, 56 (3), pp. 227–238.
- Mertens, D., (2009a). *Research and Evaluation in Education and Psychology: Integrating Diversity With Quantitative, Qualitative, and Mixed Methods*. 3rd Edition. SAGE Publications.
- Mertens, D., (2009b). *Transformative Research and Evaluation*. New York and London: The Guildford Press.
- Mertens, D., (2014). *Research and Evaluation in Education and Psychology*. Sage Publications.
- NRC, (2013). *Rapid assessment of the education situation of Syrian refugee students attending Lebanese public schools in north Lebanon (excluding Akkar)*. Lebanon.
- ODI, (2014). *Living on Hope, hoping for education. The failed response to the Syrian refugee crisis*. Available Online: <http://www.odi.org/publications/8829-syria-refugee-education-crisis-hope>
- Reach, 2014. *REACH support to the Syrian Refugee Crisis Mapping*. [Online] Retrieved from: <http://www.reach-initiative.org/reach-support-to-the-syrian-refugee-crisis-mapping-2> (Accessed 4 July 2014).
- Reyes, J., (2013). *What Matters Most for student in contexts of adversity: a framework paper*, Washington: World Bank.

- Rutter, M., (1987). Psychosocial resilience and protective mechanisms, published in. *American Journal of Orthopsychiatry*, 57(3).
- Saldana, J., (2009). *The coding manual for qualitative researchers*. London: Sage.
- Sanders, J. and Munford, R., 2009. Participatory Action Research. In: L. Libenberg and M. Ungar, eds. *Researching Resilience*. University of Toronto Press.
- Save The Children, (2014). *Futur Under Threat, The impact of the education crisis on Syria's Children*, London, UK: s.n.
- The World Bank, (2013a). *Learning and Resilience: The Crucial Role of Social and Emotional Well-Being*. Washington DC: s.n.
- The World Bank, (2013b). *Lebanon - Economic and social impact assessment of the Syrian conflict*, Washington DC: s.n.
- The World Bank, (2014). *Education resilience research training in South Asia : building on local higher education capacities*. s.l.:s.n.
- Ungar, M., (2006). Nurturing Hidden Resilience in At-Risk Youth in Different Cultures. *Journal of the Canadian Academy of Child and Adolescent Psychology*.
- Ungar, M., (2008). Resilience across cultures.. *British Journal of Social Work*, 38(2).
- Ungar, M., 2011. The Social Ecology of Resilience: Addressing Contextual and Cultural Ambiguity of a Nascent Construct. *American Journal of Orthopsychiatry*, 81(1), pp. 1-17.
- Ungar, M., (2013). Social ecologies and their contribution to resilience. In: M. Ungar, ed. *The Social Ecology of Resilience: A Handbook of Theory and Practice*. New York: Springer, pp. 13-32.
- Ungar, M., Ghazinour, M. and Richte, J., (2013). Annual Research Review: What is resilience within the social ecology of human development? *Journal of Child Psychology and Psychiatry*, 54(4), pp. 348–366.
- Ungar, M. and Liebenberg, L., (2013). Ethno-cultural factors, resilience, and school engagement. *School Psychology International*, 34(5), pp. 514-526.
- UNHCR, (2013a). *Lebanon Inter-Agency Response: Syrian Refugees*. Available Online:
<http://reliefweb.int/sites/reliefweb.int/files/resources/Inter-Agency%20Regional%20Response%20-%20Syrian%20Refugees%2020130918.pdf>

UNHCR, (2013). The Future of Syria: The Challenge of Education. Available Online: <http://hhi.harvard.edu/content/unhcr-future-syria-challenge-educationjpg>

UNHCR, (2014a). 2014 Syria Regional Response Plan, Mid-year Update. Available Online: <http://www.unhcr.org/syriarrp6/midyear/>

UNHCR, (2014b). RRP6 MONTHLY UPDATE. www.unhcr.org

UNHCR, (2014c). Syrian Refugee Response Plan: Lebanon Interagency Update on Education, s.l.: s.n. 25.11.2014

UNHCR, (2015). Lebanon Education Dashboard Sep. - Oct. 2015. www.unhcr.org

Unicef et al., (2013). Syria Crisis: Education Interrupted. Available Online: http://www.unicef.org/media/files/Education_Interrupted_Dec_2013.pdf

UNICEF and Save The Children, (2012). Education Rapid Needs Assessment For Displaced Syrian Children, Beirut: s.n.

UNRWA, (2014). UNRWA -What We Do-Education. Available Online: <http://www.unrwa.org/what-we-do/education>

Retrieved from: <http://www.unrwa.org/what-we-do/education> (Accessed 04 July 2014).

Werner, E., (1989). High-risk children in young adulthood: A longitudinal study from birth to 32 years. *American Journal of Orthopsychiatry*, 59 (1), pp. 72-81.

Zakharia, Z., (2004). How Schools Cope with War: A Case Study of Lebanon. *Education in Emergencies and Post-Conflict Situations: Problems, Responses, and Possibilities*.

Zakharia, Z., (2013). Schooling for Youth and Community empowerment and resilience during and after violent conflict. In: M. a. c. In Matsumoto, ed. *Education and Disadvantaged Children and Young People*. New York: Pp. 32-51.

Zimmerman, M. et al., (2013). Adolescent Resilience: Promotive Factors That Inform prevention. *Child Development Perspectives*, pp. 1-6.

Data Analytics in Citizen Cyberscience: Evaluating Participant Learning and Engagement with Analytics*

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Abstract

Citizen Cyberscience (CCS) projects are online projects that engage participants with no necessary prior scientific experience in online tasks of very varied types and that contribute to the scientific research in different domains. Many research studies confirm the usefulness of CCS projects to researchers while less has been done to explore their added-value for the participants. Specifically, we are interested to know to what extent CCS projects help participants learn while participating through typically small-sized and very specific tasks. We propose in this work to include another source of quantitative data to the research toolbox usually used to evaluate learning in informal learning contexts as the context of citizen science. This data source is learning analytics that makes use of the already very ubiquitous web analytics and that is heavily used in varied online learning environments. Based on our experience with two CCS pilot projects, we created a framework to help CCS project designers properly implement learning analytics in their project in order to make the full use of these analytics and integrate them with other sources of quantitative data related to the user experience. We apply the proposed framework to explore the interaction between learning and engagement in two pilot CCS projects of different types: volunteer thinking and gaming. We conclude with a number of recommendations to avoid pitfalls and proposals for best practice based on our experience.

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Introduction

Citizen science refers to collaborative projects where researchers invite volunteers and engage them in scientific activities that they don't necessarily have any initial experience in (Hand, 2010). Volunteers are typically asked to perform data collection and processing or monitoring activities. The generalization of the interactive web2.0 in the last decade allowed for the development of Citizen Cyber Science projects (CCS) that engage participants in tasks which also involve the use of computers and the internet. Some of these multi-disciplinary projects underlying online crowd-powered systems are also addressed as Human Computation, they solicit the human cognition to achieve new capabilities beyond computer capabilities (Michelucci, 2013).

Crowd-powered science has demonstrated its usefulness for research (Sauermann & Franzoni, 2015); however, little is known about its potential for volunteers. Specifically, we are interested in understanding how citizens learn from “virtually” participating in projects, and what they do learn.

The educational impact of citizen science is already addressed by several studies (Bonney, Phillips, Ballard, & Enck, 2015; Cronje, Rohlinger, Crall, & Newman, 2011; Crall, Jordan, Holfelder, & al., 2013). Nevertheless, results on learning in citizen science focus on effects of participation on scientific literacy and on content-knowledge (Jordan, Ballard, & Phillips, 2012). Our perception of learning in CCS projects is instead multidimensional and is not limited to the scientific literacy (see discussion below), hence we need adapted evaluation tools to assess the different dimensions of the impact of CCS on the learning of the participants.

Increasingly data analytics appears to provide such an evaluation tool as it involves tracking the online actions of participants through time in order to reveal potential trends or user profiles, to analyze the effects of certain decisions or events, or to evaluate the performance of a given tool or scenario.

Globally, managers and decision makers agree in the majority on the “importance of increasing the use of analytics in decision making” (Kiron, Prentice, & Ferguson, 2014), and as analytics is becoming ubiquitous in online activities, it appeared natural to use it in education in general (Siemens & Long, 2011) and to study learning in citizen science projects as they offer a learning experience to their participants. Hence we have made learning analytics a core tool in our toolbox for evaluating learning in the pilot projects that are developed as part of the European project Citizen Cyber Lab.

This paper aims to present a framework that establishes learning analytics in a given CCS project on the basis of the expected learning outcomes of the project. The analytics data are collected and then aggregated into indicators reflecting the effective achievement of the learning outcomes of each participant. We don't discuss here the technical details of implementing and collecting analytics events. Our partners at the Citizen Cyber Lab developed for this purpose a monitoring framework: the CCLTracker presented in detail in (Fernandez-Marquez, et al., 2016). Nevertheless, our framework is independent of the analytics data collection method.

Our framework is applied to two pilot projects, a game and a crowdsourcing platform, and we share here our experience and make recommendations that we expect to be useful to other CCS project designers who wish to include learning analytics in their evaluation toolbox. In fact, nearly two decades of research in educational data mining (Romero & Ventura, 2010) demonstrates that designing systems that provide the right data and extracting useful information from large amounts of data are not trivial tasks. Also, analytics data should be triangulated with psychometric data (quizzes and surveys) which opens a large avenue for further research.

It should be kept in mind that our framework was applied to pilot projects. The data was collected during short periods of time and with a limited number of participants. Hence, the statistical analysis options were limited. The purpose of the article is not to present new statistical analysis methods of analytics data, but rather to share our experience of defining and using learning analytics in assessing learning and engagement in CCS projects. Nevertheless, as a proof of concept, we conducted a typology analysis that revealed interesting patterns in the profiles of the participants, and that would be interesting to explore in other CCS projects.

We continue our introduction with a presentation of our understanding of learning and engagement in CCS projects and with a brief introduction of learning analytics. Section I summarizes the different analytics of interest that could be generated and tracked in citizen science projects and the specific task of using learning analytics to understand which types of learning occur when participating in online citizen science activities. We present in section II the profiles of the participants in a pilot project, as revealed by the analysis of the learning analytics data. Finally, we conclude with a synthesis of the good practices learned from our experience and suggest future developments.

Learning in Citizen Cyberscience

Similarly, to formal learning contexts where learning is the result of the interactions of the learner with content, with instructors and tutors, and/or with other learners (Elias, 2011), learning in citizen science happens through activities and potentially from interaction with peers and experts.

Wiggins and Crowston (Wiggins & Crowston, 2011) describe citizen science as a type of collaboration where individuals are involved with the scientific community in research projects addressing issues from the real world or more generally ones that might interest non-specialists. Citizens and scientists work collectively to achieve a common goal, usually in the form of data collection or social action.

While the contribution of volunteers to scientific data collection and analysis has been well documented, understanding how participation in citizen science projects affects learning is at the heart of many studies (Schneider, DaCosta, Abu-Amsha, Jennett, & Kloetzer, 2016; Kloetzer, Schneider, & da Costa, 2016; Crall, Jordan, Holfelder, & al., 2013; Cronje, Rohlinger, Crall, & Newman, 2011; Jordan, Gray, Howe, Brooks, & Ehrenfeld, 2011) and the evaluation of learning outcomes of citizen science projects is increasingly gaining interest (Jordan, Ballard, & Phillips, 2012).

Learning outcomes in citizen science can in general be defined on multiple levels. There are individual-, program-, and even in some programs, community-level outcomes (Jordan, Ballard, & Phillips, 2012). There is also a balance to be clearly defined between learning goals and scientific goals (see discussion in Lieberoth, 2014). In this work we focus on the individual outcomes that are tightly linked to the learning induced by the participation.

Evidence of impact on scientific literacy and on content-knowledge is the most discussed (Jordan, Gray, Howe, Brooks, & Ehrenfeld, 2011). A recent large-scale survey was conducted to assess the different dimension of learning through participation in CCS projects (Schneider, DaCosta, Abu-Amsha, Jennett, & Kloetzer, 2016). Abide from this cross-projects study, researchers usually assess learning in citizen science with evaluation tools that are specifically designed to capture the specific nature and content of one project, which makes difficult the comparison between different projects performance.

One of the objectives of our work presented here is to set up a common framework where learning in different citizen science projects can be assessed using the same approach while adapting the tools to the context.

Preliminary research during the Citizen Cyberlab project (Kloetzer L. et al., 2013), revealed that learning in CCS projects occurs in multiple directions. Interview data indicated the existence of six categories of learning outcomes: At the task level, we distinguish learning regarding the project mechanics and pattern recognition skills. At the higher project level, we can distinguish scientific topic learning and general scientific literacy. These types of learning are encouraged in the context of the project but they are usually acquired by additional involvement in the project community. Finally, the interviews revealed the potential acquisition of off-topic (e.g. communication skills, computer literacy) and personal development skills that cover a wide range of skills with no relation to the CCS project domain or type. They are in fact fortuitous outputs induced by heavy involvement in the projects.

Traditionally, assessing citizen science projects impacts relies on pre- and post-tests and responses from surveys, interviews, and board diaries (e.g. Brossard, Lewenstein, & Bonney, 2005; Jordan, Gray, Howe, Brooks, & Ehrenfeld, 2011). Tracking the achievement of individual participants can also be done through activity logging. This article will emphasize the use of logging capabilities offered by the modern analytics frameworks to specifically evaluate the learning of participants in CCS projects.

Engagement in Citizen Cyberscience

Meece et al. (1988) set a model for cognitive engagement in the classroom. Engagement from an educational point of view is seen as learner participation, and interaction with the learning material, learning activities, and the learning community.

O'Brien and Toms (2008) proposed a conceptual framework for user-engagement with technology that could be used in various application areas, including technology-based learning, citizen cyberscience projects, etc. According to O'Brien and Toms, "Engagement is a quality of user experiences with technology that is characterized by challenge, aesthetic and sensory appeal, feedback, novelty, interactivity, perceived control and time, awareness, motivation, interest, and affect". The resulting conceptual model of engagement distinguishes 4 possible phases through an engagement process: The user initiates and sustains engagement during a session; he disengages, and potentially reengages several times during a single interaction with the system or through subsequent sessions. O'Brien and Toms also considered the factors that usually lead to non-engagement, where the user completely drops the interaction with the system.

Since learning and engagement are closely interrelated, the framework proposed here will also address the engagement of the participants in CCS projects. Well-designed analytics will allow for a better understanding of their interactions.

Learning Analytics

With the generalization of technology-based learning opportunities, and with the generalization of data science practices in increasing number of fields and domains, it was natural to see a rising interest in the collection and the exploitation of educational analytics for various purposes: educational, academic (administrative) and even economic and strategic (Ferguson, 2012). According to the 1st International Conference on Learning Analytics and Knowledge⁹, “Learning analytics deals with the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs”.

Learning analytics finds its immediate legitimacy in the contexts of online education, in Virtual Learning Environments (VLEs) and in massively open-access online courses (MOOCs) for formal or informal learning. It is used to support the provision of a timely picture of the learning process of theoretically every learner, allowing for appropriate adjustments and feedbacks and overcoming the usual delays that educational systems usually suffer from. As an example of the application of learning analytics, Morris, Finnegan and Wu (2005) studied the impact of student engagement on their success in a fully online asynchronous program. They tracked student basic activities related to LMS participation (e.g. content pages viewed, number of posts) as well as the duration of participation (e.g. hours spent viewing discussion pages and content) and they were able to discriminate significantly between “withdrawers” and “successful and unsuccessful completers”.

Similar practices seem adapted to citizen cyberscience projects. As we discussed earlier, online behavior of participants has undeniable effects on learning in citizen science projects. There are also similar concepts of engagement, hence tracking the digital traces of the participants in citizen science projects with learning analytics may provide an extra means to understand their behavior and enhance their experience. Besides, issues regarding the CCS web site usability can also be detected with analytics. Although these applications of analytics are very important, they fall outside the scope of this article.

⁹ <https://tekri.athabascau.ca/analytics/>

In addition, analytics allows for a fine-grained engagement analysis. If the analytics are well designed, an engagement study could be easily scalable, i.e. we can study engagement globally, on a daily basis, or even hourly if it is needed, provided, again, that the number of users is sufficiently high to generate meaningful statistics. Also, with the possibility of observing the user behavior in a nearly real-time manner, it is easier to detect unexpected behaviors, detect potential usability issues and make timely actions to improve pilot projects faster. User profiling/segmentation is also possible with analytics and can help to develop and assess specific actions for engaging under-represented and specifically targeted groups.

We used analytics as one part of a larger evaluation toolbox for assessing learning and engagement in CCS. Alongside the data-driven approach of analytics, we deploy other traditionally used tools such as online surveys, on-topic quizzes, diary analysis, and structured interviews with active participants and even behavioral observations and focus groups run during outreach events. In fact, learning induced by social and collaborative activities seems to be the most effective in the context of CS (Kloetzer, et al., 2013). This type of learning is not easily tracked with learning analytics, hence, analytics could be combined with online surveys and quizzes. While surveys might be subjective and respondent samples not really random, analytics could lack accuracy but would still be automatically collected for virtually every user. Merging multiple sources of data – surveys, quizzes and analytics – promises to lead to a better analysis as long as there is enough participation.

Existing learning analytics data collection tools

The use of learning analytics to inform data driven decisions is expanding in formal education institutions, hence most of the Learning management systems and MOOC platforms also offer built-in analytics tools. Game sites can now also use analytics tools available from game platforms such as the open source game analytics tool RedMetrics (Himmelstein, Goujet, & Lindner, 2016), or the one offered by Unity¹⁰ and used for example to track the educational games developed at Aarhus University in Denmark: Science at Home¹¹.

Besides these specific-context tools, there are general purpose web analytics data collection tools such as Google Analytics (GA)¹² and Piwik¹³, the leading open-source

¹⁰ <https://unity3d.com/services/analytics>

¹¹ <http://scienceathome.org/>

¹² <http://www.google.com/analytics/>

¹³ <http://piwik.org>

alternative offering similar functionalities to GA¹⁴. Using GA brings the additional benefit of being able to incorporate the demographic information that Google gathers on its users worldwide into analysis, which can be used to build the participant segment profiles. Open source analytics frameworks such as Piwik allows CCS projects to preserve ownership/guarantee confidentiality of the analytics data if the self-hosting option is chosen.

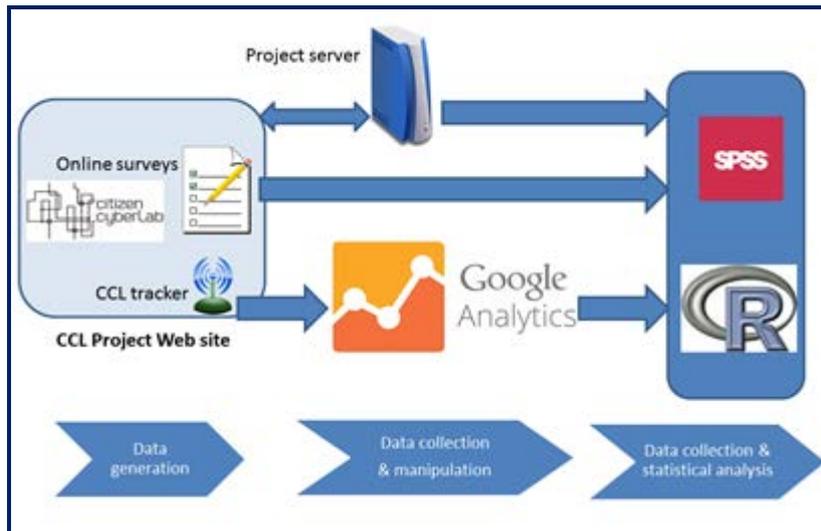
To our knowledge there are no stable standalone learning analytics tools yet. A thorough state of the art research started in 2014 is available at http://edutechwiki.unige.ch/en/Portal:_Data_mining_and_learning_analytics_tools. At present, most of the developers of CCS projects rely on server logging and on collecting data via Google analytics.

Although the framework presented here is independent of the analytics data collection tool, the selection of the tool is an important decision that impacts the entire process of designing, deploying, implementing and collecting the analytics data. Among the criteria that influence the selection of the data collection tool, we mention: the availability of the tool (immediacy and sustainability), its implementation and testing time, its accessibility (to multiple users with access rights management capabilities), its treatment of the privacy issues, its accuracy (for instance, Google Analytics in some cases, reports only a sampling of the over-all data), the GUI and interactive capabilities of first-hand manipulation, and finally, the availability of demographic info of the users.

Figure 1 shows an example of the different components involved in the process of collecting and analyzing quantitative data sources (survey and analytics data) of two pilot projects, part of the European Citizen Cyberlab project. Analytics data are collected through the use of a client-side analytics event generator: the CCLTracker javascript library (Fernandez-Marquez, et al., 2016) and then stored with Google Analytics. Survey data are collected through a LimeSurvey platform directly launched from the citizen science platforms. Data from these two sources can be cross-referenced since users are given the same anonymous identifiers in both cases. Data are exported as CSV files and can be imported into statistical packages for analysis. In our case, we used SPSS for the analysis of survey plus analytics indicators data. R was used to filter analytics data, to compute indicators (metrics computed based on the raw analytics data) and to conduct the profiling analysis introduced in the example of application section of this paper.

¹⁴ For a full list, see https://en.wikipedia.org/wiki/List_of_web_analytics_software

Figure 1. The analytics data collection scheme in the Citizen CyberLab pilot projects



I. A Framework to Use Learning Analytics in Citizen Cyberscience Projects

Overview of Analytics in Citizen Cyberscience

The analytics data that we can collect and analyze is rich and varied in scope; they allow creating explanatory models of learning. Some data give information about the demographic profiles of the participants such as age, interests, gender, and location. Other data reflect engagement with the project through time. A third group records interaction with various systems components, and indirectly tells us about their learning progress. Even the participant creativity and collaboration can be tracked with analytics.

Learning-specific analytics reflect performed actions that are potentially related to learning outcomes (e.g. time to complete a task, number of tasks done by the users, completion or abandonment of a tutorial, or the score attained in a specific activity, etc.). Our framework suggests that learning analytics should be derived from well-defined expected learning outcomes of the CCS project. As mentioned earlier, we believe that individual informal learning in CCS is multi-dimensional: learning regarding the project mechanics, and pattern recognition skills, on-topic learning and general scientific literacy and finally off-topic and personal development skills (Kloetzer L. , et al., 2013).

The engagement-related analytics that we propose in our framework follow the engagement conceptual model of O'Brien and Toms (2008). It is based on the observation of the periods of activity and inactivity as well on the intensity of activity for each participant. Analytics data seem to be a very convenient data source for monitoring user activities which can be aggregated into multiple engagement indicators. Ponciano and Brasileiro (2014) applied this conceptual model to study engagement profiles in astronomy projects from Zooniverse. The engagement profiling they conducted was based on four indicators computed on a daily basis: (1) The daily devoted work represented by the average activity duration through an active day, (2) the activity ratio which is the ratio of the number of active days to the total period of activity, (3) the relative activity duration which is the ratio of the total period of activity to the period of possible activity, i.e. the period from the first activity till the end of the project, and finally (4) the variation in activity represented by the standard deviation of the idle time between active days.

Our framework extends these engagement metrics with others, namely, duration of participation which is the span of time during which a participant returns to the project, the number of active days during the duration of participation, peak daily devoted work, total devoted work during the entire period of activity, and the skewness of the daily work through the period of activity. The skewness might reveal the pattern of engagement through time: whether the participant starts enthusiastically and then loses interest, or, on the contrary, whether, (s)he starts slowly and gets more engaged as (s)he participates further.

Creativity is also an important aspect that citizen science projects would tend to stimulate. Analytics in the large sense can also be used to detect and evaluate creativity in the interaction of participants; Jennett & al. (2013), for instance, indicate that an active project community is a good stimulator of creativity. Data such as the discussion boards of project forums are also potentially useful for assessing learning and creativity through methods of text analysis such as topic modelling, named entity recognition, key phrase extraction, or sentiment analysis.¹⁵ It could also be interesting to conduct a social network analysis and explore how the participants interact through the project communication channels.

The following matrix in Table 1 provides some generic analytics that citizen science researchers may be interested in collecting, and then combining and summarizing into meaningful indicators. Data and indicators in the matrix are classified into five

¹⁵ see http://edutechwiki.unige.ch/en/Portal:_Data_mining_and_learning_analytics_tools or <http://www.tapor.ca/> to explore existing tools.

categories: demographic, learning, engagement, creativity and collaboration. The second column contains analytics data that can be combined into indicators as those cited in the third column. These indicators can be later used in the analysis of many aspects and interactions of any of the aforementioned categories. Obviously, the matrix is not exhaustive, and not all of the suggested analytics are relevant to all types of projects (for instance, due to their pilot nature, the projects we studied lacked meaningful collaborative and creativity analytics data).

Table 1. Overview of analytics data of interest in Citizen Science

Category	Analytics data	Possible indicators (per participant)
Demographic	Age	
	Gender	
	Location / language,	
	Occupation	
	Referral*	
Engagement	Date of first activity	Activity duration
	Date of last activity	Relative activity duration (if the project has a deadline)
	Active days dates	Activity ratio Variation in activity
	Nb. completed/interrupted tasks per activity day	Average Nb. of tasks per active day Total Nb. of tasks over the activity duration Peak Nb. of tasks per active day Skewness of activity
	Session/daily duration of activity	Average session/daily duration of activity Peak session/daily activity duration Skewness of session/daily activity
Learning	Knowledge pretest and posttest(s) answers	Classification of the participant (with/without prior knowledge, expert, etc.)
	Accessed tutorials	Nb. of accessed tutorials
	Percentage of completion of each tutorial	Average percentage of completion of tutorials Nb. of completed/skipped tutorials
	Time spent on each task (completed or interrupted)	Average time spent on (completed/interrupted) tasks globally or daily
	Level achieved and date	Classification of the participant
	Individual scores or any other value computed or achieved by the participant	Daily or global average score
	Percentage of completion of each task	Average percentage of completion globally or daily
	Nb. completed/interrupted tasks per activity day	Percentage of completed tasks, globally or daily
Creativity	Nb. artifacts produced	
	Nb. of blog posts	
	Length of blog posts	Average length of blog posts

	Nb. forum messages	
Collaboration	Nb. of blog comments	
	Nb. chat messages on public channels	
	Word count of forum/blog/chat texts	Average word counts
	Nb. wiki contributions	
	Volume (word count or size) of wiki contributions	
	N artifacts shared (“words”, pics, etc.).	

* *Referral is the originating site from where visitors arrive to the CS site. Referral traffic information might help in identifying external sources that are most valuable in referring to the project site.*

A thorough examination of the proposed indicators reveal that they can further separated into explanatory indicators and (dependent) measuring indicators. For instance, regarding the learning analytics, the number of completed tutorials is a variable that contributes to the explanation of how learning is occurring, while the duration that a participant needs to reach a specific level or, or the score (s)he achieves can be considered as measures of learning. For simplicity sake we don't consider this distinction here as it also depends on the statistical analysis to be applied to the analytics data.

The Framework

In the following we use the term platform to describe any type of citizen cyberscience environment that provides a common working area for participants: these can be projects, games, platforms, or social networks, etc. We consider here analytics data in the narrow meaning, i.e. low-level data that track the interactions of a participant with the web interface of a CCS project. And we will mainly focus on learning and engagement.

Analytics Data Definition

The first step in setting up learning analytics in a CCS project is the definition of the analytics data, i.e. what we are going to measure and how we are going to measure it. As analytics are the low-level data, their definition must directly stem from the learning outcomes that are initially expected from participating in the project. Project designers, educators and developers must first reach an agreement on the learning outcomes to be evaluated. These outcomes should be SMART (specific, measurable, action-oriented, relevant, and time-related [Piskurich, 2011]). A good starting point

for the definition of citizen science learning outcomes would be the User's Guide published by the Cornell Lab of Ornithology in 2014 (Phillips, Ferguson, Minarchek, and Bonney, 2014).

Once they have agreed on learning outcomes, the team must agree on the corresponding indicators to assess each outcome, and finally on the low-level analytics data (also called analytics events) necessary to compute the indicators. Obviously, the definition of analytics can go through an iterative process but developers should be aware that the implementation of analytics should start early in the phase of development and should be tested during the test and pilot phases since introducing analytics incrementally after project start will limit the period during which meaningful analytics data can be collected for an acceptable number of participants.

As an example of a common indicator for many CCS projects, bad clicks around the project interface are an indicator of how well participants master the interface. An analytics event can be generated each time a participant clicks in a wrong place. The event can include information about the part of the interface where the bad click occurs, and on the time of occurrence. Later, several indicators can be computed, depending on the level of detail needed. For instance, a global ratio of bad clicks can be computed and analyzed. Observing the evolution of this ratio through time might reveal if the users are improving and learning how to use the interface appropriately. It is also possible to make inferences about the usability of different parts of the interface by using the details in the events that inform about the placement of the bad click.

More complex learning outcomes might involve many different analytics events or require tracking the chronological sequence of events. For instance, following an adequate playing strategy in a CCS game can be considered as an expected learning outcome. This playing strategy can be detected if a set of actions is executed in a specific order. In this case, the needed analytics data might involve several user actions and their sequencing.

Analytics Data Generation and Collection

Once the analytics data are defined, they need to be implemented through client-side analytics libraries, either domain-specific ones such as RedMetrics or Unity (mentioned above) or by using generic analytics packages such as the CCLTracker JS library that is specifically designed to generate general learning analytics (Fernandez-Marquez, et al., 2016). One highly desirable feature of CCLTracker is its high-level

Application Programme Interface (API) to ease the implementation of complex client-side monitoring tasks, such as time watching a video, or time spent doing a task, etc. As with any piece of code, analytics implementation should be carefully tested to be sure that we are gathering all the needed events and related data.

Subsequently to testing, the data collection can start. It involves observing and recording the interaction of participants with the citizen science platform. Data are generally logged and stored for later processing, yet real-time tracking might also be available (for instance if GA or Piwik are used).

Analytics Data Processing

Typically, analytics data are collected according to the following format:

Figure 1. A suggested format of an analytics data structure

User Id	Combined event	Complementary info	Date	Time
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User Id is an anonymous identifier that the developers define and make sure it is shared among all the data sources of the activity of the participants, i.e. analytics, online surveys, in-app questionnaires, etc.

Combined event is an event tag combined with some extra information. The extra information can, for instance, indicate the part of the UI where it occurs, or on the answer of the participant in a related activity.

Complementary event info is a field that does not always contain relevant information. It might be used for some types of events to give a timestamp, a percentage of completion of an activity, or the duration of time spent on the activity.

Date and **time** are the timing information to be provided for each occurring event. In some cases, a more precise timestamp is needed in order to chronologically order the events, and in this case it can be transmitted in the complementary info field.

Typically, on a normal active day, participant activities can generate thousands of events. These events are collected and processed and then aggregated into the defined indicators reflecting the learning outcomes.

Analytics Data Analysis

Once the indicators are computed for each participant and stored in a dataset of the format below (Figure 3. Analytics dataset format), the statistical analysis of the indicators can start and it is at this stage that it is possible to combine or merge the analytics data with other data sources based on the user Id's.

Figure 2. Analytics dataset format

User Id	Indicator1	Indicator2	...	IndicatorN
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The exploration, visualization and statistical analysis of the resulting data will help with testing research hypotheses and answering specific questions regarding for example the effect of engagement in citizen science projects on the learning of the participants or regarding the existence of different participation profiles.

In the case where we want to compare different CCS platforms that are serving the same purpose or same domain, we might design complex indices or KPIs (key performance indicators), and analyse the performance of the different platforms against these KPIs.

II. Example of Application

The framework proposed here is applied to two pilot projects in the Citizen CyberLab projects: GeoTag-X¹⁶ and Virtual Atom Smasher¹⁷. Ideally, analytics should be gathered for long periods and with thousands of participants to lead to interesting analysis. We were only able to track our pilot projects for short periods of time and participants were only few hundreds; in spite of this, a typological analysis returned interesting results regarding short-term engagement-learning profiles.

We start by introducing the profiling approach that we followed and then for brevity's sake, we present the analysis results of one pilot project: GeoTag-X. A similar approach was followed and similar results were also obtained for Virtual Atom Smasher (VAS) and are briefly presented in (Fernandez-Marquez, et al., 2016).

¹⁶ <http://GeoTag-X.org/>

¹⁷ <http://test4theory.cern.ch/vas/>

Profiling Participants Based on their Analytics Data

Once the different indicators of interest have been set, many statistical analysis methods can be used to gain insight into the different aspects of the participant behavior. Departing from the hypothesis that there is a correlation between the engagement through time and the learning outcomes, we propose a strategy to cluster participants based on their engagement and learning indicators. We drew inspiration from (Ponciano and Brasileiro, 2014) where the authors focused on engagement profiles while we use both engagement and learning indicators.

We conducted an exploratory cluster analysis on analytics datasets with the objective of identifying participant types. Ponciano and Brazileiro applied clustering analysis on a set of engagement indicators of participants in two projects from the Zooniverse family, tracking tens of thousands of participants over more than 18 months. Our datasets extend to a few months with only a few hundred participants. We were curious to see if applying the same approach as in Ponciano and Brasileiro (2014) on such limited datasets would reveal any interesting patterns.

Our preliminary analysis of Virtual Atom Smasher (VAS) data revealed that, for such small datasets, clustering with both types of indicators give more interesting results than with the unique engagement indicators. In fact, clustering represents a first-hand analysis and allows for the identification of participants exhibiting similar behavior patterns regarding learning and engagement.

Regarding the profiling methodology, a classical hierarchical clustering can be applied to a dataset where rows represent the identified participants in a CCS project, and columns represent the respective scaled values of the analytics-deduced indicators of each participant (i.e. a scaled version of the dataset represented in Figure 3. Analytics dataset format). Scaling the values is required to ensure the good performance and interpretation of the clustering output as the selected indicators might have very different value ranges.

Clustering is used here to identify groups of users who share similar engagement and learning characteristics. The number of clusters is not known in advance; many advanced techniques are available to estimate it. A first-hand approach would be to observe the tree diagram of the hierarchical clustering (also known as dendrogram) and see how many clusters seem clearly separate. Once the number of clusters is decided, we would examine the centers of the clusters, which are the means of each indicator inside each cluster. These centers help to assess how distinct the clusters are and what are the main characteristics of each cluster. Many metrics are also available

to assess the quality of the clustering analysis. Their presentation falls beyond the scope of this paper.

Correlation analysis is also available for testing hypotheses regarding, for instance, the relationship between different types of engagement and learning of specific aspects of the project. Predictive models can then be developed to predict which type of engagement could lead to the learning outcomes that most interest the CCS project leaders. Again, such analysis requires datasets of reasonably big sizes to be significant and lead to interesting results.

Experimentations with Virtual Atom Smasher and GeoTag-X analytics were done in R and the results for GeoTag-X are presented next.

Profiling GeoTag-X participants

GeoTag-X is a pilot crowdsourcing platform launched by UNITAR-UNOSAT to rely on human computation to support disaster response. The primary aim of GeoTag-X is to develop an application that facilitates the human harvesting and analysis of photos related to disasters around the world such as floods, drought, and war destruction, and the creation of datasets that could be used by humanitarian organizations in their response. In order to be successful in this aim, the project worked on the transfer of the expertise from knowledgeable individuals to the crowd. Specifically, the target skills are: to identify relevant photos, to conduct detailed analysis of those photos and potentially geo-reference them as precisely as possible.

A hierarchical clustering is implemented and discussed here.

We tracked the activity of the users of GeoTag-X through a period of nearly two and a half months from 5 August 2015 to 21 October 2015. During that period we gathered learning analytics from 959 users, 706 participants were anonymous and 252 participants were identified. The participants completed a total of 6837 tasks. 6669 tasks were done by identified users and only 168 (8.5%) by anonymous users. In fact, despite the high number of anonymous identifiers, the activity is mainly generated by logged-in participants.

Table 2 groups the different indicators used in the profiling analysis. They are of two types: learning and engagement, and they are computed for each individually identified participant based on her/his collected analytics data.

Table 2. Indicators used in a cluster analysis of participants in GeoTag-X

ENGAGEMENT INDICATORS	LEARNING INDICATORS
Total duration (in days)	Mean number of bad clicks per day (independently of the location of the bad click)
Number of active days in the whole duration	Ratio of bad clicks (bcr)
Mean number of events per day	Total number of started tutorials
Total number of events in the total duration	Total number of completed tutorials
Peak number of events per day	Total number of skipped tutorials
Skewness of number of events	Mean time before skipping tutorials
	Mean time to complete tutorials
	Total number of distinct completed tasks (info provided from server-side)
	Total number of started tasks
	Total number of completed tasks (not necessarily distinct)
	Mean-min-max-standard deviation of task duration

A typical task in GeoTag-X concerns answering a few multiple-choice questions about a displayed photo related to a specific disaster context. The platform provides training tutorials that are supposed to be completed prior to every different theme (called projects in Geotag-X) but the tutorials are not compulsory and can be skipped.

The hierarchical clustering mainly revealed four different participant profiles in GeoTag-X:

Users who did not submit any task (no tasks)	When the dataset was explored, we observed that 77 did not submit any tasks during the studied period. These participants visited the web site and had a limited activity with a seemingly higher bad click ratio than the other groups. These participants are grouped in one group and excluded from the clustering analysis because they lack the indicators related to task activity.
Explorer	Users with a low level of engagement, who contributed on average less than 3 tasks per user. We identified 55 users in this group. Only 10 of them came back for a third time.
Ephemeral	The group of participants who return slightly more often within a short period of time (typically within less than a week), but who, in contrast to the explorer group, has meaningful activity in the area of task submission (twenty tasks per user on average). We identified 89 users in this group.
Committed	The group of users who return several times and submit a lot of tasks (one hundred tasks per user on average). We identified 31 users in this group.

Table 3 below presents the centers of the different groups to which GeoTag-X participants belong. Some interesting indicators of the cluster centers are also depicted in Figure 5.

Table 3. The mean values of the indicators of GeoTag-X activity according to the different participant groups

	No Tasks	Explorer	Ephemeral	Committed
Sizes	77	55	89	31
Number of active days in the total duration	1.75	1.85	2.06	9.16
Total duration (in days)	6.92	5.27	3.25	32.52
Activity ratio (nbActivDays/duration)	0.80	0.75	0.85	0.39
Mean number of events per day	19.43	47.36	133.07	133.13
Total number of events in the total duration	32.77	80.49	242.78	1060.32
Peak number of events per day	27.25	61.60	177.72	368.32
Skewness of number of events	0.34	0.07	0.07	0.78
Mean number of bad clicks per day (independently of the location of the bad click)	2.27	4.69	8.65	5.77
Ratio of bad clicks (BCR)	0.13	0.10	0.06	0.05
Number of started tutorials	0.81	1.62	2.42	7.29
Number of completed tutorials	0.21	0.69	0.76	1.48
Number of skipped tutorials	0.22	0.38	0.90	3.58
Mean time before skipping a tutorial*	122.88	137.99	121.96	52.80
Mean time to complete a tutorial*	449.82	203.82	283.26	243.74
Total number of distinct completed tasks**	7.40	11.11	30.87	163.52
Total number of started tasks	3.13	6.76	29.48	142.00
Total number of completed tasks (not necessarily distinct)	0.00	2.51	19.20	99.23

Total number of distinct started tasks during the analytics collection period	2.60	5.78	26.15	118.52
Total number of distinct projects in which tasks are at least started	1.10	1.24	1.57	2.97
Mean task duration*	NA	83.73	79.25	63.61
Max. task duration*	NA	100.17	170.75	185.66
Min. task duration*	NA	68.09	19.56	5.73
Standard deviation of task duration*	NA	29.85	51.56	46.54

* Durations are provided in seconds

** Information provided from GeoTag-X server and not from the analytics.

The distribution of the groups resulting from the typological analysis shown in the head of Table 2 and depicted in Figure 4 indicates that 47.6% of the identified participants in GeoTag-X (the ephemeral and committed groups) had a meaningful contribution. Individual participants from these two groups typically submit more than twenty different tasks and contribute to several projects on the site (Figure 5 [c] and [e]).

Figure 3. Distribution of GeoTag-X participant types in terms of number of participants

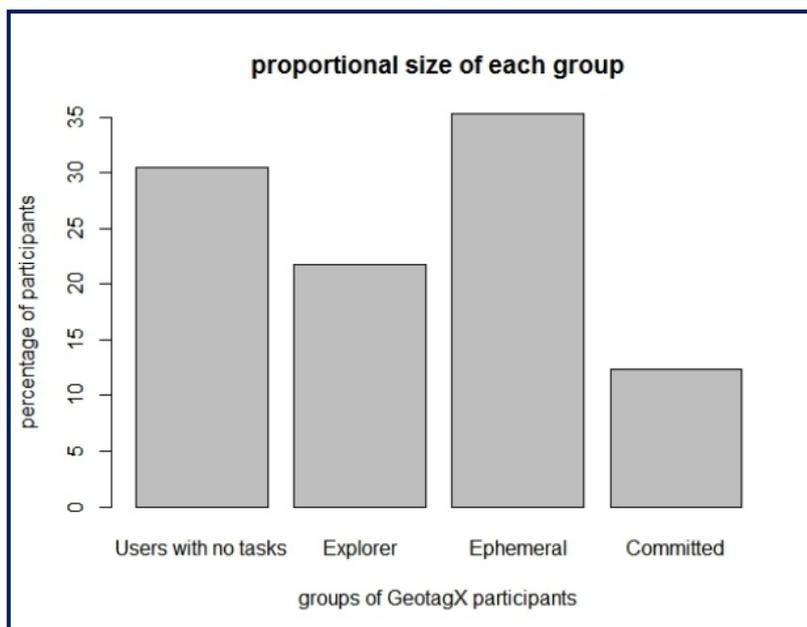
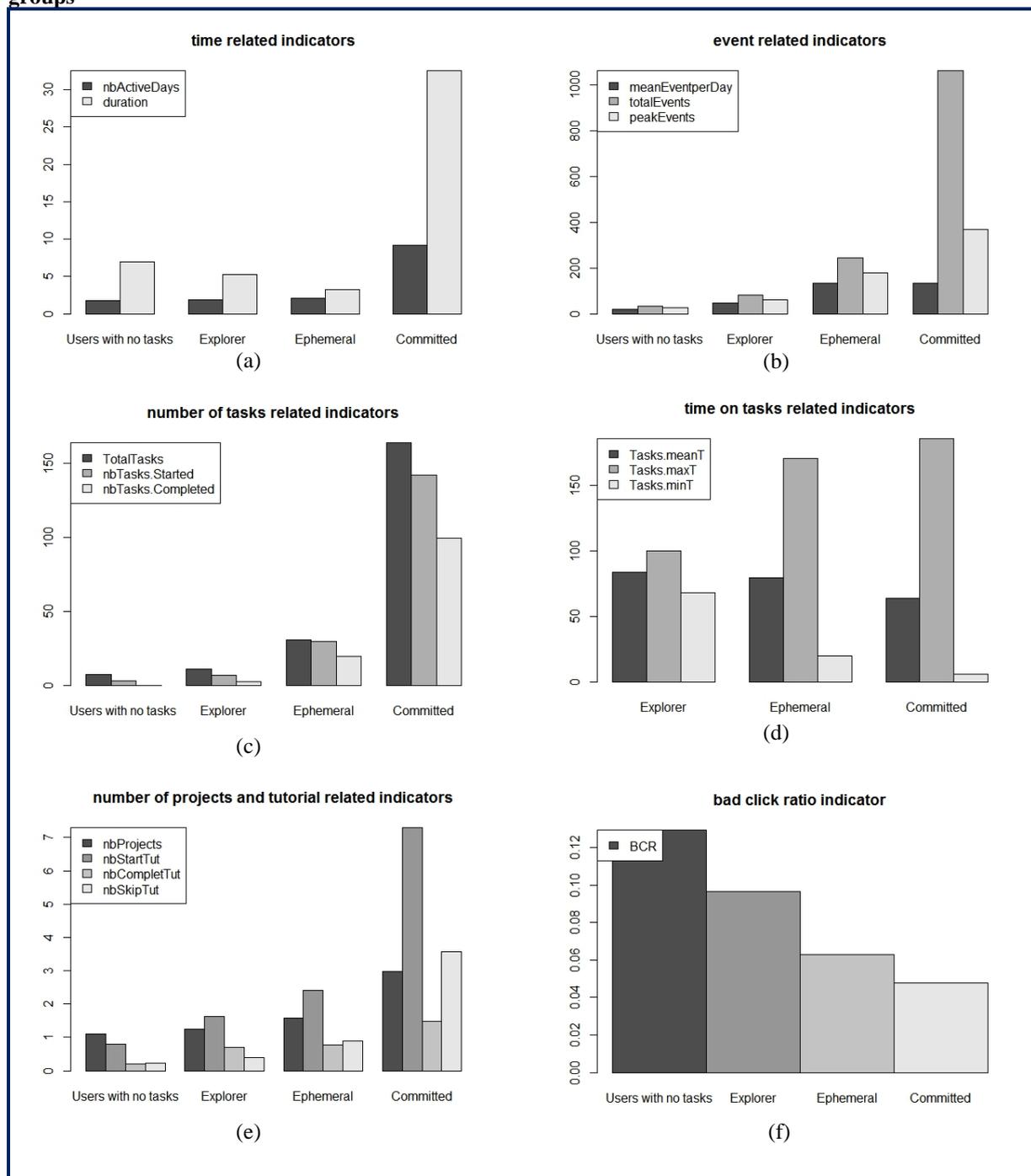


Figure 5 (a) depicts the longer durations (in days) during which committed participants stayed connected to the project (i.e. returned to it) in contrast with the other groups. The number of active days of this group is also higher. We observe that the higher level of participation (number of tasks submitted) involves a higher number of visits (more active days) and longer durations during which participants stay on the website and return to the project.

Figure 4. Some indicators of GeoTag-X activity according to the different participant groups



The counts of events in Figure 5 (b) shows the higher intensity of activity of the committed group, and also reveals that the ephemeral group has a higher activity than the explorer group.

The total task bar in Figure 5 (c) uses the data stored on GeoTag-X server and shows the total number of tasks that each participant contributes independently of time. That is why we see a small number of tasks attributed to the first group who submitted no tasks during the period of the analytics collection. This indicates that participants from this specific group had a limited activity before the analyzed period. Their activity type is closest to the explorer group.

Figure 5 (d) reveals a disparity between the minimum times to complete a task for each group. One might expect that the longer the participants remain on the GeoTag-X website, the faster they manage to submit tasks. As detailed in Table 4, the global correlation confirms this hypothesis with a significant negative correlation although of a small value. The in-group correlations are not significant since the number of active days is small for the participants in the explorer and ephemeral groups, and the number of participants is not large enough in the committed group.

Table 4. Correlations between the minimum time to submit a task and the number of days of activity in each group and globally for all the participants

		Minimum task duration
		X
		Nb. Active Days
Explorer	Correlation	0.138
	Significance	0.300
Ephemeral	Correlation	-0.061
	Significance	0.600
Committed	Correlation	-0.138
	Significance	0.500
Global	Correlation	-0.218
	Significance	0.004

A one-way ANOVA is also applied to test if the value of the minimum duration to complete a task differs significantly among the three groups. The test confirms this difference with a high significance (p-value < 0.001). The same ANOVA analysis is also applied to the mean duration and also confirms differences in values among groups but with a weaker significance (p-value = 0.02921). In fact, the difference in mean durations to complete a task among the ephemeral and the explorer groups is not significant as confirmed by a t-test.

Theoretically, it is possible to merge analytics data designed according to the proposed framework with online survey data of the CCS project. Interesting analysis can be conducted with the condition of having enough participants who are tracked with analytics and who answer the surveys. GeoTag-X proposed two online surveys (Kloetzer L., Schneider, da Costa, Abu-Amsa, & Jennett, 2015) – a pre-test offered at the sign-up and a post-test offered after a user has completed 30 tasks. Both short surveys were designed in cooperation with the pilot project team to measure project specific learning and reasons motivating participants to participate in GeoTag-X.

As the number of participants was limited, out of the 221 who answered the pre-test survey, only 55 answered the post-test survey. Also, since the analytics data collection was not fully possible before the beginning of August 2015, we have analytics data for only 23 participants who answered both surveys. As a proof of concept we present in Table 5 the distribution of the answers to a pre-test question regarding prior knowledge in disaster management. The total number of respondents is 102 participants:

Table 5. The frequency according to the different groups, of answers to a survey question regarding the prior knowledge in disaster management

	No Tasks	Explorer	Ephemeral	Committed	Total
I have studied disaster management	0	1	10	1	12
	0,00%	8,33%	83,33%	8,33%	100%
I have no previous knowledge of disaster management	8	11	12	10	41
	19,51%	26,83%	29,27%	24,39%	100%
My current occupation is related to disaster management	5	2	5	2	14
	35,71%	14,29%	35,71%	14,29%	100%
I have read articles/books about	10	3	9	3	25

disaster management	40,00%	12,00%	36,00%	12,00%	100%
I have studied disaster management at college	2	1	4	3	10
	20,00%	10,00%	40,00%	30,00%	100%
Total	25	18	40	19	102

The Cramer'V coefficient of Table 5 is of 0.255 which indicates a weak relationship between the prior knowledge as informed by the pre-test survey question and the group to which the participant belongs. We can see for instance that the majority of committed participants have no prior knowledge in disaster management. The total scores to the survey questions also show this fact (see), a progress in the post-test total score is also visible, but as the data are very limited in size we cannot test any statistical hypothesis within groups. A full analysis of the survey is available in: Kloetzer L., Schneider, da Costa, Abu-Amsha, & Jennett (2015).

Table 6. The distribution of the scores of committed participants who answered the tests. The maximum score is 80.

	Pre-test	Post-test
Less than 50	8	1
51-60	2	3
61-70	6	5
71-80	2	8

The scores and answers of the committed participants indicate that their engagement is not due to their experience. It will be interesting when enough data has been gathered to properly assess their learning induced by the participation in the project.

III. Good practices in the use of learning analytics

Our experimentation with the learning analytics of both VAS and GeoTag-X reveals that valuable insights could be gained from analytics data. The full exploration of all avenues requires long periods of data collection and more participants. The following list sketches general recommendations for a full exploitation of learning analytics.

They are the result of our experience with the learning analytics of the two pilot projects VAS and GeoTag-X, using CCLTracker (Fernandez-Marquez 2016) and GA services for the collection of data. Data manipulation and analysis are done in R.

Design Aspects
Analytics should be present starting from the first phases of the design of the projects.
The design of the tracking activity is a collaborative work between educators, designers and developers to define the relevant expected learning outcomes and how to track them.
The definition of analytics is a top-down process: After specifying the Expected Learning Outcomes according to the different dimensions of the learning, the needed indicators should be derived followed by the needed analytics to compute these indicators. A bottom-up feedback is also necessary, as we need to be sure that the analytics we expect to build our indicators are practically available.
We have to keep in mind that analytics cannot track everything. For instance, the duration of a session is a very questionable concept as a user might keep the page/task active while not working on it and it is difficult to guess when (s)he really abandons.
Analytics data can be combined with electronic surveys and questionnaires. They can also be combined or triangulated with server-side logs to better track the behavior of the users.
Based on the expected participation in the CS project, the data scientist should forecast and allow for reasonable activity duration before starting the analysis.
Technical aspects
It is important to start by setting up reliable and scalable user identification schemes respecting the privacy and allowing the connection with potential electronic surveys and questionnaires that users might also fill in.
Anonymous contributions are important to many CCS projects; however, in these cases, we cannot carry out an engagement or learning assessment as anonymous users cannot be tracked through time even if they return several times to the project. In such cases, only contributions through individual activity sessions can be tracked without any identification of the users.

In order to separate the event tracking logic from the specific service that collects the analytics, user behavior must be tracked locally (client-side) and interesting events are defined with a suitable data structure using, for example, a framework such as CCLTracker, then the data can be sent to GA, or any other analytics service or stored on the project servers.

In general, we must explicitly track the start-time and the finish-time of each meaningful user action. Including the duration of the action allows also for simplifying the data processing, otherwise, each action should have a unique Id to detect the events that track its beginning and its end or its interruption. This ultimately makes the structure of an analytics event complex, and potentially dependent on the selected analytics collection and storage option (e.g. locally, GA, etc.), hence the events should be carefully designed from the beginning.

Special attention should be given during migration of data, server logs and analytics schemes to a new version of the project platform, hosting environment, or web interface. Without backward compatibility of the data and the analytics, the use of analytics in the long-term will be compromised.

Spare enough time to test analytics data collection and consider all the use cases. For instance, we noticed that when tracking clicks on hyperlinks, if the user decides to open the link in a separate tab to keep the project page open, the click event is not tracked.

Statistical analysis could be done in any statistical packages such as SPSS or using the programming language R.

Finally, we would recommend storing analytics data locally to keep the ownership, have full control on the data, and be confident of its quality. If the demographic data offered by Google is really important for the project team and it is not available through other channels, Google analytics service can be used to track global activity on the project platform without necessarily implementing a tracking system that sends all the events to GA, but in this case, one should be aware that the possibilities of crossing different types of analytics can become limited, also, that extra time should be devoted to develop the visualization and manipulation capabilities that Google analytics avail to its users through the GA web interface.

Conclusion and Future Work

Most citizen science projects have an educational aspect and expect to improve the scientific literacy and the public understanding of science in addition to their ultimate goal of supporting researchers in accomplishing tasks with the help of the crowd. Learning analytics is a source of valuable data for tracking the activity of the participants and understanding how and what they are learning when participating in online citizen science projects.

Also, analytics can be most helpful in feedback loops as it allows for a better understanding of the behavior and the profiles of the participants in CCS projects, and helps programs to develop specific actions in four different directions identified in Bonney et al. (2015), namely project design, goals achievement (outcomes) measurement, diversification of targeted volunteers through adapted outreach actions, and ultimately, the exploitation of analytics in conjunction with other evaluation tools might reveal new directions of research to explore.

When the analytics data are well-defined, they offer many possibilities to fine-tune the analysis of the participant behavior. With further experimentation, our framework can be extended to propose such possibilities. For instance, Jordan et al. (2012) suggest that some projects with long time run and long term participants may consider different types of learning outcomes for different levels of participant engagement. For example, it may be worth engaging long-term volunteers in different types of activities hence with different learning outcomes to be assessed. In contrast, short-term volunteers who might participate only a few times may require less training, and still provide meaningful contribution and potentially also meaningful learning of different aspects.

Also, depending on how analytics data timing is defined, a detailed analysis of the activity of the participants can be conducted to potentially detect chronological patterns. For instance, previous studies revealed some weekend bias in the CS data collected to support phenology studies (Cooper, 2014). Such analysis might in turn inform outreach actions: If we know that citizen scientists are more active on weekends or during specific periods, tailored actions can be launched at convenient points in time to encourage them to connect to the project.

The typological analysis of engagement and learning indicators revealed interesting patterns that are different from the ones revealed in long-term engagement profiling presented in: Ponciano and Brasileiro (2014). There were similarities between the results of the analysis of Geotag-X and VAS analytics data. In Geotag-X there are groups who didn't contribute, who only explored the site with a very limited

contribution, who meaningfully contributed but for short periods of time and finally who were committed to the project with high level of contribution.

The participants of VAS have slightly different profiles, they are separated into participants who visited the game only for one day and never returned, those who explored the game for short periods, and those who are committed. A distinct group is detected among VAS players, and includes players who seemingly were very active but apparently didn't manage to play properly and then they abandoned the game after few days. It will be interesting to apply the same learning-engagement typology analysis to different types of CCS projects and see if common patterns arise. Also, we are aware that applying the same analysis to larger datasets might change the resulting typology.

Although our experimentation with the learning analytics of two pilot CCS projects has many limitations, it allowed us to gain insights into how analytics data should be designed to help assess the learning of the participants. The framework that we propose in this article may help other CCS project teams to methodically include learning analytics in the project development cycle in order to avoid the pitfalls that we identified during our own research and practice.

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References

- Bonney, R., Phillips, T., Ballard, H., & Enck, J. (2015). Can citizen science enhance public understanding of science? *Public Understanding of Science*.
- Brossard, D., Lewenstein, B., & Bonney, R. (2005). Scientific knowledge and attitude change: The impact of a citizen science project. *International Journal of Science Education*, 27(9).
- Cooper, C. B. (2014). Is there a weekend bias in clutch-initiation dates from citizen science? Implications for studies of avian breeding phenology. *International journal of biometeorology*, 58(7).

- Crall, A., Jordan, R., Holfelder, K., & al., e. (2013, August). The impacts of an invasive species citizen science training program on participant attitudes, behavior, and science literacy. *Public Understanding of Science*, 22(6).
- Cronje, R., Rohlinger, S., Crall, A., & Newman, G. (2011). Does Participation in Citizen Science Improve Scientific Literacy? A Study to Compare Assessment Methods. *Applied Environmental Education & Communication*, 10(3).
- Elias, T. (2011). Learning Analytics: Definitions, Processes and Potential.
- Ferguson, R. (2012). Learning analytics: drivers, developments and challenges. *International Journal of technology Enhanced Learning*.
- Fernandez-Marquez, J. L., Charalampidis, I., Abu-Amsha, O., Grey, F., Fuchs, B., & Schneider, D. K. (2016). CCLtracker Framework: Monitoring user learning and activity in web-based citizen science projects. *The Human Computation Journal*, *Forthcoming*.
- Hand, E. (2010). Citizen Science: People Power. *Nature* .
- Himmelstein, J., Goujet, R., & Lindner, A. (2016). How Open Game Metrics Can Turn Any Game into Citizen Science. *Human Computation*, *forthcoming*.
- Jennett, C., Eveleigh, A. M., K., A., & Cox, A. (2013). Creativity in citizen cyberscience: All for one and one for all. *ACM WebSci13, 'Creativity and Attention in the Age of the Web' Workshop*. Paris, France.
- Jordan, R. C., Gray, S. A., Howe, D. V., Brooks, W. R., & Ehrenfeld, J. G. (2011). Knowledge Gain and Behavioral Change in Citizen-Science Programs. *Conservation Biology*, 25(6).
- Jordan, R., Ballard, H., & Phillips, T. (2012). Key Issues and New Approaches for Evaluating Citizen-Science Learning Outcomes. *Frontiers in Ecology and the Environment*, 10(6).
- Kahn, W. (1990). Psychological Conditions Of Personal Engagement And Disengagement At Work. *Academy of Management Journal*, 33(4).
- Kiron, D., Prentice, P. K., & Ferguson, R. B. (2014). Raising the Bar With Analytics. *MIT Sloan Management Review*, 55(2).
- Kloetzer, L., Schneider, D., & da Costa, J. (2016). Not So Passive: Engagement and Learning in Volunteer Computing. *Human Comutation Journal*.

- Kloetzer, L., Schneider, D., da Costa, J., Abu-Amsha, O., & Jennett, C. (2015). *D6.3 Learning in Citizen Cyberlab*. Deliverable. Récupéré sur to be accessible after approval at <http://citizencyberlab.eu/research/deliverables/>
- Kloetzer, L., Schneider, D., Jennett, C., Iacovides, I., Eveleigh, A., Cox, A. L., & Gold, M. (2013). Learning by volunteer computing, thinking and gaming: What and how are volunteers learning by participating in Virtual Citizen Science? *ESREA 2013*. Germany.
- Lieberoth, A. (2014). Getting Humans to Do Quantum Optimization - User Acquisition, Engagement and Early Results from the Citizen Cyberscience Game Quantum Moves. *Human Computation*, 1(2).
- Meece, J. L., Blumenfeld, P. C., & Hoyle, R. H. (1988). Students' goal orientations and cognitive engagement in classroom activities. *Journal of educational psychology*, 80(4).
- Michelucci, P. (2013). "Synthesis and Taxonomy of Human Computation," . Dans *Handbook of Human Computation* (pp. pp. 83–86). New York: Springer .
- Morris, L., Finnegan, C., & Wu, S.-S. (2005). Tracking Student Behavior, Persistence, and Achievement in Online Courses. *The Internet and Higher Education*, 8(3).
- O'Brien, H., & Toms, E. (2008). What is user engagement? A conceptual framework for defining user engagement with technology. *Journal of the American Society for Information Science and Technology*, 59(6), 938–955. doi:<http://dx.doi.org/10.1002/asi.20801>
- Phillips, T., Ferguson, M., Minarchek, M. P., & Bonney, R. (2014). *User's Guide for Evaluating Learning Outcomes in Citizen Science*. Ithaca, NY.: Cornell Lab of Ornithology.
- Piskurich, G. (2011). *Rapid Instructional Design: Learning ID Fast and Right*. John Wiley & Sons.
- Ponciano, L., & Brasileiro, F. (2014). Finding Volunteers' Engagement Profiles in Human Computation for Citizen Science Projects. *Journal of Human Computation*(6).
- Romero, C., & Ventura, S. (2010). Educational Data Mining: A Review of the State-of-the-Art. *IEEE Transaction on Systems, Man, and Cybernetics*, 40(6).
- Sauermann, H., & Franzoni, C. (2015). Crowd Science User Contribution Patterns and Their Implications. *Proceedings of the National Academy of Sciences*, 112(3).

Schneider, D. K., DaCosta, J., Abu-Amsha, O., Jennett, C., & Kloetzer, L. (2016). Participation and learning patterns in Cyber Citizen Science. *Human Computation Journal*.

Siemens, G., & Long, P. (2011, July/August). Penetrating the Fog: Analytics in learning and education. , vol. 46, no. 4 . *EDUCAUSE Review*, 46(4).

Wiggins, A., & Crowston, K. (2011). From Conservation To Crowdsourcing: A Typology of Citizen Science. *44th Hawaii International Conference on System Sciences*.

Interview with Dr. Oula Abu-Amsha



Dr. Oula Abu-Amsha is a scholar of computer science and applied mathematics. She holds a Ph.D. from Versailles Saint-Quentin-en-Yvelines University and is highly regarded for her leadership in integrating educational technologies in the Syrian higher education system. Dr. Abu-Amsha has contributed two articles to - Syrian Academics in Exile: (1) The role of risks and resilience in access to education: a case study of a Syrian community school in Beirut Lebanon, and (2) Data Analytics in Citizen Cyberscience: Evaluating Participant Learning and Engagement with Analytics. She is currently undertaking a career re-orientation to the field of data science.

NRV: Can you tell us a little about your background in Syria, why you decided to leave and where your journey has taken you?

Dr. Abu-Amsha: I used to be a university professor in computer science and applied mathematics. I used to teach mainly engineering school students. In 2012, my husband and I decided to leave the country with our family. We first moved to Lebanon. We spent 2 years there. In 2014 we managed to leave to another country in Europe. I was invited to spend one year as a visiting scholar where I engaged in the trendy field of data science, and I am at present invited to another university with the hope of securing a stable job at the end.

NRV: In your article you speak about some of the main barriers/challenges that Syrian children face in the Lebanese schools (language of instruction, resources and so on). Can you tell us a little about these barriers and how they hinder Syrian children education in Lebanon?

Dr. Abu-Amsha: My first interaction with education in Lebanon came through my children. I have 3 children and had to choose a school for them. Then I discovered what are the big barriers to children enrolling in schools there. It was the language barrier at first and then the financial barrier, of course, as the private schools are very expensive. But most Lebanese children go to private schools, 70% of them. Public

schools have their own problems – limited resources and they are in fact lagging behind since the Lebanese civil war. The primary barrier is the language used at schools. In Syria we teach in Arabic. The children start English at age 9 or 10. A few start earlier but in general they study in Arabic. Arriving to Lebanon, it depends on the schools, but most of the subjects are taught in English or French. Arriving with no language skills the children are unable to cope. They are also not treated well in the system. They are also bullied by the other children. Many of the children sit aside, they do not socialise. They try to be on their own. Most of the time it's the system that is not very welcoming. There is also the problem of lack of documents.

With the financial difficulties of the parents sometimes they send the children to work. The lack of security is also a problem. Many families don't feel secure in their neighbourhoods, so, for example, they don't want to send their girls to school. Syrian parents were also expecting events to settle down sooner at home so they could return. They were waiting for the situation to improve. This vision has changed now. They have been 2 or 3 years out of their country and have become more aware that they have to send their children to school.

NRV: For these children who have been out of school is there any support shown for them, on a community level?

Dr. Abu-Amsha: I don't know how it is outside of Beirut but there were some initiatives that were not able to be sustained for more than a few months or a year. Small initiatives are not very sustainable. I don't think there is too much effort. For the moment the demand is far higher than what is available. The biggest task at present is enrolling the children who already had access to the Lebanese schools in the last two years. Those who have been out of school for a longer while are unfortunately not the priority.

At the ministry level they are trying to institute some Arabic teaching but there are other barriers like transportation that is a huge problem. For example, if the school is far from where the children live it is hard and expensive to commute. I've learned from "Jusoor" that even this year they were trying to have 100% enrolment in the second semester for all children who were enrolled in the public school for 3 years or less. But even in this they have a 40% drop out rate due to the transport issue and mistreatment at school. The Lebanese teachers are not trained to work with the Syrian students. Although we are neighbour countries and historically the same population, we evolved differently during the twentieth century. And I think we have a different perception of reality. There is also an enmity between Syrians and Lebanese since the

Lebanese civil war. The Syrians feel like they are not welcome. This is very difficult for a small child to understand.

I don't think there is much being done for the children who have dropped out. Maybe there is some vocational training. The problem is that most of the neighbouring countries have their own problems. You cannot ask Lebanese people to give more than they already gave. Jordan is the same. It is difficult for our children, our generation. I know there are many NGOs on the ground who are trying to give some programmes and training, but it is I believe, still marginal.

NRV: It is interesting that the majority of children in the study who dropped out of education are boys. Research into higher education attrition of Syrians in exile suggests that women are more adversely affected than men. Why do you think there is this mismatch?

Dr. Abu-Amsha: The problem is that this research just deals with the children who were at school. I don't know how many more were at home and never attended. I'm just saying that the girls who were at school, who had access, were more able to cope. I don't have representative samples for gender. Generally speaking, children's education is really supported by Syrians. After food, shelter and security this is very important for all of us. I have many friends who are in Syria who stayed in the country just because their children are still able to pursue their studies there.

The problem is with the exiles. Parents usually don't have the same possibilities. It depends also on other issues. For instance, parents are more concerned with security issues regarding girls more than boys. Sometimes boys don't have the chance to go to school because they are sent to work. Girls have a higher risk of being married at a younger age. So you have many factors that affect boys and girls. Its more about risk factors than gender. I can tell you about a family that I met. The girl used to continue to go to school (she has dropped out because of lack of access) and the boy was put to work in a shop to subsidise the family. It depends, it really depends.

NRV: The article also brings up the 'mistrust' that exists among Syrians because of the divisive nature of the war. How did this challenge you as a researcher and how did you overcome this? Have you any tips for researchers to try to limit the draining nature of such emotional and close research?

Dr. Abu-Amsha: During the research I tried to avoid mentioning any political issues. I tried to be very neutral. I was discussing education not politics. Regarding the emotional involvement, it is very difficult to maintain the professional distance. Till now when I'm involved in something that is related to Syrian education I can get very emotional very quickly. During the period I was carrying out the research I was discussing this with the World Bank education team, and they told me they knew it was very exhausting and emotional. They tried to support me remotely. Until now I'm still having visions and images of the difficulties that the people (children and the parents) told me about. It's very painful. But it gives us energy when you feel like you are trying to improve the situation.

NRV: You end the article on a positive note about the positivity that exists for capacity building. Are you positive about the future of Syria?

Dr. Abu-Amsha: I think we need to train more teachers, more people who stay with the children – teachers, assistants, etc. I think we need to think more about building the capacity of Syrians. Many of the people who have stopped their education at universities have the capacity to teach. That would be very efficient if they could teach. We will have this lost generation but if we train the older Syrians to be educators they can help the younger generation to catch up. The big issue is teenagers. The language barrier is bigger and the gap between the two education systems is very big for them. These people need to have some vocational training. I know that there is an NGO that is trying to provide vocational training but they are really limited by their resources. They need funding. We need them. If we can get people in the community to set up their own projects they will run it better than an NGO. This is a really big issue. For the future we have to build on the young Syrians. We need to give them training, vocational training, teacher training. It will help when things settle down. I think that many things have been done in Africa that we can learn from.

NRV: What does the future hold for you as a researcher?

Dr. Abu-Amsha: For the moment I am trying to get involved in refugee education, but it is really difficult. It is really a closed universe. You cannot get access to it easily without many connections. Until now I have not been able to work in this area and for the moment I am trying to make myself a place in data science. I learned a lot on my own, to gain the necessary skills. My professional situation is not very stable yet. It is a very competitive domain. I don't know if I will find a stable job in the future. I am still trying to secure something. In parallel, I am also volunteering in the project "Jamiya" which aims to bring higher education opportunities to Syrians. If I have the chance to choose, I would prefer refugee education on data science but I don't have any possibilities up until now.

Governance of Agriculture in Syria between Economics and Politics: Analysis of the Pre-Revolution Period

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Abstract

This brief paper provides a descriptive analysis of governance in Syrian agriculture with the aim to reveal the ultimate causes of the Syrian uprising that started with mass protests in March 2011. The paper characterizes the political economy of agriculture and public policy environment with some illustrations from history to help understand the policy origins, their economic rationales and their social contexts. The paper shows how the Syrian regime's agricultural policy was centered on controlling the farming and rural community even when it was declared otherwise. Over the last five decades, farmers have been squeezed and marginalized, but after 2000, extreme poverty reached unprecedented levels in a context of escalating corruption and neglect of their demands.

Introduction

The Syrian Arab Republic contains an important part of the famous 'Fertile Crescent', known by many scholars of human history as the origin of modern agricultural societies. Over the millennia, agricultural activities in the region have seen numerous adaptations, but even in the first decade of the 21st century, the agricultural sector still plays a dominant role for the Syrian national income as well as for employment generation. The sector still, both in terms of employment and gross domestic product, provides 25-30% on both accounts.

In this paper, I aim to present a summary of the public policies, regulations and procedures that have governed the agricultural sector up until 2011, with a focus on

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the situation in the first decade of the 21st century. As such, I aim to highlight potential relationships between these policies and the popular protests which started in March 2011 and later transformed into a tremendously bloody armed conflict.

The paper starts with a general characterization of the public policy environment with some illustrations from history to understand the origin of some public policies not just in terms of their economic rationales but also in terms of social and class conflicts. This is followed by a descriptive analysis of the most important public policies, the way they evolved, and their various impacts on the agricultural sector, farmers' lives and rural income. The paper concludes with a discussion of the political issues and the drastic changes that occurred in the period 2008-2011.

Political Economy of Syrian Agriculture

The rural areas and the agricultural sector have always received considerable attention from policy makers in the last decades – in particular from 1963 when the Al-Baath Socialist Party came to power. Major policies were formulated to reshape the sector through price mechanisms for the so-called strategic crops (mainly wheat, cotton and sugar beet) and infrastructure investment in rural areas (primarily roads, dams, irrigation networks and land reclamation). However, the laws of agrarian relations and land reform enforced in 1964 were the most important tools for obtaining a structure of production according to the national preferences. The latter being defined by the new ruling socialist elite. The former being defined by the authorities confiscating land in excess of a certain ceiling and distributing it to domestic landless farmers. According to the laws governing agrarian relations it was guaranteed that farmers retain at least 80% of their output if the landlords provided only land in sharecropping arrangements while landlords lost rights to fire farmers from their “historical lands”. In parallel, the Baath authorities nationalized most industries, trade and banks and established a centrally planned economy in line with the dominant socialist model of the era. At the political level, these economic regulations were accompanied by a confiscation of political freedom and the establishment of one-party political regime.

However, this drastic change cannot only be explained by the will of the new political class inspired by socialist ideas. In addition to this will, there were tangible socio-economic problems which the earlier political elite had failed to resolve, for which the agrarian question was at the core. On the one hand, Syria before 1963 lacked basic infrastructure, especially in the rural areas (such as roads, communication, electricity networks), while there was a need to expand agricultural land since the cultivable area

of the time had already been exhausted. On the other hand, the farming community was already striving for agrarian reforms to empower the actual farmers who were deprived basic rights by the landlords who belonged to the same urban class that owned most economic enterprises and from which most politicians of the era descended.

The need for the huge investments to provide public goods and services (such as water, energy networks, dams) that the emerging private sector was unable to provide called for a greater role of the State in the economy. In addition, there was a need to do something for the farming community to gain their support for the ‘process of the socialist transformation’, considering that the old contractual procedures were considerably biased towards absentee landlords while real farmers received no more than 25% of the output for their labor across the year.

The introduction of the new regulations induced noticeable growth and development in the following two decades for two major reasons. First, the centralization of decision-making facilitated resource mobilization and allocation towards desirable investments such as dams, irrigation canals, land reclamation, and building of new factories mainly for import substitutions of production inputs. Second, the laws of land reform and agrarian relations provided sufficient protection to farmers who became more motivated to increase labor productivity.

Two decades later, the centralized decision-making process, in the absence of a free press and independent civil society organizations, was transformed into a dictatorial closed system that generated a level of corruption never reached in the country before (Al-Hamash, 2012). In the same token, the incomplete property rights connected with the law of land reform, as beneficiaries were granted the full right of use and entailment without the right of sale, caused land fragmentation after the death of the first generation. Land fragmentation was in turn one reason for poor investments in agriculture after 2000 as many farms became economically unviable in size despite having very fertile soil. In the meantime, the law of agrarian relations discouraged investments where it was applied as both parties lacked secure control over the land (Sadiddin, 2005).

Moreover, the centralized planning system, when applied to agriculture, deprived farmers of the free choice of cropping and sale of output. Until the 1990s, farmers had to comply with the annual plan set up centrally by the Ministry of Agriculture and Agrarian Reform (MAAR) and in most cases they had to sell their output to parastatal agencies at administered prices that mostly did not reflect the market signals. Even short-term credit and extension services were linked to the annual plans. Farmers who

refused to comply were denied access to services and faced serious risks of crop destruction that caused high tensions and lack of cooperation with public servants. This implicit taxation against agriculture was justified by the prevalent economic paradigm that the path to development is exclusively through industrialization while agriculture was regarded as a stagnant sector and incapable of boosting growth (Wattenbach 2006; Wehrheim 2001).

After the collapse of the Socialist Bloc and the loss of the political and ideological support, the Syrian regime came under increasing pressure to change, which pushed for the adoption of some new regulations, mainly Investment Law no. 10. The Country, therefore, opened up partially for private sector involvement in industry and trade creating noticeable growth (up to 5% annually) in the first half of the 1990s. However, growth went down to less than 1% in the second half of the 1990s for reasons that have mainly to do with politics more so than with the Law No. 10, as people who benefited from the law mostly belonged to the new capitalist class descending from or highly connected to the centers of power in the regime. This new class, who accumulated wealth over the preceding 20 years, managed to channel economics openings to their interests block new entrants into the economic arena¹⁸.

During this time farmers operated in an environment prone to water scarcity with low average annual rainfall. In 1999-2001, a harsh drought hit the country and caused a significant reduction in agricultural output that contributed to the stagnation of the economy. The mismanagement of water resources through excessive use of surface and ground waters in the 1980s left little space to use irrigation to mitigate the drought's effects (Wattenbach, 2006).

Socio-Economic Environment of the Farming Community in 2000s

After the death of the ex-president Hafez Assad and the transfer of power to his son Bashar, things started to change slightly for agriculture as the government for the first time declared that planning in this important sector would be indicative rather than strict. However, the only tangible consequence was the omission of crop destruction risks in case farmers were found not in compliance with the annual plan. Furthermore,

¹⁸A very famous example of this was reported by Riad Seif, ex parliamentarian and a current opposition figure, in a small book that was distributed unofficially during Damascus Spring in 2001. This caused the arrest of Seif who was later sentenced 5 years in jail.

the long-term effects of land reform became a critical issue by 2000. In addition to land fragmentation, the lack of title deeds as the agrarian reform land was not officially demarcated, generally presented a constraint to accessing long-term credit through formal channels and hence slowed down agricultural investments. This resulted in the development of parallel arrangements as the only viable solution for farmers who were obliged to accept terms considerably exploitive and imposed by traders and input dealers/suppliers, most of who operated illegally (Wattenbach, 2006).

The main sources of credit, other than the public Agricultural Cooperative Bank (ACB), were “informal” traders of wheat and cotton. In such cases, a trader bought the production of wheat or/and cotton (which were state-controlled crops) in advance at prices much lower than the official prices (about 30% lower). The trader gave cash to the farmer when needed according to agreed arrangements. After the production was delivered to the trader, the trader sold it to the relevant governmental institution. Sometimes, the produce was sold through the cooperative of the village by the trader using the name of other farmers. While such activity was illegal it was usually protected by the social norms. Consequently, the official credit system favored well-off farmers at the expense of medium and small sized ones, although the latter constituted the bulk of the farming community in 2010 (Sadiddin, 2005).

Farmers also faced serious problems in marketing crops that were not sold to the government, such as fruits and vegetables as well as a large group of legume, cereals, oilseed, and others. These crops were marketed through private sector channels and their prices were determined through the interactions of market forces. The absence of price stabilization policies resulted in fluctuating prices exposing farmers to a high level of income risk. This was particularly true for small farmers who lacked other economic activities that could be used to manage income risk. Price fluctuations also shaped farmers’ preferences in output sale and many farmers, who are usually risk-adverse, used to sell their crops in the field at the fixed price to traditional traders called *guarantors*. In this way, farmers expressed their willingness to sacrifice on average some margin for securing a minimum level of revenue, pushing them again into exploitive terms.

Those who decided to take the risk of price fluctuations also had to deal with commissioners in the wholesale markets, to whom farmers were obliged to pay at least 10% of the output value in order to access the market place and get assistance to sell their output. These marketing arrangements generated a long chain of intermediate operators between the agricultural producers and the final consumers with the

agricultural surplus squeezed away from farmers who remained the weakest agents in agro-food chains (Sadiddin, 2005).

Agricultural Policies in Syria before 2011

Agricultural policies are all public laws, actions, decisions and regulations that affect directly farmers' decisions. In the Syrian context, they are usually classified into irrigation policies, licensing policies, price and output delivery policies, and policies of input distribution and credit.

Irrigation-Related policy

Speaking about irrigation policy means policies related to the provision of irrigation water at the farm level. In Syria, this includes all policies that affect all kinds of water accessibility by farmers and determine the costs of water as well as the magnitude of these costs. The latter is determined in Syria by irrigation source which can be categorized into networks, rivers, and private tube-wells.

The State constructed, especially in the seventies, a large number of irrigation canals that drained water from dams to fields. Most maintenance costs of these projects were borne by the government. Farmers with access to them usually paid an irrigation fee per hectare of land on an annual basis, which contributed slightly to the maintenance costs, regardless of the amount of water used, so the regulation provided no incentive of water saving by farmers. Farmers using rivers water for irrigation usually did not pay fees as they drew water directly from the source using a private engine individually or collectively, and so they bore the pumping costs which were significant in cases of long distances (Sadiddin, 2010).

Pumping costs however, were significant when farmers used private wells and those represented more than 70% of Syrian farmers with access to irrigation. Such costs increased with time as the water table went down due to drought and excessive use of groundwater. Most pump-sets used diesel whose price was controlled by the government since the 1970s, and was subsidized until 2009, when the government introduced a sudden price increase by more than 300%, causing the failure of a significant part of farming activities. The effects of this price increase was disastrous in the northeast of the country where the water table was very low and the cost of pumping was already high (Sadiddin, 2010).

Licensing Policy

Despite the declaration of indicative planning, the annual agricultural plan remained until 2011 a central element of the agricultural policy in the country. It aimed to direct farmers towards a particular pattern of land use perceived by policy makers as best able to achieve the national objectives. The plan served as a framework at the beginning of each cropping year to guide the provision of credit, inputs and other services to farmers through the Agricultural Cooperative Bank (ACB). The annual plan was implemented by means of a licensing system where farmers were required to grow certain crops written down in the license document which was delivered to them by the agricultural units in their villages.

Compliance with the license was fundamental to access credit and obtain price support if any. However, this licensing system that denied any effective role of free choice and market mechanism was behind the major part of corruption and related rent-seeking activities in the agricultural sector and the related agro-food industries. Numerous farmers, mostly the well-off, managed not to comply with the licensing system without paying the price of exclusion from credit and other services (Wattenbach, 2006).

Pricing and Delivery Policy

From a policy viewpoint, crops in Syria can be classified into strategic crops and others. Strategic crops are those with prices affected directly by government pricing policy, either through administering fixed prices or through setting floor prices. The crops considered strategic in Syria were wheat, barley, cotton, sugar beet, tobacco, lentils, and chickpeas. The government annually set prices for all strategic crops at which public agencies and establishments would buy the outputs. These prices were applicable at the same level throughout the country and were all determined based on unit costs of production, aiming to isolate farmers from market forces and motivate farmers to produce specific crops in line with policy preferences. The prices of other crops (non-strategic) were determined through the interactions of market forces without any direct intervention from the government through traders (Sadiddin, 2010).

Credit and Input Distribution Policy

The ACB was the major distributor of physical inputs in the country although the private sector became active in this area after 2005. Most Syrian farmers used to get the major part of their inputs requirements from the ACB. The ownership of an

agricultural license was essential to buy inputs from the ACB, in which inputs were sold according to specific figures that reflected crops requirements of each input per hectare. The price of fertilizers was fixed and subsidized from the early 1990s until 2009 when the government raised their prices significantly in an effort to bring them closer to their international market counterparts. In the same year the government raised the diesel price by more than 300% (Parthasarathy, 2000; Parthasarathy, 2001; Sadiddin, 2010).

Conclusions and Political Implications

Agriculture has received increasing attention from policy makers in Syria since the 1960s. However, farmers well-being has never been the core of this attention. The Syrian regime's major attention was to use the sector to better control the country. On the one hand, the agrarian reforms enabled the new regime to destroy the economic power of the old political class as a means to deprive them of their political power. On the other hand, the regime managed to create a system of control of farmers, giving them something but not sufficiently to empower them economically and socially, and politically.

In the meanwhile, the cost of the policy was high in terms of resource depletion, especially as water was the scarcest resource in the country. The loose control over its use in the 1980s and 1990s resulted in a wide diffusion of illegal well digging, some of which were licensed later but others not. In any case, this has led to uncontrolled and unorganized use of water which caused overexploitation of the resource across the country. In several studies, it is reported that water deficit is huge and requires special and urgent attention due to continued reliance on inefficient methods of irrigation and over-cultivation of water-demanding crops such as cotton and sugar beet (NAPC, 2005; Sadiddin, 2013; Varela-Ortega and Sagardoy, 2001).

Although agriculture has been always taxed by the government, the bias against agriculture has tremendously increased after 2000. The neo-liberalist orientation of the consultants surrounding the "young modern president" pushed further towards neglect of rural communities in general and farmers in particular. It can be safely said that before 2000, during the era of Assad the father, the regime was careful always to respond to the minimum demands of the farming community and never allowed extreme poverty to diffuse. However, Assad the son dealt with their demands in a less accommodating way. This was reflected when the government raised the prices of diesel by 300% in 2009 in a period when the country was experiencing a harsh drought that negatively affected national output.

The taxation of agriculture by the rest of economy was justified in the 1960s-1970s by the paradigm of development through industrialization. However, the consequence was that neither agriculture nor other sectors grew significantly to keep pace of population growth. This generated marginalization dynamics that caused several negative phenomena. One is the growth of poverty belts among the big urban centers (especially in Damascus and Aleppo), made mostly by rural-urban migration. Another, and more important, is the unprecedented diffusion of extreme poverty among the rural population. A few studies carried by the UNDP have estimated that extremely poor people accounted for more than 8% in 2004 and they increased to 12% in 2007 (Abu-Ismail, Abdel-Gadir & El Laithy, 2009; El Laithy and Abu-Ismail, 2005).

This was the condition of the farming and rural communities in Syria when winds of change hit the Arab region in 2011. It was not by chance that in Syria, as opposed to other Arab countries, the mass movement of protests was based in the rural areas. The regime's response to retrieve the importance of agriculture was too late to stop the protests mainly because it was based on the same reasoning of reforms made in 1964. The intention of the regime was to silence people rather than to satisfy their demands, which have grown substantially and significantly in quantity and in quality during the last half century.

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References

Abu-Ismail, K., Abdel-Gadir, A. & El-Laithy, H., (2009). 'Poverty and Inequality in Syria (1997-2007)'. *Arab Development Challenges Report Background Paper 2011/15. United Nations Development Program (UNDP)*. Available from: http://www.undp.org/content/dam/rbas/doc/poverty/BG_15_Poverty%20and%20Inequality%20in%20Syria_FeB.pdf.

Al-Hamash, M. (2012), 'Arab Baath Socialist Party in Syria: 1953-2005' in *Nationalist Parties, Movements and Organizations in the Arab Homeland*, Eds. M. J. Barout, Arab Unity Studies Center (AUSC), Beirut, pp. 88-175 (In Arabic).

El Laithy, H., & Abu-Ismaïl, K., (2005). 'Poverty in Syria: 1996-2004: Diagnosis and pro-poor policy considerations'. *United Nations Development Program (UNDP)*. Available from:

<http://www.planning.gov.sy/SD08/msf/PovertInSyriaEnglishVersion.pdf>

NAPC, (2005). 'Economic incentives and policy options for sustainable water use in agriculture: the case of Al-Khabour basin, Syria', *National Agricultural Policy Center (NAPC)*, Damascus, pp.82. Unpublished working paper available upon request from the author.

Parthasarathy, N.S. (2000). 'Agricultural inputs liberalization', *FAO Project GCP/SYR/006/ITA, the National Agricultural Policy Centre (NAPC)*, Damascus, pp.131. Available from: <ftp://ftp.fao.org/country/syria/pdf/credit.pdf>

Parthasarathy, N.S. (2001). 'Agricultural credit', *FAO Project GCP/SYR/006/ITA, the National Agricultural Policy Centre (NAPC)*, Damascus, pp. 108. Available from: <ftp://ftp.fao.org/country/syria/pdf/credit.pdf>

Sadiddin, A. (2005), 'Syria farming systems: farming systems of the central irrigated and rain fed plains and Al-Ghab', *National Agricultural Policy Centre (NAPC)*, unpublished working paper, pp.80., available from the author upon request.

Sadiddin, A. (2010), *Agricultural policy impact on the stability of farm income and water use in the North-East of the Syrian Arab Republic*. Ph.D thesis, Dipartimento di Economia e Politica Agraria. Università degli Studi di Napoli Federico II. Available from: http://www.fedoa.unina.it/4111/1/Tesi_di_dottorato-Ahmad-Sadiddin.pdf [9 February 2016].

Sadiddin, A. (2013), 'An assessment of policy impact on agricultural water use in the northeast of Syria' *Journal of Environmental Management and Sustainable Development*. Vol. 2. No. 1. pp. 74-105.

Available from: <http://www.macrothink.org/journal/index.php/emsd/article/view/3255> [9 February 2016].

Varela-Ortega, C., & Sagardoy, J.A., (2001). 'Agricultural water use', *FAO Project GCP/SYR/006/ITA, the National Agricultural Policy Centre (NAPC)*, Damascus, 150 pp, Available from: <ftp://ftp.fao.org/country/syria/pdf/water.pdf>

Wattenbach, H. (2006). 'Farming Systems of the Syrian Arab Republic', *FAO Project GCP/SYR/006/ITA, National Agricultural Policy Center*, Damascus, 145 pp. Available from: <ftp://ftp.fao.org/docrep/fao/009/ag418e/ag418e00.pdf>

Wehrheim, P. (2001). 'Taxation and net transfers to the agricultural sector', *FAO Project GCP/SYR/006/ITA, National Agricultural Policy Center, Damascus*, 81 pp.

Available from: <ftp://ftp.fao.org/country/syria/pdf/taxation.pdf>

Interview with Dr. Ahmad Sadiddin



Dr. Ahmad Sadiddin is a pre-eminent scholar of agronomy and agricultural economics. He holds a Master's from the University of London and a Ph.D. from the University of Naples Federico II. He was recently head of the Supply and Demand Analysis Unit in the Agro-Food Policies Division of the National Agricultural Policy Center, a research center within the Syrian Ministry of Agriculture and Agrarian Reform, that was established with the support of the United Nations Food and Agriculture Organization. He is currently in his second year of the IIE-SRF fellowship at the University of Florence, Italy

NRV: Can you tell us about your work in Syria and what led you to seek exile overseas?

Dr. Sadiddin: When the Arab Spring started I was doing my military service at the end of 2010. From the beginning we noticed that it involved the army against the protests. We (me and my colleagues) were in the north of Aleppo. We were a special group, all doctors of research, about 35 years old, older than our other colleagues. We started to feel some fear of being obliged to go to the field and participate in operations. They didn't allow any of us to exit for a long time. This was the general context. I was sent to the north of Raqqa. I was never asked to participate in military operations thanks to the fact that I come from a small city called Al-Rastan. From the beginning of the uprising it was one of the hot spots of Syria. It's the city where the Free Syrian Army (FSA) was founded. I was regarded as a suspect from my commanders, so they preferred to keep me in the barracks and under their control. There was some doubt that I may not do what was requested of me. From the end of 2012 it was clear that the government stopped all discharges of soldiers, so we were kept as reserve as no political solution was near. We decided to look for individual solutions. So we defected in the end. All of my friends in the barracks went one after the other. I left at the end of August. I went out of the barracks for a 3-day visit to my family and didn't come back. I was in contact with people who helped me to leave the country. I went to Turkey for a few months and waited for my visa to come to Italy, since while I was in the military I had already applied for this scholarship from the

SRF. They told me the results a couple of weeks after I left the army. When I left Syria I had something to help me to establish my normal life outside of Syria.

After I left the situation escalated considerably. In the last year for example there are so many reports of random detention and torture of academics and students. Students also started to fear being drafted to the military. In general, even if I had not been serving in the army 99% I would be outside of Syria now as the situation became impossible for normal life, a normal career. Even in the areas under the control of the rebels, there are no institutions, the areas are always bombed. For people like me there was no way to live a normal life. Regardless of my situation I would have left the country anyway. The people with whom I'm in contact, most have left the country. Those who haven't left are doing nothing. People who teach at the universities go on of course, but there is no research. All the projects have been suspended or cancelled. Even those that remain just remain because they have to stay with their parents or they haven't found any possibility. People are waiting.

NRV: You introduce your article by drawing our attention to Syria's Fertile Crescent'. Can you elaborate on this a little and give us an indication of the types of agriculture that have thrived in the region.

Dr. Sadiddin: The region extends over 5 or 6 countries today. They call it the cradle of civilisation. It is where the first settled communities started. It has comparatively moist and fertile land compared to the surrounding region. The concept has also been used to refer to different meanings as well, such as in international geo-politics. It is the centre of the so-called old world. It has always been problematic in the sense that everyone has always wanted something there. There are some findings from the history of agriculture, crops like wheat, lentils etc. were domesticated in the region 10,000 years BC. Also some animals were domesticated there. The start of agriculture was in that region. It has an old tradition, however these agricultural systems were born and evolved, naturally up to a certain point in this region. Until the beginning of the 19th century the evolution was more natural. Nothing was imposed on people in terms of what they would grow – just cultural influences from invasions and so on. For example, no one knows certainly when olive entered the region. Crops like cotton and sugar beet entered the region recently. Cotton for example entered with the French intervention in Egypt after the beginning of the 19th century. These crops have been associated in a certain way with colonisation, especially with the expansion of England and France. They wanted these countries to supply the raw materials for the industrial revolution in these countries. Cotton and sugar beet are two of the most

important strategic crops. Even when the so-called Socialist governments came to power they adopted these crops. In the case of the Syrian government, apart from producing crops for farmers, they used it for political means. E.g. cotton is easily to manipulate in the international markets. Sugar beet was used to create a certain amount of staples as sugar and it is one of the most import crop staples. So for a long time they kept producing these crops, despite the fact that the government was losing money as they were achieving their political objectives.

NRV: Was this connected with land ownership as well?

Dr. Sadiddin: Of course. When they applied the so-called agrarian and land reforms, it was a kind of reciprocal relationship. On the one hand the government gave the land to the farmers but the farmers didn't own the land completely. They were required to produce certain crops. The central plan was decided in Damascus and then distributed to the governorates and then the local levels and so on. The village level was required to tell the farmers what to do. The farmers didn't have complete property rights and there were no other possibilities. They might not find markets for other crops, etc.

NRV: How was the land divided up among the farmers?

Dr. Sadiddin: Large farms in Syria don't exist. Now the average size is about 3 hectares for irrigated land and 10 hectares for rain fed land. It is quite small. This is because of the laws I was talking about. In Syria we don't talk about land owners but land holders. What matters is who manages the land. Agrarian reform land by law is owned by the State and the farmers are just beneficiaries. Farmers have the right to give their land to their descendants but they do not have the right to sell it. In the case of the so-called agrarian relations the land in most cases is owned by the original land absentees. Anyone who had land of more than 10 hectares irrigated land, and 30 hectares for rain fed land (this was the ceiling). Any land in excess had been be confiscated and distributed to famers in the 1960s. The only region where we found relatively large farms is in the north east and the reason is because historically that land was considered rain fed. With time it has been converted to irrigated but it still has the same characteristics. You rarely find a farm bigger than 10 or 12 hectares.

NRV: In relation to law reform and agrarian relations in the 1960s - was the redistribution system troubled by corruption and mismanagement or was it a seamless transition?

Dr. Sadiddin: There has been no objective research that I have read about this. No one conducted good research on this in a very articulated manner, no investigations, no surveys about this, but what we know is that during our research we talked to a lot of people and they told us some stories. For example, in a region called Al-Ghab, which is one of the most fertile regions in the country, they said that when the land was redistributed in the 1970s to landless farmers they gave only to each family 2.5 hectares. It was mismanagement more than corruption. The government behaved without looking to the long run. We found that each family only had 0.5 hectares and many of these farms became economically unviable. Also half of the farms were fragmented between different areas. In the end they were abandoned, deteriorated. The fact that the government didn't allow the sale of this kind of land meant the market didn't function well. It wasn't favourable to the farmers. Corruption in the strict way could have happened but we have no proof. Another example that is still talked about is from the north-east of Syria where it is historically populated by the Kurdish minority. Many organisations and activists say that during the 1960s a lot of land owned by Kurdish absentees was confiscated and distributed to Arab families. The government had a kind of policy to surround the borders of Turkey with a border of Arabs. In this way the land reform law that was in theory made for social justice and economic growth was also used for political objectives and discrimination. We are still now dealing with that.

NRV: Did the fixing of crops translate on the production in the country? What other effects has crop price fixing in the country?

Dr. Sadiddin: This has had one of the most important and one of the most negative impacts on the country. They had the intention to make the majority of farmers' dependent on the state. In time the farmers lost the initiative to be respondent to the market. From the 1990s the government realised that this was going to be a burden. When they first started the system, the prices of commodities like sugar beet and cotton were high on the international market. In the 1970s it was ok. On the one side farmers were ok as they didn't have any information about the international price. The government took advantage of this with the surplus. After the 1990s and the collapse of the Soviet Union the price of commodities collapsed. Especially cotton, wheat and sugar beet. Then the fixed price in Syria was higher than on the international market.

The government didn't want to upset the farming community as the regime was used to getting its support from them. At the end of the 1990s with the transfer of power to Assad the son, things went wrong. Every time he wanted to make a change it was opposed by the institutions. In 2003 the price of oil was low on the international market and the government could sustain the price of energy in the domestic market without creating side problems like smuggling. They wanted to keep these prices low to support industry and so on. On the international market the prices were going much higher. We were surrounded by countries that were net importers of diesel - Turkey, Lebanon and Jordan. Smuggling grew a lot. From Syria to Lebanon and Turkey especially. The price in Syria was 7 pounds and in Turkey it was 30. At that time the government was advised to start restructuring and start increasing the price gradually. They didn't listen and relied on the so-called security solution to control smuggling. They started to arrest people etc. But it came to nothing in the end. It took 4 years before the head of the state understood that the corruption within his system was blocking all of this. They were convinced that price increase was inevitable. They were saying that one third of diesel was being smuggled outside of the country. In 2006 it wasn't easy in everyday life where you found yourself short of diesel, e.g. you would have to look one week before etc. When they started reform it was too late. They felt under pressure and increased the prices by more than 300% in 2009, which was a big shock. Many farms, in the north especially, closed. Many farmers abandoned them for jobs in areas surrounding cities. We started to see this in Damascus in 2010 where people who left their farms in places like Raqqa and Hassakeh came because they couldn't afford the cost of pumping water on their farms.

NRV: Towards the end of the article you state that the protest movements primarily took place in rural areas in Syria. What impact did this have on farmers in the country?

Dr. Sadiddin: This is one noticeable thing about where it started. It started in Daraa. It's a small city, maybe 100,000 inhabitants, but it is one of the most developed areas of the country in terms of agriculture. Even when the protests moved to other areas, apart from Hama which was massacred in the 1980s by the regime, I would say that the protests were mainly rural. It's a continuous process of neglecting the rural community in general, whether through agriculture directly or through other services. The main difference between the father and son is, while they were all oppressors and corrupt, the father in the end could manage to keep everything under control, even the corruption. The father understood that the countryside of Syria was the most delicate element. It was the element that gave the system its stability. Assad's son lost this. He

missed the balance that was created by his father. He neglected totally the rural community in general. He started making deals with urban based business men. They cut support for agriculture and services to the rural areas, pollution, irrigation and so on. The countryside got angry. Some of this discrimination was sectarian. The Arab Sunni felt they were discriminated against. They make up the majority of people and felt they were marginalised. The main problem with this family is they think they are godlike. They are actually arrogant. Even the way they reacted to the initial protests. The exaggerated reaction.... fighting a fly with a rocket.

NRV: What is the current state of farming in Syria? Is production continuing despite the increased volatility of the civil war?

Dr. Sadiddin: The regime has lost most of the agricultural areas. The three governorates that used to produce the bulk of agriculture are under the control of the Kurds, PYD or ISIS. Between these trade is going on because they have mutual interests. E.g. the regime buys oil from ISIS. Wheat is the same as oil. The only thing is no one talks about it because the amount of money that ISIS gets from wheat is not that much. The money ends up in the pockets of farmers. ISIS just manages it (the only areas where there is no exchange of commercial activities with the rest of the country are the areas that are controlled by the Syrian rebels, which trade with neighbouring counties: Jordan in the south and Turkey in the north). A small search on the net would reveal that in 2014 the EU issued a decision to impose sanctions on Mr. George Haswani who was the middle man between ISIS and the Syrian government. They made sanctions on him because he was facilitating oil exchange between the regime and ISIS. There was an agreement signed by the regime, represented by Haswani, and ISIS. They met somewhere between Damascus and Deir Ezzor to sign an agreement. The agreement was that ISIS would pump a certain amount of oil every day to Homs refinery and they would get something like 25 million dollars a day. From a political point of view, the regime has the right to procure this kind of material, but what disappoints me is that everyone talks about oil being smuggled to Turkey, which is a very small amount, but no one wants to say anything about this. Despite these EU sanctions no one talks about it.

NRV: What are your future hopes for the country? What do you see happening there?

Dr. Sadiddin: In my case, and not just me, but hundreds of thousands of Syrians who have left the country, I know many dream of going back. The future of Syria will depend on them, in us. We are now in exile, but at least we are not under bombing, we don't face risks of random detention etc...we can learn, we can produce. Before 2011 when I was working in Syria all my research was about Syria, but as I say in the article, and now here, Syrian public institutions were closed. They never favoured consultation of public opinion, academics, universities. They were always neglected. The first thing is this should change. The governance that will emerge must learn from the past that there is a fundamental rule in their construction of research centres, universities etc...and in order for them to participate actively they must be free. There must be intellectual freedom as this is fundamental to scientific research. The second thing is they must be independent of any pressure, especially political pressure. In my particular case I am working in a very reputable university and learning a lot. I'm learning skills that I wouldn't have learned if I stayed in Syria. The experiences of other countries, particular things that are relevant to my field of work. All of this could benefit the country directly or indirectly. If I can learn from the experiences of other countries, it would help to open a kind of dialogue in the country. If the opportunity arises for us to come back, any Syrian exile. This is the only hope that one day this exile experience may turn out to become an enrichment to the Syria of the future.

There is a risk that if the war continues for a long time people may find it difficult to go back. If it continues for another 5 years we imagine all of the Syrian minds are lost, and we may also lose an entire generation. Many children don't go to school; many don't go regularly. Others live under fear. Apart from losing a lot of minds we are also losing a generation. The war must be ended today.

Algorithm and Techniques of Prediction, Data Mining, and Big Data Analysis for Healthcare, Society, Trade and Industry

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Abstract

Several areas, like weather, health, society, trading, industry, etc., need to predict some decisions about some parameters, which help the management and departments of a company or state institutions with their planning and marketing strategies. To get right decisions we need to define and design a predictive model based on intelligent analysis techniques of the stored data and measurements. Some of these areas are focused in our executed projects, which support a country to manage its tasks smartly and enable the management of institutions, companies of industry and trade, or departments to be optimized, flexible, quick, and smart and to preserve the country from undesired criminal events.

In this article we summarize the most important points of our projects together. In the security field we have developed a predictive model to extract information about group or persons which are on the way to become criminal. For an economy field, namely construction companies, we designed a system to predicate the advantages and disadvantages of construction equipment and its costs. For a health care system, which uses some sensors to recognize the motion of very sick people, we developed a data analysis technique which estimates the similarities between some object (sensors) to reduce the cost of production of the suit of sensors. For all previous fields we defined and implemented an algorithm, which computes the exact value of a statistical and holistic function distributively, which is used in the previous developed techniques, to make the execution of these technique more efficient.

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Introduction

Predictive models are designed for several areas, like weather, healthcare, society, trading, industry, etc., to predict some decisions about some parameters. These models include algorithms and several techniques of data mining and data analysis. The fields of healthcare, society, trading and industry are focused in our projects, which support a country to manage its tasks smartly and enable the management of institutions, companies of industry and trade, or departments to be optimized, flexible, quick, and smart and to preserve the society from undesired criminal events. In this article we represent the most important points of our developed projects.

As the prediction of criminal or terroristic developments for a person's behavior is very important and takes a big role for the parents, society and the country security, we have developed a predication technique depending on Decision Support Tree (DST) using XML¹⁹- and XQuery²⁰-Technologies. After managing all available data about a person with regard to the personal data protection we determined the parameters, which play a decisive role in our technique and are classified into essential and non-essential elements. This technique should be able to extract information (knowledge) about groups or persons, which are on the way to become criminal (Balouch, 2012).

In the construction companies the construction equipment is the most important physical assets that companies hold. Effective equipment management, which is required to take necessary operational and strategic decisions, is a vital need to achieve the success of those companies. This includes purchase, operation, retirement, renting, maintenance and repair, etc., with the least cost of operation as well as the best investment of the capital. The evolution of the use of automation technology and information management systems associated with the increasing volume of collected equipment data shows the need for a tool to take advantage of the huge collected data in equipment management. For this reason, we suggest a data warehouse²¹ for construction equipment management for engineering companies in the Syrian public sector. We also present a primary decision support system which would allow visual analysis of the equipment data at different levels to help equipment managers fix the hidden problems behind operating equipment and then provide decision-making of equipment management a high level of flexibility (Hasan, 2012).

¹⁹ XML is abbreviation for eXtensible Markup Language and is a document format.

²⁰ XQuery is a Query Language for XML- documents.

²¹ Data warehouse is a system used for reporting and data analysis.

The similarities between some objects like construction equipment, recognition of motion sensors, etc. can incur extra costs for the data analysis. Therefore, we need to develop techniques which can trace objects with similarities. For example, recognition of motion according measurements needs data (values) from many sensors, like Position, Velocity, Acceleration, Orientation, etc. We have two major ways to determine which placements of sensors on the body are required to recognize the motion. The first way connects its work with the results of other scientific branches like sports science and game development. Alternatively, when many sensors are placed on the body, without knowing which sensors are required and an analysis of the stored data for each sensors is carried out, the behavioral similarity of these sensors can be extracted. The aim of both strategies is to reduce the cost of building a suit of sensors and simultaneously to keep the results of the recognition of motion correct. We followed the second strategy and developed a new analysis techniques depending on a linear regression (Balouch, 2015c) and nonlinear regression (Balouch, 2016a). In this paper we follow the second strategy and represent the new linear regression analysis²² “ReSeVA”, which depends on vector definition (on its angles and length) and on the principle of Newton’s law of motion (Balouch, 2015c).

In most data analysis²³ techniques, we use many several aggregate functions. A parallel computation of functions on distributed multi sets requires more work and resources to execute this kind of computation. This is more difficult if the desired function is a statistical holistic²⁴ one. The computation of these functions plays a very important role in fields of query processing, query optimization, big data analysis and evaluation. It becomes more important if it must be executed on distributed multi data sets. The computation of such functions needs iterative and recursive steps which can compute an exact or approximated value. This causes an expensive blocking time. The challenge in this field is how to reduce the iterations (recursion) and the blocking time minimally. The algorithm, which is represented “PCM-oMaRS”, is published in the American Research Journal (Balouch, 2015a) and its optimization is published in the ACIT’15 (Balouch, 2015b) and in the IAJIT (Balouch, 2016a). To the best of our knowledge, there is no other algorithm which solves the problem of computation of the exact median in distributed multi sets with steps without usage of iterations or recursions. PCM-oMaRS solves this problem without such a step and blocks determinate data only once by one step if it is necessary. This algorithm consists of three major phases and depends on the mathematical definition of median. PCM-

²² Regression analysis is a statistical process for estimating the relationships among variables.

²³Data Analysis is a process of inspecting, cleaning, transforming, and modeling data with the goal of discovering useful information, suggesting conclusions, and supporting decision-making.

²⁴ Holism is the idea that systems and their properties should be viewed as wholes, not as collection of parts.

oMaRS provides a more efficient execution not only in distributed datasets even in local datasets with enormous data. The reduction of blocking time of streaming data and of complex cost is a recent growing interest in distributed aggregation, thanks to emerging application areas such as, e.g. data mining or sensor networks. Therefore, we focus on the optimization facilities of one step of the PCM-oMaRS algorithm. With this optimization strategy we can simply see that this strategy makes this step more efficient. Then, we show that the complexity of this algorithm is in the worst case a quick sort algorithm.

Data minimization plays an important role in accelerating query processing. The aim of PArADISE is to develop a privacy-friendly query processor that implements the aspects of data minimization and data avoidance. The processor is integrated within the PArADISE-framework. The evaluation of the framework is based on the sensor and context information collected at the Smart Appliance Lab of the graduate program MuSAMA.

In section I we list the literature on these subjects with a short summary. The predictive model for criminal behavior is presented in section II. Section III elaborates on the predictive model for construction equipment. Section IV presents the ReSeVA methodology. Section V presents the PCM-oMaRS. Section VI presents the optimization of PCM-oMaRS algorithm with a statistical study of the implementation of this algorithm. Section VII presents information about PArADISE.

I. Literature Review

Balouch (2012) presented the TEPTCP technique, which analyses stored XML documents according to predefined parameters using DST and XQuery. The author has developed, with this tool, an initial methodology to predicate the criminal behavior of persons with regard to the personal data protection.

Hasan et al. (2012) suggested a data warehouse for construction equipment management of engineering companies in the Syrian public sector. This data warehouse is designed to improve the sources of data for the knowledge discovery. In addition, this research presents a primary decision support system which allows a visual analysis of the equipment data at different levels of details that helps equipment managers to fix the hidden problems behind operating equipment and then provide decision-making of equipment management with a high level of flexibility. The next step defined a non-parameter mining algorithm to construct the decision.

Balouch (2015c) presented the ReSeVA analysis technique to reduce unneeded sensors (objects) according to their similarities, which can be extracted with this technology. This technique depends on Newton’s second law of motion and the definition and principles of vector science. The other analysis (Balouch, 2016b) depend on second Law of motion by Newton and Euler equations, which build a nonlinear regression.

An efficient method to solve the problem with the parallel computation of statistical holistic functions, which can be used in data analysis, is presented in Balouch (2015a). The optimization and statistical information are shown in Balouch (2015b) and (2016a). Descriptions and information about PARADISE can be found in Grunert (2014a), Grunert (2014b) and in Grunert and Heuer (2014).

II. Predictive Model for Criminal Behavior

As the prediction of criminal or terroristic developments for a person’s behavior is very important we have developed a predication technique which depends on Decision Support Tree (DST) using XML- and XQuery-Technologies. After managing all available data about a person we determined the parameters, which play a decisive role in our technique and are classified into essential and non-essential elements (Balouch, 2012a).

Decision Support Tree (DST) and its Essential and Non-Essential Parameters

We represent the two kind of predefined elements and the decision tree for essential elements.

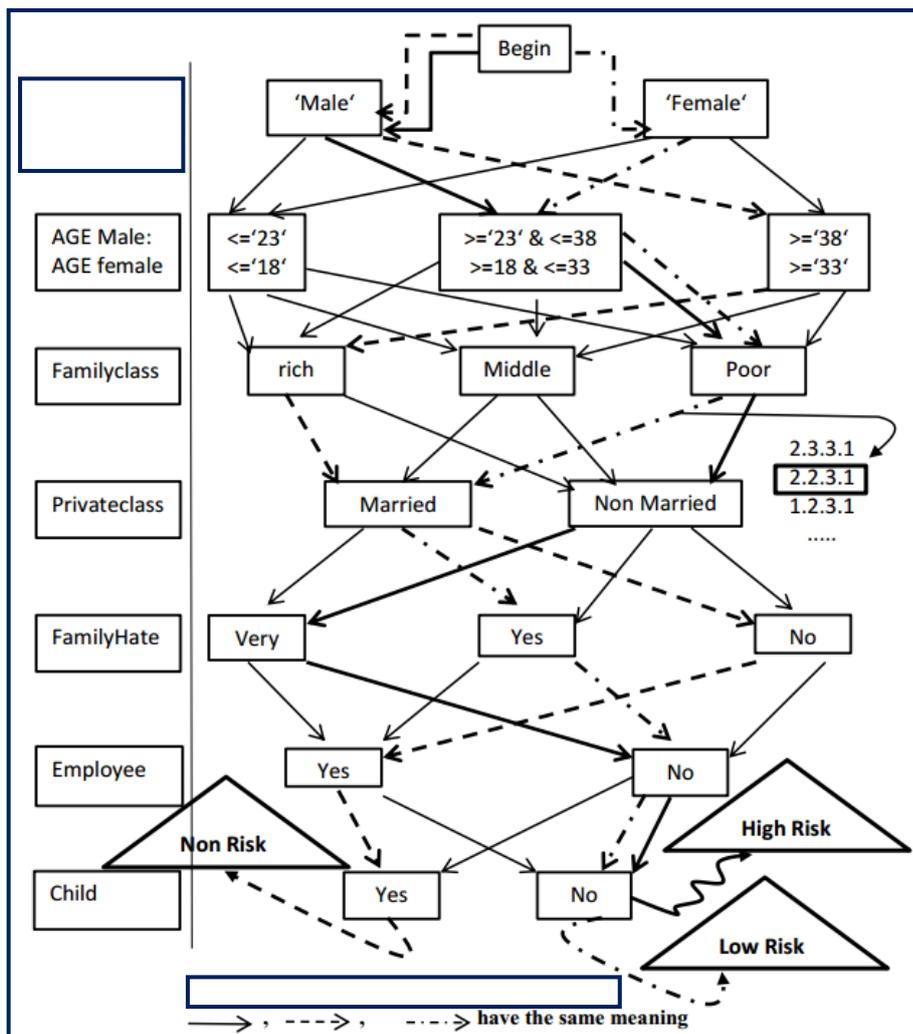
Table 1: Essential and Non-Essential Elements

Element Type	Element	Content
Essential	Gender	‘Male’ or ‘Female’
	Age	Years
	Family Class	‘Rich’, ‘Middle’ or ‘Poor’
	Private Class	‘Married’ or ‘Single’
	Family Hate	‘Very’, ‘Yes’, ‘No’

	Employee	'HighEmp', 'MiddleEmp', 'LowEmp'
	Has Children	'Yes' or 'No'
Non-Essential	City	String
	Hood	String
	Street	String
	Mobile	String
	Last Name	String

Now we present the decisions' tree depending only on the above listed essential elements, that illustrates all rules that we can compute to find the required case.

Figure 1. Decision Tree for essential elements



Each value in each level has a number to navigate on this tree. This numbering starts with number “1” from left to right. The encoding of each path depends on the numbering of each values which belongs to this path. For example, the path with encoding “2.2.3.1” means that the value of the gender is ‘Female’, of the Age belongs to the range ‘>=18, <=33’, of the family class is ‘Poor’ and of the private class is ‘married’. From this encoding example we can see that each path for each node of this tree is encoded. The process of this strategy can be worked only sequentially. This simplifies the processing. Through these possibilities we can differentiate between ‘High risk’, ‘Low risk’ and ‘Non- risk’. With the support of Non-essential elements later steps of this level’s strategy can be decided on more clearly (unique: in the best case). After the creation of the desired tree we begin to define the data mining associated rules depending on the created tree.

Mining Associative Rules

Some rules are defined in (Balouch, 2012a). One rule of them regarding to the result ‘High Risk’ is defined below:

```

If sex= ‘male’ AND
    age <=23 OR [age>=23 AND age<=38] AND
    FamilyClass = ‘Poor’ AND
    PrivateClass = ‘Non Married’ AND
    FamilyHate = ‘Very’ AND
    Employee = ‘NO’ AND
    Child = ‘NO’
then Risk = ‘High’

```

Using XQuery we define a query which illustrates this rule according to an XML-document depending on the following DTD.

```

<!ELEMENT Persons (Person+)>
<!ELEMENT Person (PrName, PrClass+, PrEmployee, PrSex, PrAddress+)>
<!ATTLIST Person PrId CDATA #REQUIRED, PrAge CDATA #REQUIRED>
<!ELEMENT PrName (FirstName, MiddleName, LastName)>
<!ELEMENT FirstName (#PCDATA)>

```

```

<!ELEMENT MiddelName (#PCDATA)>
<!ELEMENT LastName (#PCDATA)>
<!ELEMENT PrClass (FamilyClass, FamilyHate,PrivateClass, PrChild)>
<!ELEMENT FamilyClass (#PCDATA)>
<!ELEMENT FamilyHate (#PCDATA)>
<!ELEMENT PrivateClass (#PCDATA)>
<!ELEMENT Child (#PCDATA)>
<!ELEMENT PrEmployee (#PCDATA)>
<!ELEMENT PrSex (male | female)>
<!ELEMENT male EMPTY>
<!ELEMENT female EMPTY>
<!ELEMENT PrAddress (City, Field, Street, Tel+, Mobile+)>
<!ELEMENT City (#PCDATA)>
<!ELEMENT Field (#PCDATA)>
<!ELEMENT Street (#PCDATA)>
<!ELEMENT Tel (#PCDATA)>
<!ELEMENT Mobile (#PCDATA)>

```

We can write the following XQuery-statement, which presents the above defined rule.

```

let $p := doc('person.xml')\Persons
for $pp in $p\Person
where $pp\PrSex = 'Male' and
$pp\@PrAge <=23 or
($pp\@PrAge >=23 and $pp\@PrAge <=38)) and
$pp\PrClass\FamilyClass = 'Poor' and
$pp\PrClass\PrivateClass = 'Non Married' and
$pp\PrClass\FamilyHate = 'Very' and
$pp\PrClass\PrEmployee = 'NO' and
$pp\PrClass\PrChild = 'NO'
return<HighRisk>$pp\PrName</HighRisk>

```

This technique can be completed with additional elements and simple algorithms. For more complex research fields we need to use other mining algorithms and technologies. Some of these technologies are explained in the following section.

III. Predictive Model for Construction Equipment

Effective equipment management, which is required to take necessary operational and strategic decisions, is an urgent need for many companies. This includes purchasing, operations, retirement, renting, maintenance and repair, etc. The evolution of the use of automation technology and information management system associated with the increasing volume of collected equipment data, shows the need for a tool which enables companies to take an advantage of this huge collected data in equipment management. For this research we suggest a data warehouse for construction equipment management of engineering companies in the Syrian public sector. This will improve the sources of data for knowledge discovery. In addition, this research presents a primary decision support system which allows a visual analysis of the equipment data at different levels of details that helps equipment managers to fix the hidden problems behind operating equipment and then provide decision-making of equipment management a high level of flexibility. (Hasan, 2012)

Table 2 represents the Bus Matrix between dimensions and the needed operational business processes.

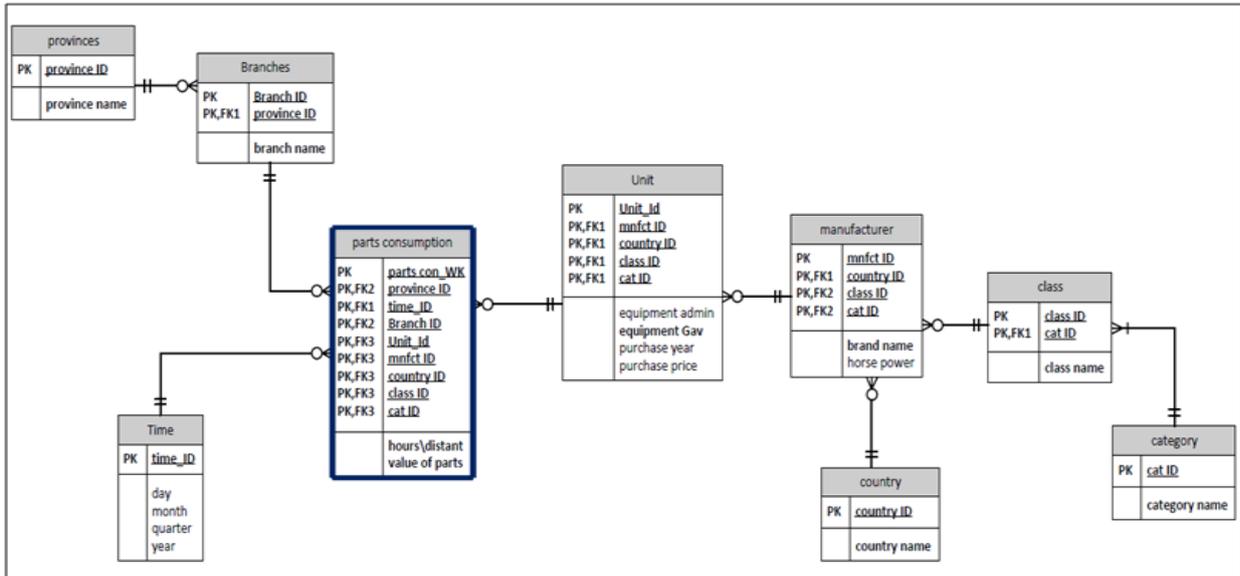
Table 2: Bus matrix (business processes and operational processes)

Dimensions \ Business processes	Equipment Group	Owner	Time	Fuel type	Fluid type	Tire type	Employee	Change tire reason	Stop reason	Place of repair	Cost item	Income item
Fuel consumption	X	X	X	X								
Fluid consumption	X	X	X		X							
Tire consumption	X	X	X									
Change Tire	X	X	X			X		X				
Parts consumption	X	X	X									
availability	X	X	X						X			
Repair cost	X	X	X							X		
Equipment investment	X	X	X								X	
Branch return		X	X								X	X
Human resource		X	X				X					

Many fact and dimensional tables are defined depending on the snowflake schema in this work. Figure 2 illustrates the snowflake-schema²⁵ for the fact table “part consumption”.

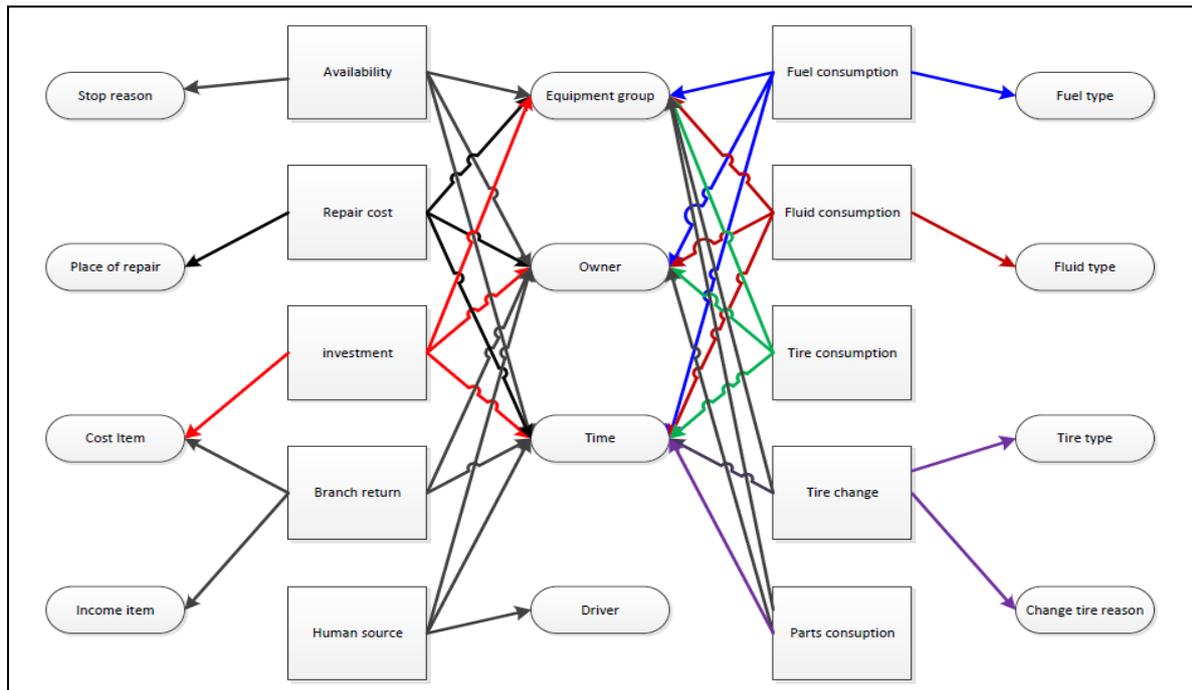
²⁵Snowflake-Schema is a logical arrangement of tables in a multidimensional database.

Figure 2. Snowflake-schema of 'part consumption'



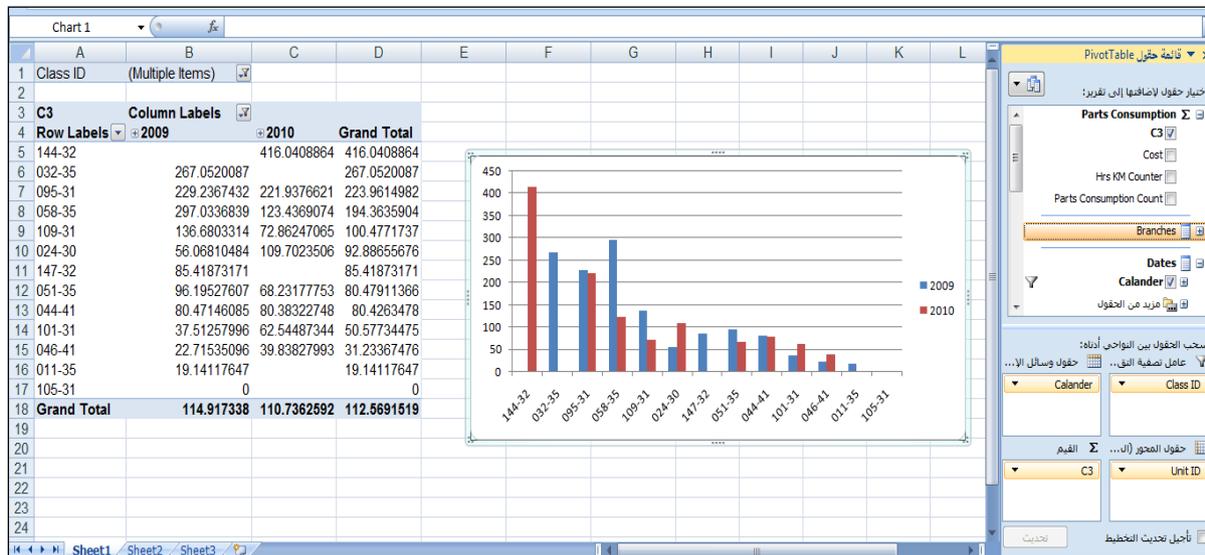
The general diagram of the project is illustrated in Figure 3.

Figure 3. General Diagram



After applying some OLAP²⁶ visualization techniques we show the following diagram according to the part consumption for the construction equipment in Latakia, Syria.

Figure 4. Hourly, part consumption for the construction equipment in Latakia, Syria



Using a data warehouse supported by the ETL²⁷ and OLAP tools we achieved our target to build a predictive system for the company ‘ESKAN’ which owns these data and equipment. After these steps we defined a non-parametric algorithm to cluster the stored data and extract a predictive decision of the management of construction equipment. For example, to know which equipment brand is suitable for stated geographical terrain, which equipment must be changed, or when is the time to change some spare parts.

It takes time to extract the similarities between some objects like construction equipment, measurement sensors, etc. For this we need to develop a method to analyze the stored data. For this field we illustrate in this article the following section, which describes a technique to analyze the sensors’ data. The target of this analysis is to extract the unnecessary sensors (those which are very similar).

²⁶ OLAP: Online Analytical Processing. OLAP tools enable users to analyze multidimensional data interactively from multiple perspectives.

²⁷ ETL: Extraction, Transformation, Load are the three phases to clean and store the data.

IV. Reducing Objects Using ReSeVA

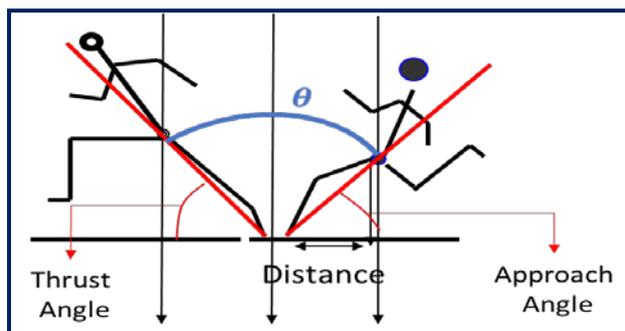
Care systems are today one of the most important things in the medical and computer science fields. They provide very sick people with some safety and to help to manage dangers in their lives.

There are two major ways to determine which placements of sensors on the body are required to recognize the motion. The first way is to connect its functioning with the results of other scientific branches such as sports science and game development. The other way depends on the following strategy. Many sensors are placed on the body, without the knowledge of which sensors are required. Then according to an analysis of the stored data for each sensor, the behavioral similarity of these sensors will be extracted. The target of both ways is to reduce the cost of building a suit of sensors, and simultaneously to keep the results of the recognition of motion correct. With ReSeVA (Balouch, 2015c) we define a model to extract the similarity of sensor measurements without any knowledge of other scientific fields. This model depends on the angle and on the length of all the vector of each sensor.

Motion Definition by Newton

The motion equation is a linear circular equation determining by angles (Figure 5).

Figure 5. Motion determining by angles



The motion can be determined by computing the approach angle and thrust angle. For this principle we added the mechanism which we defined the vectors between the coordinates-center and the center of the body for the different positions and consider on the angle (θ) between two vectors and later to complete the model we compute the angles (α, β, γ) between vectors and coordinates-axes (OX, OY, OZ) respectively and calculate the length of each vector, because the angle and the length of vectors

together can recognize the motion not only in walking but in other motion situations (sitting, walk-sit, standing, etc.).

ReSeVA (A Vector Analysis)

With this technique we consider each tuple of each object (sensor) as a vector²⁸. ReSeVA starts with a derivative of a new model of the stored data. This model depends on two parameters, the length and the angle of the vector.

$\vec{U}_{s_j i} = x_{s_j i} \vec{i} + y_{s_j i} \vec{j} + z_{s_j i} \vec{k}$ is a vector, where $x_{s_j i}$, $y_{s_j i}$, $z_{s_j i}$ are the measurements-tuple (position, velocity, acceleration, etc.) of sensor j in the time i on the axis OX, OY, OZ respectively. The length of this vector is defined as:

$$|\vec{U}_{s_j i}| = \sqrt{(x_{s_j i})^2 + (y_{s_j i})^2 + (z_{s_j i})^2}$$

The angle between two successively vectors is as following:

$$\theta_{s_j i} = \arccos \left(\frac{\vec{U}_{s_j i} \cdot \vec{U}_{s_j i+1}}{|\vec{U}_{s_j i}| \cdot |\vec{U}_{s_j i+1}|} \right)$$

We restored the resulting values in a new table (Table 3).

Table 3: Derived Table

Time	Sensor 1		Sensor 2		...	Sensor n	
	$\theta_{s_1 i}$	$ \vec{U}_{s_1 i} $	$\theta_{s_2 i}$	$ \vec{U}_{s_2 i} $		$\theta_{s_n i}$	$ \vec{U}_{s_n i} $

²⁸ Vector is a geometric object that has length and direction. It is frequently represented graphically as an arrow.

According to the new measurements we define four linear regressions. Regression Re_{θ_j} depends on the angle between the vector and the successful one:

$$Re_{\theta_j}: \theta_{sji} = a_{s_j} + b_{s_j} |\overrightarrow{U_{s_jl}}|$$

Regressions $Re_{\alpha_j}, Re_{\beta_j}, Re_{\gamma_j}$ depends on the angles between the vector and the X-Axis, Y-Axis and Z-Axis respectively.

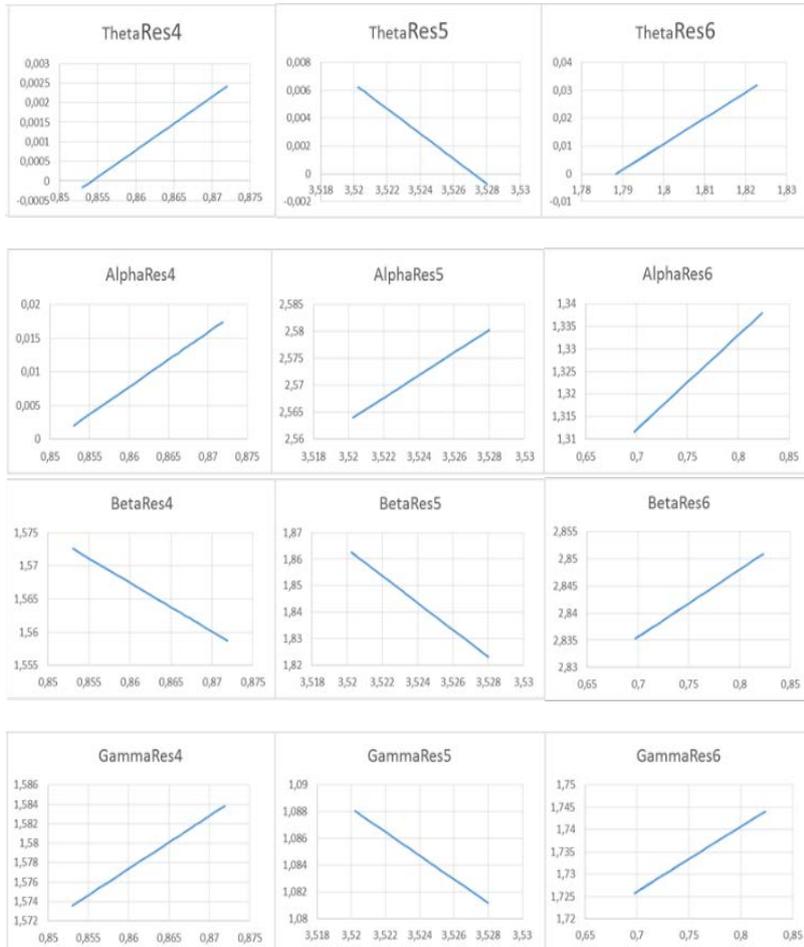
$$Re_{\alpha_j}: \alpha_{sji} = a_{\alpha_j} + b_{\alpha_j} |\overrightarrow{U_{s_jl}}|$$

$$Re_{\beta_j}: \beta_{sji} = a_{\beta_j} + b_{\beta_j} |\overrightarrow{U_{s_jl}}|$$

$$Re_{\gamma_j}: \gamma_{sji} = a_{\gamma_j} + b_{\gamma_j} |\overrightarrow{U_{s_jl}}|$$

According to these regressions we found the following illustration of similarities of our stored tables.

Figure 6: Illustration of regressions / many angles



In using a data analysis (Big Data Analysis - in healthcare systems with sensors) we wanted to get results that could give us decisions about which sensors can be eliminated. The similarities between the sensors according to their measured data are extracted, which illustrated through the derived model with its linear regressions. According to these similarities and other factors like placement of sensors we can determine the sensors, which can be eliminated. The methodology (ReSeVA) can be applied not only according to measurements of the same type like position-, acceleration- ... or velocity-measurements but also according to a mix of measurements of different types. That means that we can define a vector, which contains values of different measurement types (position-, acceleration- ... and velocity-measurements all together in one vector). This analysis has the following properties, uncomplicated computations, applicable on all data models, applicable on raw data, applicable on derived data, applicable on $2D, 3D, \dots, nD$ spaces, implementable by using data analysis tools, like tools in all database systems or R, Matlab, Excel, etc., and implementable and integral in all Analysis systems.

In the most complex data analysis we apply some aggregate statistical functions. Some of these functions are holistic. There are two ways to apply a parallel computation of holistic statistical function. The first one calculates an approximated value the other one computes the exact value by using complex iterations or recursion. In the following section we represent our PCM-oMaRS algorithm, which shows us a way to compute the exact value of such functions without needing to execute complex iterations or recursion.

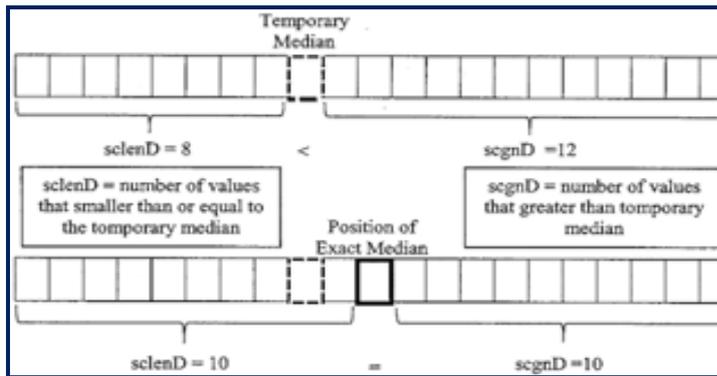
V. PCM-oMaRS Algorithm

In this section we will give a short introduction of PCM-oMaRS algorithm (Balouch 2015a). The general mechanism, steps and mathematical validation of this algorithm are represented in the following.

Illustration of PCM-oMaRS algorithm mechanism

Figure 7 shows an abstraction of the mechanism of our algorithm cleared by one sequence. In this figure we can see that the finding of position of exact median depends on the value of $sclenD$ and of $sgenD$ in which will be known to which direction the position must be moved from the position of the temporary median to achieve the position of the exact median.

Figure 7. Abstract of PCM- oMaRS algorithm mechanism



PCM-oMaRS Algorithm Steps

PCM-oMaRS Algorithm applies two sub algorithms. The first one is to find a candidate value of the median. The second one to compute the exact value of the median. The steps are represented in Algorithm 1:

Algorithm 1: PCM-oMaRS (D_i)

```

#Execute Subalgorithm 1
CandidateFinding( $D_i$ )
#Execute Subalgorithm 2
PositionFinding( $D_i$ ,  $MedT$ )
return  $MedE$ 

```

The algorithm starts with the first sub-algorithm “CandidateFinding”. Subalgorithm1 ask each multiset to send its minimal, maximal and median values. The candidate value of the median is the value of the median of all received values after the sorting.

Subalgorithm1CandidateFinding(D_i)

```

#Get minimum, maximum and median of  $D_i$  (Step 1)
foreach ( $D_i$ )
{
    Get  $MinD_i$ ,  $MaxD_i$ ,  $MedD_i$ ;
}
#construct multiset  $Ord$  (Step 2)
 $Ord = \{MinD_i, MaxD_i, MedD_i; i = 1, \dots, n\}$ 

```

```

#sorting Ord
Sort(Ord)
#compute Median of Ord (Step 3)
MedT=Med(Ord)
return MedT

```

If the size of the sequence Ord is EVEN then the temporary median value is the first/second value of the two middle values of Ord instead to compute the average of both middle values. MedT must stay one of the existing values not new calculated values. The following steps belong to the second sub-algorithm “position finding”. These steps will be optimized in the following section of this article.

Subalgorithm2 computes firstly the position of the exact median to get the value of the exact median located in the calculated position. (For more detailed information about PCM-oMaRS algorithm see: Balouch 2015a).

Subalgorithm2: PositionFinding (D_i, MedT)

```

# Sum numbers according MedT (Step 4)
foreach (Di)
{
# counting numbers that are greater than MedT
cgnDi=count ({Ni | Ni >MedT})
# counting numbers that are smaller than or equal to MedT
clenDi = count ({Mi | Mi ≤ MedT})
# sum all cgnDi and all slenDi
scgnD = sum (cgnDi)
sclenD = sum (clenDi)-1
}
# Calculate the exact median MedE (Step 5)
if (scgnD < sclenD)
{
MedLP = (sclenD - scgnD)/ 2;
# Construct multiset LtD and sorting it descending
LtD= {maximum MedLP largest {Ni | Ni ≤ MedT}}
MedE =LtD[MedLP]
}
else if (scgnD > sclenD)

```

```

{
MedRP = (scgnD - sclenD)/ 2;
# Construct multiset GtD and sorting it ascending
GtD= {maximum MedRP smallest {Ni | Ni >MedT}}
MedE =GtD[MedRP]
}
else MedE = MedT
return MedE

```

Mathematical Validation of PCM-oMaRS

To prove that the definition of the exact median of distributed multi sets is correct, we show the following. We define a multi set ρ which containing the first $P - 1$ elements of GtD and sort it. Then we see:

$$n_{\rho} = |\rho| = P - 1$$

Now let we have the new RS' and LS' depending on Med_E and Med_T , so that

$$RS' = RS \setminus \{\rho \cup \{Med_E\}\}$$

$$LS' = C \cup (LS \setminus \{\mu\}) \cup \rho \cup \{Med_T\}$$

Where RS is the set of all values that are greater than the temporary median and LS is the set of all other values (values that are smaller than or equal to the temporary median). Then:

$$n_{r's} = n_{rs} - (n_{\rho} + 1) = n_{rs} - ((P - 1) + 1)$$

$$n_{l's} = n_{ls} + n_{\rho} + 1 = n_{ls} + (P - 1) + 1$$

In the following we give mathematical forms to prove that the relationship:

$$P = \frac{(n_{rs} - n_{ls})}{2} \text{ guaranteed this validation.}$$

$$P = \frac{(n_{rs} - n_{ls})}{2} \Rightarrow 2P = n_{rs} - n_{ls}$$

$$(P - 1) + (P - 1) = n_{rs} - 1 - n_{ls} - 1$$

$$n_{ls} + 1 + (P - 1) = n_{rs} - 1 - (P - 1)$$

$$n_{ls} + (P - 1) + 1 = n_{rs} - ((P - 1) + 1) \Rightarrow n_{ls'} = n_{rs'}$$

The Definition of exact median of distributed multi sets is valid. These expressions are valid for the case (count of all values, which are smaller than or equal to the temporary median, is smaller than the count of all values that are greater than the temporary median). Analogically for the first case steps are calculated for the second one.

Getting the multi set ρ , containing the first $P - 1$ elements of LtD , so that

$$n_{\rho} = P - 1.$$

Now we have the new LS' and RS' depending on Med_E and Med_T , so that

$$LS' = C \cup (LS \setminus \{\mu\}) \setminus \{\rho \cup \{Med_E\}\}$$

$$RS' = RS \cup \rho \cup \{Med_T\}$$

Then

$$n_{ls'} = n_{ls} - (\rho + 1) = n_{ls} - ((P - 1) + 1)$$

$$n_{rs'} = n_{rs} + n_{\rho} + 1 = n_{rs} + (P - 1) + 1$$

We know that:

$$P = \frac{(n_{ls} - n_{rs})}{2} \Rightarrow 2P = n_{ls} - n_{rs}$$

$$(P - 1) + (P - 1) = n_{ls} - 1 - n_{rs} - 1$$

$$n_{rs} + 1 + (P - 1) = n_{ls} - 1 - (P - 1)$$

$$n_{rs} + (P - 1) + 1 = n_{ls} - ((P - 1) + 1) \Rightarrow n_{rs'} = n_{ls'}$$

The Definition of Median is in this case valid too.

Example of an Application

Let us have the following multi datasets after ordering:

$$D1 = (3, 5, 11, 27, 30)$$

$$D2 = (1, 7, 27, 27, 29)$$

$$D3 = (10, 18, 27, 30, 32)$$

In the first step we have to get Med_T a temporary median. Med_T is the median of Ord -set in which contains ordering all Minimal, Maximal and Median values of each Dataset. The minimal, maximal and median values for each dataset are as following:

$$MinMaxMedD1 = \{3, 11, 30\}$$

$$MinMaxMedD2 = \{1, 27, 29\}$$

$$MinMaxMedD3 = \{10, 27, 32\}$$

Then the ordered set of them is:

$$Ord = (1, 3, 10, 11, 27, 27, 29, 30, 32)$$

And the median of Ord is the temporary median, Med_T and equal to 27.

$$Med_T = 27$$

Now we start with step 4. We calculate $cgnD1$, $cgnD2$ and $cgnD3$ (number of all values that greater than Med_T of each dataset respectively) as following:

$$cgnD1 = |\{30\}|, cgnD2 = |\{29\}|, cgnD3 = |\{30, 32\}|$$

Now the number of all values that greater than Med_T in all datasets is $scgnD$:

$$scgnD = 1+1+2=4$$

On the other hand, we calculate now the number of all values that smaller than or equal to Med_T :

$$clenD1 = |\{3, 5, 11, 27\}|$$

$$clenD2 = |\{1, 7, 27, 27\}|$$

$$clenD3 = |\{10, 18, 27\}|$$

That means, the number of all values that smaller than or equal to is $sclenD$:

$$sclenD = (4+4+3)-1=10$$

(-1) is because we do not need to take the temporary median itself into consideration. That means, actually instead of counting $clenD2$ as:

$$clenD2 = |\{1, 7, 27, 27\}|$$

We count $clenD2$ as:

$$clenD2 = |\{1, 7, 27\}|$$

Now we have the case:

$$sclenD > scgnD$$

We start now with step 5 of PCM-oMaRS algorithm:

$$MedLP = ((sclenD - scgnD) / 2)$$

$$MedLP = (10 - 4) / 2 = 3$$

Now we know that the position of exact median is to find in the left side of temporary median in 3 positions. We get now LtD , the sequence that contains maximum 3 largest numbers from each dataset smaller than or equal to Med_T outer Med_T self.

Max 3 greatest Nrs of $D1 \leq 27(Med_T)$ are 27, 11, 5

Max 3 greatest Nrs of $D2 \leq 27(Med_T)$ are 27, 7, 1

Max 3 greatest Nrs of $D3 \leq 27(Med_T)$ are 27, 18, 10

Then, LtD is as following:

$$LtD = (27, 27, 27, 18, 11, 10, 7, 5, 1)$$

The exact median is now:

$$MedE = LtD[3] = 27$$

The value 27 is really the exact median because the number of all values that greater than 27 is equal to the number of all values that smaller than or equal to 27 minus 1 (the median itself).

In the following sections we focus on the optimization of PCM-oMaRS algorithm and its complexity cost, in addition we discuss some statistical information of our implementation.

VI. Optimization of PCM-oMaRS Algorithm

The single step in which we can implement an optimization is the step 5 of PCM-oMaRS algorithm. In this step we can apply another computation strategy. This strategy makes a brilliant optimization of this algorithm. This Optimization step will be illustrated in the following sub section. More information about the optimization and statistical information you can find in Balouch (2015b).

Position Finding Optimization

In step 5 of PCM-oMaRS algorithm we find the relationship of position determination in two cases. The first one is if $sclenD$ is greater than $scgnD$. The second case is if $sclenD$ is smaller than $scgnD$. For the second case we could not find any possibility of optimization but for the first case we found that we can optimize this case with clever steps. $scgnD$ is the number of all values that are greater than the temporary median and $sclenD$ is the number of all values that are smaller than or equal to the temporary median. Now, we make the change. Instead of calculating the number of all values that are smaller than or equal to the temporary median, we calculate the number of all values that are smaller than the temporary median and the number of all values that are equal to the temporary median in $sclnD$ and $scenD$ respectively. The second sub-algorithm is optimized as following:

Algorithm 2: Optimized PCM-oMaRS (Di).

```
#Execute Subalgorithm I
CandidateFinding(Di)
#Execute Subalgorithm 3
OptimizedPositionFinding(Di, MedT)
return MedE
```

Like the un-optimized version of PCM-oMaRS algorithm we start with the first sub-algorithm “CandidateFinding”. This sub-algorithm stays unchanged. Therefore we go the second sub-algorithm “OptimizedPositionFinding”.

Subalgorithm 3: OptimizedPositionFinding (Di,MedT)

```

# Sum numbers according MedT (Step 4)
foreach (D_i)
{
#counting numbers that are greater than MedT
cgnDi=count ({Ni | Ni >MedT})
# counting numbers that are smaller than MedT
cInDi = count ({Mi | Mi < MedT})
# counting numbers that are equal to MedT
cInDi = count ({Mi | Mi = MedT})
# sum all cgnDi, all cInDi and cenD
scgnD = sum (cgnDi)
sclnD = sum (cInDi)
scenD = sum (cenDi)-1
}
# Calculate the exact median MedE (Step 5)
if (scgnD < (sclnD+scenD))
{
MedLP = ((sclnD+scenD)-scgnD)/2;
if (MedLP ≤ scenD)
MedE= MedT
else
{
# Construct multiset LtD and sorting it descending
LtD= {maximum MedLP-scenD largest {Ni | Ni < MedT}
}
MedE =LtD[MedLP-scenD]
}
}
else if (scgnD > (sclnD + scenD))
{
MedRP=(scgnD-(sclnD+scenD))/2;
# Construct multiset GtD and sorting it ascending
GtD= {maximum MedRP smallest {Ni | Ni >MedT}}
MedE =GtD[MedRP]
}

```

```

else MedE = MedT
return MedE

```

In this case we can see simply that if the position of *MedLP* is smaller than or equal to *scenD* then we do not need to make any other computations to get the exact median. In this optimization step we make this case belonging to the best cases of PCM-oMaRS algorithm.

In this optimization strategy we remark also that if the *MedLP* is greater than *scenD* then instead of sending all sequences of datasets to send back the maximum *MedLP* values smaller than or equal to temporary median, the algorithm sends all datasets back to the maximum (*MedLP*–*scenD*) values smaller than the temporary median. This step of our optimization also reduces the number of values that will be sorted to get the exact median. The other case of this step remains unchanged as follows: the last case of this step is the simplest one and presents one of the best cases of this algorithm. In the following section we represent the solution of the previous example with the optimization.

Example of an Application with the optimization

Let us now apply our optimization of the previous example to clear the efficiency. Let us start with step 4 the calculation of *cgnD1*, *cgnD2* and *cgnD1* stay unchanged as following:

$$cgnD1 = |\{30\}|, cgnD2 = |\{29\}|, cgnD3 = |\{30, 32\}|$$

Where the number of all values that are greater than *Med_T* in all datasets is *scgnD*:

$$scgnD = 1 + 1 + 2 = 4$$

Now, we calculate the number of all values that are smaller than *Med_T*:

$$clnD1 = |\{3, 5, 11\}|, clnD2 = |\{1, 7\}|, clnD3 = |\{10, 18\}|$$

That means, the number of all values that are smaller than *sclnD*:

$$sclnD = 3 + 2 + 2 = 7$$

On the other hand, we compute the number of all values that are only equal to Med_T :

$$cenD1 = |\{27\}|, cenD2 = |\{27,27\}|, cenD3 = |\{27\}|$$

That means, the number of all values that are smaller than $sclnD$:

$$scenD = 1 + 2 + 1 - 1 = 3$$

Now we have the case: $(sclnD + scenD) > scgnD$, we start now with step 5 of PCM-oMaRS algorithm:

$$MedLP = ((sclnD + scenD) - scgnD)/2$$

$$MedLP = ((7 + 3) - 4)/2 = 3$$

Now, we know that the position of exact median is found in the left side of temporary median in 3 positions.

Now before we get LtD , the sequence that contains the maximum 3 largest numbers from each dataset smaller than or equal to Med_T differencing Med_T self. We compare the $MedLP$ with $scenD$. If $MedLP \leq scenD$ then we do not need to do any more computations because the temporary median has the same value as the exact median. That means:

$$MedE = MedT = 27$$

Based on this example we can see the important role of this optimization. This optimization provides best cases of our algorithm.

Statistical Study of PCM-oMaRS Algorithm

In this section we discuss the cost of the complexity of our algorithm and give basic statistical information of our implementation experiments. Depending on tests of implementation of PCM- oMaRS algorithm we have received some important results. We have carried out over 55000 tests with Eclipse-Parallel-Luna on intel(R) Core(TM)2 Duo CPU P9600 processor with 8GB RAM. These results are organized in a short statistical study as follows.

We have classified the required data to getting the exact median in 4 classes depending on our results. We have found that in the worst case of applying the PCM-

oMaRS algorithm we need to receive only 21.31% of all values in all datasets and in the best case we do not need to receive any value (0% of all values). In 35.63% of all tests we do not need to receive any data (0% of all values) to get the exact median and in 43.47% of all tests we need 0.01-4.99 % all values. Belong to the sector 5-9.99% all values 14.76% of all tests and in 7.14% of all tests we need 10-21.31% all values.

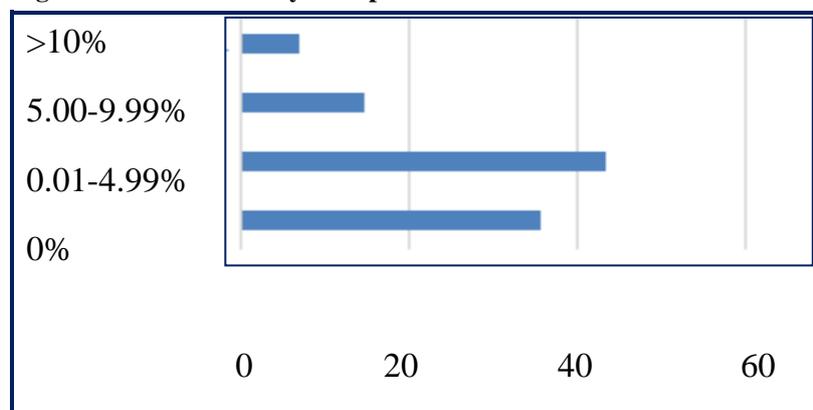
This statistical information is represented in the following table:

Table 4. Statistical information

Required Data	% all tests
0%	35,63
(0,01-4,99) %	43,47
(5,00- 9,99) %	14,76
(10,00- 21,31)%	07,14

This table is represented in the following diagram (Figure 8):

Figure 8. Statistical study of implementation of PCM- oMaRS



The analysis technique and the algorithm can be applied in several projects, which support developments of assistive systems. In the following section we represent one of the projects, which are developed or are under development at the *Department for Databases and Information-Systems* at University of Rostock.

VII. PArADISE

PArADISE is a tool to support developers of assistive systems and – later on – users of assistive systems by performing queries and analyzing large amounts of sensor data. The system is privacy-aware by pooling existing data protection concepts and algorithms as well as developing and implementing new ideas into a database framework. For example, we developed an algorithm to ensure k-anonymity over multiple queries (Grunert 2014a) and an algorithm to efficiently detect quasi-identifier attributes in high dimensional databases (Grunert & Heuer 2014). We introduced the basic idea of the framework briefly in (Grunert 2014b). In this section, we present some of the individual components of the system in detail.

PArADISE implements a privacy-aware query-processor-engine, which is used in dynamic ad-hoc sensor-networks. The basic architecture of the framework is illustrated in Figure 3. The user can set up privacy policies which are compared with the queries of the assistive system. The information flow is checked before and after the data is queried. Important aspects are the time and space complexity, since the sensors may not have enough processing power or main memory to modify the data in soft or even hard real time. Accordingly, it must be decided at runtime, a) which algorithms are applied and b) whether preprocessing on a particular node can be computed at all. In general, the compression of the data should take place as close as possible to the sensor; in the best case where the data is generated. Non-anonymized data should only be transferred if this is explicitly required or the modification on the affected node is not possible (aspect of data minimization). In order to decide if the anonymization can be computed on a specific sensor node, the processor consults hardware properties like:

- CPU-performance and -usage,
- available and maximum main memory and
- available and maximum hard disc memory.

These properties are checked and evaluated against the time and space complexity of the used algorithm. By this, a selection of suitable algorithm and load balancing can occur at runtime.

The processor works in three stages. The system can send queries towards the data storage. During the query processing, the query and the result will be modified under integrity constraints to achieve privacy while maintaining a certain, predefined degree of veracity. The modified results are masqueraded as normal results.

Conclusion

Database systems and the techniques of data analysis, predictive models, and data mining support each company and each governmental institutions to plan and manage their strategies in the best way and form. Our executed projects that included and developed such systems and techniques, support a government to manage its tasks smartly and enable the management of institutions, companies of industry and trade, or departments to be optimized, flexible, quick, and smart and to preserve the society from undesired criminal events. Our projects are applied and implemented in several areas, industrial and commercial companies, offices of criminal investigations and healthcare institutions. The improvements of these real life implications through applying our research ideas in a country make the management smart and improve the strategies to meet their goals and aims in more efficient ways.

Predictive models are applied in several fields and play an important role at the management and marketing level. The above first presented model to predicate the criminal behavior of persons depending on the Decision Support Tree (DST) using XML- and XQuery-Technologies and with regards to the personal data protection, play a very important role in society and security. The other presented model belongs to the predication is in the construction equipment. Using data warehouse, OLAP and data mining algorithms to make this predication enables us to make a decision about some parameters of the equipment that is used and to support management with its future plans. To execute a good predictive model, we need to define a good analysis of this technology.

The data analysis ReSeVA depends on Newton's second law of motion and the principles of vector science. By using this analysis according to its defined linear regression, the similarities between sensors will be extracted. According to these similarities and other parameters we can determine which sensors are unnecessary and thus can be eliminated.

Most data analyses apply some aggregations, like statistical function. In most cases we have to execute such functions parallel. There is a problem if this function is holistic. Solving this problem in the field "computation of statistical holistic functions (like median) on distributed datasets" divided into two main directions. The first one concerns the approximation methods. The other one focuses on the computation of the exact median with usage of iterative or recursive steps. We have shown that we can compute the exact median with clever steps depending on the calculation of the position of the exact median without needing to apply iterations or recursions to get the value of the exact median. That means, PCM-oMaRS algorithm guarantees the

maximum reduction of median computation steps. Instead applying blocking of the required data at the beginning of an execution of an algorithm, the data may be blocked only in one non-iterative or recursive step with the execution of our algorithm and if it is necessary.

We have shown that most computations of our algorithms are calculated in the local nodes (computers), basic operations and operation with efficient complexity will be executed in the master computer (global one). This means that the costs of complexity of our algorithm is computed through the common communication costs and local execution costs like all other algorithms in addition to the cost of an efficient sort algorithm in step 5. In our experiments we have proved that the execution of our algorithm can be more effective in the local execution too, if we divided the local dataset that contains enormous values in many local datasets.

To make the execution of this algorithm more efficient, we have optimized some steps of it. The major aim of this optimization is to increment the achievement of the best case and to reduce the amount of the needed values, which are required to compute the exact value of the median. We have implemented this algorithm by Java with two different input possibilities. The first one is with manually target inputs to test extreme cases of value distributions and the other one is random inputs to be able to check all possible cases with the passage of time. We have tested the implementation of our algorithm with more than 40,000 cases, some of these depended on the manually targeted inputs and the rest were in relation to the random inputs. In each case, the number of datasets is different, and each dataset includes many different values.

The aim of PArADISE is to develop a privacy-friendly query processor that implements the aspects of data minimization and data avoidance. The processor is integrated within the PArADISE-framework. The evaluation of the framework is based on the sensor and context information collected at the Smart Appliance Lab of the graduate program MuSAMA.

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References

Balouch, A., 2012, 'Initiative Development of prediction of criminal and terroristic behavior using XML-Technologies and Data Mining Strategies', in Magazine of University of Tishreen, Syria.

Balouch, A., 2015a, 'PCM-oMaRS Algorithm: Parallel Computation of Median-Omniscient Maximal Reduction Steps', in *American Research Journal of Computer Science and Information Technology*, vol.1, no.1, pp.1-11. Available from: <https://www.arjonline.org/papers/arjcsit/v1-i1/1.pdf>

Balouch, A., 2015b, 'Optimization of Position Finding Step of PCM-oMaRS Algorithm with Statistical Information', in *International Arab Conference on Information Technology ACIT'2015*. Available from: <http://acit2k.org/ACIT/images/stories/year2014/month1/acit2015/325.pdf>

Balouch, A., 2015c, 'Reducing Sensors according to a Vectors Analysis of stored measurements (ReSeVA)', in *American Research Journal of Computer Science and Information Technology*, vol.1, no.1, pp.20-27. Available from: <https://www.arjonline.org/papers/arjcsit/v1-i1/3.pdf>

Balouch, A., 2016a, 'Optimization of Position Finding Step of PCM-oMaRS Algorithm with Statistical Information', in *International Arab Journal on Information Technology IAJIT*. Volume13, No. 1A, pp.208-214. Available from: [http://ccis2k.org/iajit/PDF/%20Vol%2013,%20No.%201A%20\(Special%20Issue\)/325.pdf](http://ccis2k.org/iajit/PDF/%20Vol%2013,%20No.%201A%20(Special%20Issue)/325.pdf)

Balouch, A., 2016b, 'Reducing Sensors Using Nonlinear Regressions Analysis of stored measurements (ReSUNoRA)', in *IEEE International Conference on Big Data and Smart City (ICBDSC)*, March 15-16, 2016.

Grunert, A. & Heuer, A., 2014, 'Big Data und der Fluch der Dimensionalität: Die effiziente Suche nach Quasi-Identifikatoren in hochdimensionalen Daten', in *Proceedings of the 26th GI-Workshop on Foundations of Databases (Grundlagen von Datenbanken)*. Available from: <http://ceur-ws.org>

Grunert, H., 2014a, 'Distributed Denial of Privacy', in *INFORMATIK 2014: Big Data Komplexität meistern*, pp. 2299–2304. Springer.

Grunert, H., 2014b, 'Privacy-aware Adaptive Query Processing in Dynamic Networks', in Proceedings of the 8th Joint Workshop of the German Research Training Groups in Computer Science. Anja Jentsch, Tobias Pape and Sebastian Pasewaldt (Edt.).

Hasan, B., Naja, H., Balouch, A., & Makkiah, S., 2012, 'A Decision Support System for Construction Equipment Management Based on Data Warehousing Technique', in Magazine of University of Tishreen, Syria.

Interview with Ammar Suhail Balouch



Dr. Ammar Suhail Balouch was born in Syria in 1976. He is married and has three children. He received his PhD. from University of Rostock in Germany in 2006. He is currently a researcher at the Chair of Database and Information Systems in the Institute of Computer Science at the University of Rostock. He is active in and concentrates his research on analysis and evaluation of big data and parallel computation of statistical functions. He managed and supervised several IT projects. Focuses were on data mining and data warehousing technologies in the application areas Trading and Construction Equipment. He is a supporter and cofounder of organizations of human support and rights.

NRV: Can you start by telling us a little about your background in Syria and how you came to be where you are today.

Dr. Balouch: I was born in Latakia. I finished my Bachelors diploma in Computer Science in 2001. Because I was one of the best students I got a scholarship from the University of Tishreen to get a PhD. I travelled to Rostock at the end of 2001. During my scholarship I got married and had two children. In 2006 we returned to Syria. Until 2012 I worked at the University of Tishreen, as I had a permanent position as an Associate Professor there. Additionally, I signed two contracts with two private universities - Mamoun University in Aleppo and the Arab Academy for Science and Technology in Latakia.

I was in Syria from the beginning of the revolution. We wanted to achieve our goals peacefully. But the Assad regime used guns from the first minute against the protestors. The government invited me to talk about the events so I informed them that using guns would not resolve the problem. The real solution would be achieved only with positive changes to the regime. On 25th March 2012 the state security forces in Latakia arrested me. After 3 days they transported me to Damascus. It was a very bad time. On 17th April I was released but constrained in my city. On the 10th July the State Security forces arrested my brother. One day after his arrest my father received a call from these forces. They told him, my other brother and myself had to come to the State Security Agency. We met up and decided to leave Syria. I lost everything that I had. For example, the State Security took my car, tried to take my house – they could

not as I had listed it under the name of one of my family. The government wouldn't give me a passport so we fled to Turkey illegally. I stayed there for one year and a half. Then through support from my colleagues in Rostock I got a passport from the German embassy in Ankara with visas for my family to travel to Rostock. With the support of the IIE I got a contract with the University of Rostock.

NRV: As many of our readers will be unfamiliar to your field of expertise can you explain a little what your research involves?

Dr. Balouch: I'll try to simplify it. My research affects society in various fields – health care, security and so on. Its developing new techniques of data analysis. For example, in the health care system. Some teams try to design techniques to recognise movements of very skilled people. We try to support these systems. We have developed algorithms that can compute the value of statistical functions – e.g. medians, averages etc. Our processes are very expensive and very long.

NRV: One of the most sensitive issues in your work is predicting human behaviour, that is at the crossroads of computer science, data management and social sciences. With this in mind can you tell us some basic features of your model?

Dr. Balouch: Before I tell you that, I should give you some background on my motivation for developing this technique. I have a brother who was one of the best students of mechanical engineering at his university. During the time when I was in Germany in 2003 the State Security tried to arrest him. He was not in Syria at the time. As a way to get him they arrested my father. Then the State Security arrested him for 8 years on charges of terrorism. It was horrific for me. My brother was involved but not a terrorist. Therefore, I decided to develop a system which supports state security systems to get a better strategy to resolve such conflicts. I met some social scientists to design the best parameters for such situations. For example, essential parameters and non-essential parameters. Those which can help us to make a decision. We can get the contents of these parameters. We can get the contents of these parameters from existing reports such as information about kindergarten, school, university and work places. As you know in this time each teacher makes notes about the students and so on. We can explore these reports in other forms suitable to our parameters. Tracking their behaviour over a specific period of time. It's important to note their development from school to university.

NRV: How can you eliminate human error?

Dr. Balouch: It's a good question. This depends on confidentiality of the people and how they work with the content of the defining parameters. We need to combine each model with experienced people. It all depends who uses it and how it is used.

NRV: What are the main ethical considerations that you have in creating and using such a model to predict human behaviour?

Dr. Balouch: Using big data analysis is a double edged sword. We can put rules in place to control the usage of these techniques. I can say that if the use of these techniques preserves and protects the data then it has only advantages for society. But if the protection of data is not preserved then the big data analysis can play the role of dictator against humanity.

NRV: In the article you mention that your projects 'applied and implemented in several areas, industrial and commercial companies, offices of criminal investigations and healthcare institution'. Besides the fact that data mining and big data analysis can be an "opportunity" in many scientific fields, how is your work contributing to societal changes? (What are the real world implications of this for working people? Is there a danger that such models displace working people and can lead to more unemployment, more discontent with excessive control etc?)

Dr. Balouch: My projects help support humanity. There is no danger with the implications of my project in terms of employment. These projects lead to more employment as we need more people who can process it, who can work in the best way with the projects. My goal is to provide a simplification for our lives and increase the chance for employment.

NRV: How do you think your research work could help Syria to recover?

Dr. Balouch: As I said, my projects are suitable for various fields like economy, health care organisations etc. I think my experience would help to build new systems

for a modern Syria. Not only in the university fields or management fields but in many others to build our dream to see a modern Syria.

In terms of Syria's future, I see a black future. Because when I'm optimistic I think it needs more than 10 years for safety there. Safety for me is the most important thing in a country. But I have a dream, like in Germany after the Second World War. It developed very well. I hope that in Syria we can see something similar. I hope we can get such development in a short time.

NRV: Can you tell us a little more about your co-founding of organisations for human support and rights?

Dr. Balouch: This was when I was in Turkey. The first organisation I co-founded was for human support. I was an unsalaried CEO to support orphans and their mothers. The next case was to support refugees who stayed in Syria with practical protects. For example, establishing safe drinking water projects. During this time there were some people in Syria who sent me studies to produce energy and asked me to find support for these studies in Germany. For example, we achieved to establish bread ovens for use inside Syria. Up to now it works and produces bread for people. The other project up to now is also working to get water and filter it for people. The other projects I worked on were for human rights. The main aim was to document cases of arrest, kidnapping and detention by the Assad regime and other military organisations, e.g. Hezbollah, Isis.

Copyright (Amidst) Chaos in Syria: One Step Forward...

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Abstract

There is hardly any legal topic evokes the same emotional response that has accompanied the debate over the modernization of intellectual property laws in Syria in general and the Copyright and Related Rights Law of 2013 in particular. Many still perceive the World Intellectual Property Organisation's system as a form of 'colonial exploitation' intended to advance the interests of the developed world at the expense of poor countries. Discussions were further influenced by concerns over the education sector that has suffered more than its share of conflict and has lost a significant proportion of its infrastructure. This article, offering a novel insight into the Syrian copyright system, will: (1) examine the major aspects of the Copyright and Related Rights Law of 2013; (2) investigate the extensive use of copyright exceptions and compulsory licensing to limit the impact of copyright protection on the Syrian education system; (3) examine the extent to which the new law has successfully moved the Syrian copyright system into the new millennium.

Introduction

During the course of the last few years a significant number of Syrian laws have been updated.³⁰ The driving force behind these reforms has been two-fold: Firstly, to ensure the conformity of Syrian legislations with international obligations; and secondly, to ensure the ability of Syrian law to address the challenges posed by modern digital technologies. To this end, in 2013, the Syrian government passed the Copyright and

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³⁰ Examples include, Patent Law No 18 of 2012, Law of Electronic Transactions No 3 of 2014, Syrian Company law No 29 of 2011, Trade Mark Law No 8 of 2007 (as amended) and Arbitration law of 2008.

Related Rights Law to protect the interests of the copyrights owners and the public in the digital age. The question to be raised therefore has the new law utilised and sensitized copyright related issues to Syrian society's needs? Developing a full understating of not only how copyright law can affect the Syrian economy but more importantly how to connect this war torn society with the economic realities of this digital age, is a must of the drafters of this law are to achieved their clearly ambitious goals. This requires the examination of a range of issues including economic policies, political stability, technical infrastructure and the rule of law. We restrict our discussion mainly to the last issue. Since this is perhaps the first real attempt to enact a truly comprehensive copyright legislation in Syria, one cannot be blamed for hoping that all aspects of this newly introduced law are thoroughly examined and tailored to meet the legal requirements of the mammoth task of rebuilding the Syrian economy and at the same time to ensure the compatibility of the law with international IP norms.

As it seeks to become a full member of the WTO³¹, among other issues, Syria has been faced with the challenge of updating its intellectual property arsenal to satisfy the demands of Article 4(i) of the WIPO Convention, signed by the Syrian government in 2004.³² This section calls on all contracting parties to promote the 'development of measures designed to facilitate the efficient protection of intellectual property throughout the world and to harmonize national legislation in this field'.³³ In this regard Syria has been aided by the United National Development Programme (UNDP): A programme which has played a major role advising and aiding the Syrian government in many areas including matters related to law reform.³⁴ Indeed, through funding specific projects such as one addressing 'Trade Policy Reform & [the] WTO',³⁵ the UNDP has notably helped Syria to establish the Department of Trade Related Aspects of Intellectual Property to develop national intellectual property policy in light of Syria's obligations under the WTO.³⁶

³¹ On 4 January 2010 Syria has been granted an observer status but has not yet submitted its Memorandum on the Foreign Trade Regime: www.wto.org/english/thewto_e/acc_e/a1_syrian_arab_republic_e.htm Last accessed 1 June 2015.

³² http://www.wipo.int/treaties/en/ShowResults.jsp?country_id=164C. Last accessed January 5, 2016.

³³ Convention Establishing the World Intellectual Property Organization, Article 4(i)

³⁴ A list of all UNDP's projects in Syrian can be accessed via this link:

http://open.undp.org/#2012/filter/operating_unit-SYR. Last accessed February 26, 2016.

³⁵ A project which sought to create a knowledge base on trade related legal frameworks and build capacity for a task force on trade policy and WTO pre-accession steps - see Project No 69241, 'Trade Policy Reform and WTO' available at: https://info.undp.org/docs/pdc/Documents/SYR/00056542_WTOPDsigned.pdf. Last accessed February 26, January 2016.

³⁶ Established by decision No 2533 on 30 October 2006. (unpublished)

One of the most recent examples of law reform to arise out of these efforts is the law relating to Copyright and Related Rights of 2013.³⁷ Regulations relating to copyright and related rights in Syria can be traced back to the law No 12 of 2001³⁸ but this prior legislation arguably offered nothing more than a collection of badly drafted provisions that were lacking in both comprehensiveness and in their ability to address the relevant issues adequately.³⁹ It is therefore perhaps safe to assume that the Syrian Copyright and Related Rights Law of 2013 is the first *serious* attempt to regulate copyright related matters in Syria.

In comparison with its predecessor, the new law touches on a number of copyright pressing issues with particular focus on the implications of technology for this field. This article will therefore seek to explore the new legislation in order to identify and offer comment on the Syrian approach in light of both current technological challenges and Syria's international IP obligations⁴⁰. To that end some aspects of the legislation will be addressed in turn: Starting with subject matter and ownership before moving on to explore the rights granted, exceptions, remedies and provisions regarding compulsory and collective licencing in turn. While an exhaustive translation of the national legislation is outside the scope of this article we will nonetheless seek to identify points of interest throughout as well as to reflect in the closing section on the legislation as a whole.

A Brief Aside: The Syrian Legal System

Before any exploration of Syrian copyright can begin however it is first of all necessary to briefly note the nature of the Syrian legal system as a whole. In principle, Syria is a civil law country and its legal system is therefore based on an extensive body of codified statutes. In practice however this body has previously included

³⁷ The Law of Copyright and Related Rights of 2013 amending the first Syrian copyright law of 2001. The new Law which came into force in March 2014 can be accessed via this link: <http://moct.gov.sy/moct/?q=ar/node/302>. Last access January 1, 2016.

³⁸ A copy of the law could be accessed via this link, www.wipo.int/wipolex/en/details.jsp?id=6648. Last accessed 28 January 2016.

³⁹ Apart from a single unclear and confusingly drafted Article (Ex Article 3(h)) which briefly touched on the protection of the so called 'computer programming files' and which could possibly be interpreted as covering 'databases' under some readings the previous law failed to address pressing issues related to online and computer technologies.

⁴⁰ For example, Syria is bound by the Berne and Rome conventions: See www.wipo.int/treaties/en/ShowResults.jsp?lang=en&treaty_id=15 and www.wipo.int/treaties/en/ShowResults.jsp?lang=en&treaty_id=17 respectively (both last accessed 27 January 2016).

influences from tribal law⁴¹ and today draws its features from a mix of civil law⁴² and religious law⁴³ with Islamic jurisprudence forming a major source of legislation.⁴⁴

In the Syrian courts a judge does not have much room for manoeuvring when it comes to fashioning an appropriate remedy for the case before them. In general, the conception of the judiciary as a body which should be restricted to applying, rather than identifying or developing, the law is strictly followed in Syria with the sole exception of the Court of Cassation: A body which retains a limited role in the law-making processes, particularly in civil and commercial litigations. For intellectual property disputes however the Court of Cassation has so far declined to play a role and therefore, practically speaking, Syrian law in this field is based mainly on the legislation as enacted.

As a consequence of there are very few published decisions relating to copyright law in the Syrian legal system and those decisions that do exist typically lack detailed explanation or reasoning. The courts in Syria thus have little guidance beyond the legislation itself when it comes to adjudicating intellectual property disputes. When exploring the legislation, it is important to bear in mind therefore that any ambiguities noted are unlikely to be resolved through judicial clarification. This is unlike the situation in Europe and the US where the courts regularly take an active role in determining the limits of legislation through their interpretation of specific terms⁴⁵.

What's in a Law? How the New Syrian Law Stacks Up

Having briefly introduced the Syrian legal system the content of the 2013 Copyright legislation can now be explored.

⁴¹ The most notorious two examples of tribal-related rules were Articles 508 and 548 of the Syrian Criminal Law (honour crimes). Both Articles repealed in 2011.

⁴² The Syrian civil law No 84 of 1949 can be accessed via this link:

http://www.wipo.int/wipolex/en/text.jsp?file_id=243234. Last accessed January 1, 2016.

⁴³ Before the Islamic religious courts for instance, the judge is entitled to refer to other, secondary sources, such as *ijma*, *qiyas* and *ijtihad* (a kind of Islamic soft law).

⁴⁴ Article 3 of the Constitution of the Syrian Arab Republic of 2012, www.moj.gov.sy/index.php?option=com_content&view=article&id=36:2014-05-24-12-21-16&catid=2:syrianlegislation&Itemid=3. Last accessed 28 January 2016.

⁴⁵ For example, in the US the courts have determined the extent, and limits on, of the doctrine of 'fair use'. See for example *Campbell v. Acuff-Rose Music*, 510 U.S. 569 (1994) (determining that commercial parody could qualify as fair use). In the EU courts regularly determine the applicability of copyright legislation to new technologies, for example in: *ITV Broadcasting v TVCatchup* (C-607/11) (finding that re-transmitting a television signal over the internet could fall within the scope of 'communicating the copyright works to the public), or *Nils Svensson and Others v Retriever Sverige AB*, Case C-466/12 (finding that hyperlinking was not an act that could be restricted by copyright owners provided that the linked website was 'freely accessible').

What, who, and how long? Subject matter, ownership and duration of rights

Firstly, when it comes to subject matter the Syrian legislation is largely a mirror of Article 2 of the Berne Convention⁴⁶. Literary, scientific and artistic works are protected whether or not they are fixed in any material form and irrespective of the value of the work or purpose for which it was created.⁴⁷ Protection is granted to all oral, written, photographic and digital forms of production whatever the mode or form of their expression including, but not limited to, unrecorded lectures or sermons.⁴⁸

The Syrian law of 2013 also modernised the scope of copyright protection by adding new sections to specifically address the protection of computer programmes and databases. Article 2(9) provides for the protection of computer programmes (covering both the source and object code). While the law does not specifically state the category under which computer programs will fall it would appear that they are most likely protected as literary works.⁴⁹ All forms of databases are likewise protected providing that the database is original by reason of the selection, arrangement or the connection between its contents.⁵⁰ This requirement is close to the content of Article 5 of the WIPO copyright treaty, although it is interesting to see that the Syrian interpretation has added the option for originality by reason “the connection between its contents” to the WIPO definition. Whether this addition has any impact on the scope of protection in practice is however unclear, although it does not *prima facie* appear to add anything material.⁵¹

It is notable that, unlike the UK⁵² and the USA⁵³, Syria has opted not to include a requirement of fixation. Such an approach is not unusual among civil law countries,

⁴⁶ Compare the texts of: Berne Convention for the Protection of Literary and Artistic Works, Article 2 and Copyright and related rights law of 2013, Article 2.

⁴⁷ *Ibid*, 2(a).

⁴⁸ *Ibid*, 2(b).

⁴⁹ This interpretation is in line with Syria’s obligation under the WTO. Article 10(1) of TRIPS Agreements for instance states that: ‘Computer programs, whether in source or object code, shall be protected as literary works under the Berne Convention (1971)’. Article 4 of the WIPO Copyright Treaty also provides similar language: ‘Computer programs are protected as literary works within the meaning of Article 2 of the Berne Convention’. Furthermore, the general view in Syria seems to indicate that computer programs are protected as literary works. See for example, Mohamad Wasel, ‘The Legal Protection of Computer Program’, *Damascus University Journal of Economic and Legal Sciences*, Vol 27, Issue 3, 2011, page 13-14; See further Adnan Branbo, ‘Legal Protection of Computer Programs’, *Journal of Informatics*, April, Issue 13, 2007.

⁵⁰ Copyright and related rights law of 2013, Article 2(10).

⁵¹ Article 5 of the WIPO Copyright Treaty provides that: ‘Compilations of data or other material, in any form, which by reason of the selection or arrangement of their contents constitute intellectual creations, are protected as such...’: WIPO Copyright Treaty, available at:

http://www.wipo.int/treaties/en/text.jsp?file_id=295166#P61_6598. Last accessed 10 June 2016.

⁵² Copyright, Designs and Patents Act 1988 s3 (2)

⁵³ Title 17 U.S. Code § 102 reads ‘... Copyright protection subsists... in original works of authorship fixed in any tangible medium of expression, now known or later developed, from which they can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device...’

where the option under Berne for national legislators to decide whether or not to include a fixation requirement⁵⁴ has led to a number of nation states deciding not to precondition copyright in this way⁵⁵. Copyright holders can also optionally register their work in Syria⁵⁶, although the process involves the submission of a number of details⁵⁷ to the Author and Other Related Rights Department of the Syrian Government along with a fee⁵⁸ and does not appear to grant any additional legal rights.

In terms of a positive threshold works do have to be the result of ‘human intellectual creation’⁵⁹ to qualify for protection, setting an originality standard that appears to be equivalent to the concept of an ‘author’s own intellectual creation’ in European copyright law. For databases the emphasis on originality in terms of the selection or arrangement of a database’s contents is likewise similar to the European position⁶⁰ and in particular is very close to express requirements of the UK provisions on database copyright⁶¹.

Additionally, for works qualify for protection they must also generally be works of either permanent residents of Syria, Syrian citizens or their ‘equivalents’.⁶² The term ‘equivalents’ is not defined by the law but, according to Article 3 of the Berne Convention and Article 5 (1) of the Rome Convention which the law draws heavily upon, it would appear that it most likely refers to authors who are nationals of a country that grants national treatment to Syrians creators in turn. For sound and visual recordings however it’s considered enough for the *producers* alone to be resident in Syria or to have their headquarters there, regardless of the nationalities of any other parties involved.⁶³

⁵⁴ Berne Convention for the Protection of Literary and Artistic Works, Article 2(2).

⁵⁵ Examples include, the German Copyright Act, Article 2 (1); the French Copyright Code, Article L112-2; and for the Middle East, the Copyright Law of Morocco 2-00, Article 2 and Article 3 of the Copyright and Related Rights of Algeria.

⁵⁶ The Syrian Ministry of Culture has issued an executive instructions/guidance in matters related to the implementation of the law and, more specifically, on the subject of registration for all types of copyrightable works: Resolution 86/ Ministry of Culture 7/1/2014. Available via <http://moct.gov.sy/moct/?q=ar/node/302>. Last accessed January 26, 2016

⁵⁷ Such as name, address, a copy of the applicant’s ID, a description of the subject matter and two copies of the work in published form as well as electronic copies if required: Resolution 86/ Ministry of Culture 7/1/2014, Article 2

⁵⁸ Article 4 of Resolution 86/ Ministry of Culture 7/1/2014.

⁵⁹ Copyright and related rights law of 2013, Article 2(b). Article 1 defines a creative work as a ‘new’ if it has either not previously existed, is a work that contains original elements or is a work that has special unknown character.

⁶⁰ Recital 39 of Directive 96/9/EC of the European Parliament and of the Council of 11 March 1996 on the Legal Protection of Databases, 1996 O.J. (L 77).

⁶¹ Copyright, Designs and Patents Act 1988, s3A (2)

⁶² Copyright and related rights law of 2013, Article 93 (1).

⁶³ *Ibid*, (3); Article 2(1), (c) of the Rome Convention.

Alternatively, protection can also be extended to works irrespective of the place of residency or the nationality of the author(s) if they are published for the first time in Syria or if they are republished in Syria within 30 days of its first publication abroad.⁶⁴ These provisions also apply to informatics works which are produced in Syria⁶⁵ and to works of architecture physically located in the country as well as art-related works that are embedded in any Syrian structure.⁶⁶ Similar rules exist for broadcasts with not only broadcasting organisations based in Syria qualifying for protection but also those who broadcast their work from any station physically located in Syria.⁶⁷

Performers however enjoy more limited rights under the legislation. Unless their works have been mixed with other protected forms recognised by the 2013 law their rights are only protected provided that they are both Syrian nationals and that their work was either performed in Syria or fixed via audio or visual protected forms.⁶⁸ Additionally, expressions of folklore and traditional culture expressions are expressly excluded from the scope of commercial exploitation, unless a written permission from the Ministry of Culture can be obtained: These must remain in the public domain for the Syrian people as a whole.⁶⁹

For those works that do fall within the qualifying scope of the above provisions Syrian legislation extends a lifetime of the author plus 50 years' term of protection unless the law provides otherwise⁷⁰, with all works falling into the public domain once copyright expires.⁷¹ In this regard Syria has followed the minimum duration required under the Berne Convention closely⁷² and this close adherence is continued in the specific terms provided for anonymous and pseudonymous works (50 years⁷³). The latter 50-year term is also extended to unpublished works as well⁷⁴ mirroring Article 3 (1) (a) of Berne.⁷⁵

Interestingly, Syria has also taken advantage of the option offered under Article 7(4) of the Berne Convention to set the term of protection for works of applied art to the

⁶⁴ *Ibid*, Article 93 (2), in line with Article 5 (2) of the Rome Convention.

⁶⁵ *Ibid*, Article 93 (5).

⁶⁶ *Ibid*, Article 93 (4).

⁶⁷ *Ibid*, Article 96 (1), (2).

⁶⁸ *Ibid*, Article 94, (1), (2).

⁶⁹ *Ibid*, Articles 70, 72 and 73.

⁷⁰ *Ibid*, Article 19.

⁷¹ *Ibid*, Article 24.

⁷² Article 7(1) of the Berne Convention for the Protection of Literary and Artistic Works

⁷³ Copyright and related rights law of 2013, Article 22, applying the minimum term required under Article 7(3) of the Berne Convention for the Protection of Literary and Artistic Works.

⁷⁴ Copyright and related rights law of 2013, Article 21 (b).

⁷⁵ Article 3 (1) (a) provides the 'protection of this Convention shall apply to: (a) authors who are nationals of one of the countries of the Union, for their works, whether *Published or not*' (emphasis added)

minimum possible duration of 25 years.⁷⁶ This stands in stark contrast to the position in the UK and the US⁷⁷ where such works enjoy the full term of artistic copyright protection (assuming, of course, that they qualify for protection at all) and where only a limited exclusion from *infringement* is provided for in very narrow circumstances⁷⁸.

Beyond Berne, Syria has also stuck to the minimum terms permitted under several other international treaties. For broadcasts the 20-year minimum term from the Rome convention has been adopted⁷⁹, while for audio-visual works the 50-year minimum term under the Beijing treaty has been used⁸⁰. Syria has however gone beyond the minimums in two cases: for both sound recordings and performances a 50-year period of protection has been granted⁸¹, with performances also in the interesting position of being offered 50 years of protection both from the beginning of the following calendar year in which the work was *performed* and, if the work has been *fixed*, 50 years from the end of the year in which it was fixed⁸². Potentially, therefore, it would appear that a performance could be protected for up to a 100 years in the event that a performance goes unrecorded for 50 years before then being recorded. Whether this dual protection is intended or not is unclear.

Finally, it should briefly be noted that databases are offered 25 years of protection under the 2013 law, running from the beginning of the following calendar year in which the database was created.⁸³

The Rights Granted: Economic Rights, Moral Rights and Collecting Societies

When it comes to economic rights Syrian law is, in the main, fairly standard. The Copyright and Related Rights law provides authors with the right to economically exploit their works by all means, including publication, adaptation and translation.⁸⁴

⁷⁶ Copyright and related rights law of 2013, Article 23 (a).

⁷⁷ Copyrightable works of applied art is subject to a number of conditions set by Title 17 U.S. Code § 101 of the United States Copyright Law.

⁷⁸ Where an artistic work has been exploited by making, by an industrial process, articles and marketing such articles in the UK or elsewhere, the reproduction of such articles by others shall not qualify as infringement once 25 years from the end of the calendar year in which the articles were first marketed has passed: See Copyright, Designs and Patents Act 1988, s52

⁷⁹ Copyright and related rights law of 2013, Article 32; Article 14 of the Rome Convention for the Protection of Performers, Producers of Phonograms and Broadcasting Organisations

⁸⁰ Copyright and related rights law of 2013, Article 21 (a); Article 14 of the Beijing Treaty on Audio-visual Performances, which was ratified by Syria in 2013.

⁸¹ Copyright and related rights law of 2013, Article 21 (a) and Article 30.

⁸² *Ibid*, Article 30.

⁸³ *Ibid*, Article 23 (b).

⁸⁴ *Ibid*, Article 6(1- 5).

Performers and broadcasters are also entitled to economically exploit their works by reproduction, distribution, rental transcription or otherwise.⁸⁵

Remarkably however the Syrian legislation also includes very generous provisions on the subject of resale rights. The copyright owner of the single master copy of a literary work, sheet music, painting or sculpture has a non-transferable rights to demand adequate remuneration from every sale following the date of the copyright owner's assignment of his/her rights.⁸⁶ This right applies to all copyright holders, including foreign authors, under the condition of national treatment and caps the maximum remuneration (very generously) at 10% of the value of the sale⁸⁷. If the copyright owner is a foreign national the rate of remuneration is set according to the norms in his own country providing that such rate does not exceed a 10%.⁸⁸

In comparison to the European approach this is an extraordinarily lavish resale right. The closest equivalent from a European perspective to these provisions is the artist's resale right provided for under the Resale Rights Directive⁸⁹. Not only is this more limited in terms of subject matter than their Syrian equivalent however – applying only to “original work[‘s] of art”⁹⁰ rather than literature and music also – it also applies a significantly lower royalty rate: Only 4% under the European regime for the lowest value works falling to a mere 0.25% for works worth more than €500,000⁹¹. The Syrian law implementation is therefore wider in both scope and value.

Beyond economic rights, Syria has also implemented a generous interpretation of moral rights that is more in keeping with the continental European approach than the Anglo-American.⁹² Pursuant to Article 5 (which mirrors Article 6*bis* of the Berne Convention⁹³) the author under Syrian law shall have the rights to be identified as such; the right to object to any distortion, mutilation or other modification or derogatory actions regarding the work; and, interestingly, the positive right not to use their own name should they so choose.⁹⁴ The author also shall have the right to communicate his work to the public including control over the form and date of

⁸⁵ *Ibid*, Articles 14, 26, 27, 28 and 29.

⁸⁶ *Ibid*, Article 7 (a).

⁸⁷ *Ibid*, Article 7 (a) and (b).

⁸⁸ *Ibid*, Article 7 (b).

⁸⁹ Directive 2001/84/EC of the European Parliament and of the Council of 27 September 2001 on the resale right for the benefit of the author of an original work of art (Resale Rights Directive).

⁹⁰ Article 1(1) and 2(1) of Directive 2001/84/EC, (Resale Rights Directive).

⁹¹ Article 3(2) and 4 of Directive 2001/84/EC, (Resale Rights Directive).

⁹² For example, the 1990 Visual Artists Rights Act of the United States recognizes moral rights in relation to works of visual art only

⁹³ Article 6*bis* of the Berne Convention for the Protection of Literary and Artistic Works.

⁹⁴ Copyright and related rights law of 2013, Article 5 (a), (2), (3), (4) and (5).

communication (publication).⁹⁵ These moral rights are perpetual and non-assignable for money or otherwise, although no prohibition of waiver is mentioned.⁹⁶ The same rules apply to the moral rights of performers also.⁹⁷

If the copyright holder wishes to transfer any of these rights, either through assignment or licencing, the Syrian law provides that copyright is transmissible by testamentary disposition or a legal act (assignment, licensing or otherwise). An assignment or license of copyright can relate to the whole or only a part of the rights that the copyright owner has the exclusive rights to.⁹⁸ There is an express requirement of writing for these assignments, although Syria has embraced modernity by allowing ‘other electronic means’ to be used for this purpose also⁹⁹. The assignment contract must however still be clear and must specify precisely the assigned right(s), contract duration and any place(s) where the work might be performed, published.¹⁰⁰

In another pro-authorial twist however the legislation also expressly includes an automatic right of reversion under certain circumstances. In the event that the assignee has failed to invest in the assigned right for two years without due cause the original copyright owner will be entitled to terminate the contract without jeopardising the assignee’s right for compensation.¹⁰¹ What exactly qualifies as an investment, or as ‘without due cause’, is however left unfortunately unexplained by the law. The right is supported though by a blanket prohibition against the assignment of whole future copyright works by authors¹⁰² unless this is to a collecting society¹⁰³, suggesting that the protection of authors from unforeseen consequences is a strong aim of the 2013 law.

Indeed, the creation of a new collective licencing body in Syria can be seen as a further sign of support for authors under the new framework. Previously no such body existed in Syria, however the new law provides for the establishment of a society to help both copyright owners and the prospective licensee to exploit works protected by copyright.¹⁰⁴ This is a welcome step. In an exception to the prohibition against assigning future copyright authors and performers of works are able to exclusively license both their current and their future rights to the collecting society to act as an

⁹⁵ *Ibid*, Article 5 (a), (1).

⁹⁶ *Ibid*, Article 5 (b).

⁹⁷ *Ibid*, Article 25 (a) and (b).

⁹⁸ *Ibid*, Article 8 (a).

⁹⁹ *Ibid*, Article 8 (b).

¹⁰⁰ *Ibid*, Article 8 (b).

¹⁰¹ *Ibid*, Article 11.

¹⁰² *Ibid*, Article 12.

¹⁰³ *Ibid*, Articles 12, 49 and 50.

¹⁰⁴ *Ibid*, Article 49.

agent on their behalf.¹⁰⁵ Royalties are distributed to the members in proportion to the use made of a particular work at least once a year¹⁰⁶ and, acting with just cause, authors, performers and the collecting society are each entitled to terminate their licensing agreements provided the other party is notified three months before termination.¹⁰⁷ Overall therefore this represents a positive development for Syrian creators.

The Limits of Protection: Copyright Exceptions

The scope of the 2013 legislation is not the only source of interest: Copyright exceptions are also one of the most significant aspects of the new law. Unlike the previous (repealed) 2001 law which contained only a single vaguely drafted article dealing with copyright exceptions¹⁰⁸ the new law sets out a much large number of provisions (14 to be specific) spelling out in details those acts that may be done in relation to copyright works.¹⁰⁹

The most significant of these can be found in Article 33 of the 2013 law. This Article outlines a remarkably broad personal use exception that provides that copyright is not infringed by the making of a single copy of a legitimately published work¹¹⁰, irrespective of media, provided that this is done solely for personal use¹¹¹. The term ‘work’ in this context is very broad: it means any literary, scientific or artistic work so long as it has been published.¹¹² Some acts are excluded from the scope of this exception, but notably none of these appear to restrict it in a significant manner: The exceptions include works of architecture¹¹³; whole or substantial *photocopying only* of a written work or musical notes¹¹⁴; and the whole or partial copying of a digital database¹¹⁵ (although it should be noted that there exists a separate exception that

¹⁰⁵ *Ibid*, Article 49 and 50.

¹⁰⁶ *Ibid*, Article 64.

¹⁰⁷ *Ibid*, Article 65, (a).

¹⁰⁸ Ex Article 37 of the Syrian copyright law of 2001.

¹⁰⁹ Articles 33, 34, 35, 36, 37, 38, 39 40, 41, 42, 43, 44, 45 and 46. Most copyright exceptions are in line with Article 2*bis* (1), (2) and (3) of the Berne Convention.

¹¹⁰ According to Article 1 (definitions), publication means: making available to the public in a sufficient quantity a work or copy of the work or copy of the audio or visual recording of a work by the author or the producer by sale, renting or any other method to assign the property or possession of the work or a copy of a work or the right to use them (the work or a copy of a work). How to interpret the term ‘sufficient quantity’ is however not clear.

¹¹¹ Copyright and related rights law of 2013, Article 33.

¹¹² *Ibid*, Article 1 (definitions).

¹¹³ *Ibid*, Article 33 (1); Article 4(b) of the Berne Convention.

¹¹⁴ *Ibid*, Article 33 (2) and (3).

¹¹⁵ *Ibid*, Article 33 (4).

allows lawful users to copy databases provided that doing so is necessary to access and use the database lawfully¹¹⁶).

Conspicuously lacking from this list of restrictions is the need to acquire a lawful copy of the work in the first place. The exceptions for computer programs in the 2013 law (discussed further below) specifically include this requirement and therefore its absence from the personal use exception is particularly striking. Without this restriction it would appear that this provision effectively makes the online downloading of copyright works non-infringing in many cases: As long as only a single copy is downloaded for personal use the exception would appear to be triggered. This seems a remarkable, if perhaps unintended, outcome. The situation could perhaps be avoided if the Syrian courts were to interpret “legitimately published work” to include only authorised sources or only unaltered works (thus excluding works whose technology protection measures have been removed). However, it is unclear if the courts will be willing, or able, to do so.

Less controversially, the 2013 law also provides an exception for copying computer programs under, more limited, certain conditions.¹¹⁷ With lawful possession of a master copy a user is allowed not only to make a back-up copy in case the original is lost or corrupted¹¹⁸ but is also allowed to make up to three copies for the purpose of ‘lawful use’.¹¹⁹ The latter category expressly includes format shifting – a welcome acknowledgement of some of the challenges of interoperability in the digital age.¹²⁰ Sensibly, the law also requires the deletion of all copies made in the event that the user loses the rights to use the master copy lawfully.¹²¹

Even more welcome for those with disabilities are the broadly worded provisions on disabled access, which permit the copying of a computer programme into an accessible format without placing any restriction on the type of disability required.¹²² In this regard Syria has gone beyond the requirements of its (unratified) signature to the Marrakesh treaty – a treaty which only required action on visual impairment¹²³ – but has not gone as far as to extend the exception more broadly across the scope of copyright works.

¹¹⁶ *Ibid*, Article 40 (g).

¹¹⁷ *Ibid*, Article 33 (5).

¹¹⁸ *Ibid*, Article 40 (a) (1).

¹¹⁹ *Ibid*, Article 40, (a), (1).

¹²⁰ *Ibid*, Article 40, (a), (2).

¹²¹ *Ibid*, Article 40 (b).

¹²² *Ibid*, Article 40, (a), (3).

¹²³ Article 3 of The Marrakesh Treaty to Facilitate Access to Published Works for Persons Who Are Blind, Visually Impaired or Otherwise Print Disabled. This Treaty, not yet in force, was signed by Syria in 2013.

The 2013 law also contains a limited exception for temporary copies created as part of a technical process. Unfortunately however these are limited to broadcasting, providing that copyright is not infringed by making of ephemeral copies of a work by a broadcasting organisation by means of its own facilities and for its own use provided that:¹²⁴ The broadcasting organisation is licensed to broadcast the work¹²⁵; the temporary copy is made unusable after six months from creation unless the copyright owner agrees to an extension¹²⁶; and that, for archiving purposes, no more than a single copy is kept.¹²⁷ While these provisions are perfectly sensible for broadcasting there is no mention made of internet transmission and the temporary copies that are an inevitable and integral part of the internet infrastructure. This contrasts sharply with the technologically-agnostic approach followed by European legislators which defines a temporary copy exception in terms of its role in a “technological process” for “transmission in a network” or “lawful use”¹²⁸ – all deliberately broad terms intended to remain relevant even in the face of unforeseeable technical change. The Syrian approach, on the other hand, already seems out of date.

Finally, it should be noted that a number of more classical copyright exceptions are also regulated in full detail including copying for the purposes of research and private study¹²⁹ and quotations,¹³⁰ provided that it is accompanied by a sufficient acknowledgement and that the amount of the work taken was reasonable, appropriate and necessary.¹³¹ The law however does not provide a specific exception for cases related to caricature, parody or pastiche.

What Can Be Done? Remedies and Compulsory Licencing

In the event that the exclusive rights granted to copyright holders are infringed, the 2013 legislation also provides a guidance and markedly increases the financial penalties across the board from those available under the previous framework. Under the repealed law, only a minimum penalty of 100,000 Syrian Pounds was stated.¹³² Generally Syrian judges preferred to set penalties in this region. In most cases however the new law sets limits of between one hundred thousand to one million

¹²⁴ Article 42, mirrors Article 15 (g) of the Rome Convention.

¹²⁵ Copyright and related rights law of 2013, Article 42 (1).

¹²⁶ *Ibid*, Article 42 (2).

¹²⁷ *Ibid*, Article 42 (2).

¹²⁸ Directive 2001/29/EC of the European Parliament and of the Council on the harmonisation of certain aspects of copyright and related rights in the information society, Article 5(1) and recital 33

¹²⁹ Copyright and related rights law of 2013, Article 35 (3).

¹³⁰ *Ibid*, Article 35 (1), (2) and (3).

¹³¹ *Ibid*, Article 35 (1), (2) and (3).

¹³² Ex Article 40 of the Syrian Copyright law of 2001.

Syrian Pounds¹³³ and the inclusion of a (much higher) maximum figure in the legislation implicitly signals to the Syrian judiciary that the average penalty would be significantly higher than the 100,000 Pound region when/if needed. In the cases of piracy and counterfeiting in particular new provisions have been also added to address anti circumventions measures related to TV broadcasting.¹³⁴ This is particularly interesting given the apparent inconsistency of the increased penalties with the broadly worded personal use exception noted above.

Additionally, there are also relatively harsh penalties provided for cases of false attribution of authorship. If it can be shown that the infringer intended to deceive a false attribution of authorship regarding a literary, artistic or scientific work is punishable by imprisonment ranging from three months to two years and/or a fine of between one hundred thousand to one million Syrian Pounds.¹³⁵ To put these figures in context, they represent a fine of between just over 3 months wages to roughly six year's wages for a minimum wage Syrian worker.¹³⁶ For the lesser offence of citing (plagiarising) a copyrightable work without adequate acknowledgement, penalties still range from up to a years imprisonment to a fine of up to three hundred thousand Syrian Pounds, if not both.¹³⁷ The same penalty applies against a defender who knowingly sells, offers for sale, or distributes a falsely attributed or pirated work.¹³⁸ For repeat offenders the penalties for either offence will be doubled.¹³⁹ As protection for the author's moral rights the Syrian legislation sets strong sanctions indeed.

In terms of commercial infringement, the law provides for similar prison sentences (three months to two years) provided that the infringement was both committed in the course of business and by someone who *knows* that they are infringing copyright.¹⁴⁰ In the context of these provisions knowledge is required: it does not appear to be enough to show that the infringer should have had reason to believe that this was the case. Offering for sale, importing or exporting articles in the course of business which are an infringing copy of the protected work however does give rise to secondary liability without a strict knowledge requirement – in this case it is sufficient to show that the infringer has reason to believe that the articles are infringing – and carries similar penalties: Three months to two-years imprisonment or a fine form one hundred

¹³³ Examples include Article, 82(a), (1) and (2), Article 83, Articles 84 and 86.

¹³⁴ Copyright and related rights law of 2013, Article 84 (a), (b) and Article 85 (a) and (b).

¹³⁵ Copyright and related rights law of 2013, Article 82 (a), (1-2).

¹³⁶ As set by the Employment Law No 50 of 2004 (as amended) and legislative Decree No 38 of 2013. Using the higher wage figure with the minimum stated fine gives a fine of 3.33 months' wages at the lower extreme, while using the lower wage figure with the maximum possible fine gives an upper bound of 73.15 month's wages.

¹³⁷ Copyright and related rights law of 2013, Article 82 (b), (1).

¹³⁸ *Ibid*, Article 82 (b), (2).

¹³⁹ *Ibid*, Article 82 (g).

¹⁴⁰ *Ibid*, Article 83 (a).

thousand to one million, or both.¹⁴¹ Again, these penalties can be doubled for repeat cases.¹⁴²

As a newly added provision, Article 77 also permits courts to take into account a number of factors when assessing the damage caused by copyright infringement when they become relevant, including in particular not only the market value of the work¹⁴³ and any benefits accruing to the defendant¹⁴⁴ but also both past *and future* potential losses of earnings that stem from the infringement.¹⁴⁵ The court also has the (unsurprising) power to confiscate and tools or machinery that are used mainly to infringe the copyright work(s).¹⁴⁶

Indeed, when it comes to tools and machinery the Syrian law has seen one notable technological update. The act of possessing in bad faith, offering for sale, making, importing or exporting of any article or tool that is specifically designed to circumvent technological protection measures is now expressly prohibited.¹⁴⁷ Provided that the defendant knows or has reason to believe that the article or tool will be used to infringe copyright its import or export will be punishable by either three months to two-year imprisonment or a fine from one hundred thousand to one million, or both.¹⁴⁸

Interestingly however the *use* of circumvention tools does not itself appear to be prohibited: only possessing them in bad faith is mentioned in the 2013 law. The distinction is slight but may nonetheless prove important in the future in situations where users make use of web based tools to circumvent technological protection measures without at any time actually possessing the tool themselves. Such actions are not outside the realm of possibility but would appear to fall out with the Syrian provisions. This could cause Syria future difficulties when it comes to the fulfilment of its WIPO treaty obligations; obligations which require signatory counties to provide “effective legal remedies” against circumvention.

In many cases the need to deal with infringement remedies at all can however be avoided through an application for a compulsory licence under the provisions of the 2013 law. While the Berne and Rome Conventions limit the circumstances in which compulsory copyright licences can be granted¹⁴⁹ Syria has taken full advantage of the

¹⁴¹ *Ibid*, Article 86 (a), (1).

¹⁴² *Ibid*, Article 83 (b).

¹⁴³ *Ibid*, Article 77.

¹⁴⁴ *Id*.

¹⁴⁵ *Id*.

¹⁴⁶ *Id*.

¹⁴⁷ *Ibid*, Article 86 (a), (2).

¹⁴⁸ *Ibid*, Article 86 (a), (2).

¹⁴⁹ Subject to conditions, Article 11*bis* (2) of the Berne Convention allows for the grant of compulsory licences for jukeboxes. Mechanical licences for musical works is regulated under Article 13. Article 12 of the Rome

special provisions granted under Article II of the Appendix of the Berne Convention for developing countries.¹⁵⁰

In particular, the copyright law of 2013 has been used to respond to the urgent need for contemporary teaching resources in Arabic. The law provides that any Syrian citizen may apply to the Minister of Culture for a non-exclusive and non-transferable license to adapt (i.e. translate) *any* published work into Arabic, provided the following conditions are met: The licence is sought for the purpose of teaching at school, university or research levels;¹⁵¹ the work has not already been translated into Arabic by the owner of the right of translation or with his consent, or any translated editions are already out of print¹⁵²; and finally at least one year has passed since the date of first publication of the work.¹⁵³

Furthermore, compulsory licences are also available for works which have already been translated into Arabic under more restrictive circumstances. A Syrian citizen may also apply for a non-exclusive non-assignable license to copy and publish an already published work in Arabic¹⁵⁴ for the sole purpose of education only (*excluding* research)¹⁵⁵ provided that the following conditions are met; conditions which vary according to the field of work that is involved:

1. If the application relates to a publication in the fields of natural sciences, physics, math, informatics, information technology and business administration¹⁵⁶ *one year* from the date of the first publication must pass before an application can be submitted.¹⁵⁷
2. For publications in the fields of dramatic literature, poetry, music, art and novels *seven years* must pass after the date of the first publication before an application can be submitted.¹⁵⁸
3. For all other types of publications *five years* must pass before an application can be submitted.¹⁵⁹

Convention provides that compulsory licences January be granted to broadcasting or communication to the public of phonograms.

¹⁵⁰ Under certain conditions, Article II of the Appendix exempts a country from the exclusive right of translation provided for in Article 8 of the Berne Convention.

¹⁵¹ Copyright and related rights law of 2013, Article 48, (g).

¹⁵² Article 48 (a).

¹⁵³ Copyright and related rights law of 2013, Article 48, (a, 1) and (b, 1); mirror Article II (2), (b) of the Appendix of the Berne Convention.

¹⁵⁴ Copyright and related rights law of 2013, Article 48, (b).

¹⁵⁵ *Ibid*, Article 48, (g).

¹⁵⁶ *Ibid*, Article 48, (b) (1).

¹⁵⁷ Article 48 (b) (1) which mirrors Article II (3) (a) of the Appendix of the Berne Convention

¹⁵⁸ Copyright and related rights law of 2013, Article 48, (b), (1).

¹⁵⁹ *Ibid*, Article 48, (b), (1).

4. The above restrictions only apply where the original publication was not distributed in Syria for a reasonable price by the copyright owner or with his consent, such as to meet the needs of the public in general and education requirements.¹⁶⁰
5. If a license for translation or copying was granted, the copyright owner of the work is entitled to compensation according to fair commercial practices in the copyright owner's country of origin.¹⁶¹

Finally, if it is decided that it is in the public interest to publish or republish a work by a Syrian author, the Ministry of Culture may request the right holder, his/her successor or descendants to publish the work within six months.¹⁶² If the work was not published within the stipulated period the Ministry itself could publish the work, albeit with fair compensation to the author.¹⁶³

Even with all of these restrictions however these provisions grant a very broad scope for Arabic speakers in Syria to turn the translation or copying of translated works into a viable business model. In this regard they offer an interesting approach to ensuring that Syrian educators have access to contemporary material within a reasonable timeframe by attempting to address barriers to supply when it comes to teaching materials. In particular, the variation in time requirements between different fields offers a fascinating insight into the educational priorities of the Syrian government and the perceived shortfalls in supply. Whether in practice these licencing provisions will have any impact on educational resources however remains to be seen.

Worryingly however while Syria has included compulsory licencing provisions for apparently laudable aims they appear to have avoided including the safeguards that, under Berne, were intended to protect the authors of the original works.¹⁶⁴ The right of translation that is provided for under Article II of the Appendix of the Berne Convention must be interpreted in light of Article IV of the Appendix; an Article which sets the conditions under which a licence might be granted. For example, an applicant should firstly be required to prove that he has requested a license to translate the work and his requested was turned down or, that after due diligence on his part, he was unable to find the owner in the first place.¹⁶⁵ No mention of any such requirements are included in the 2013 Syrian law. For foreign rights holders this might

¹⁶⁰ *Ibid*, Article 48, (b), (2).

¹⁶¹ *Ibid*, Article 48, (d). This section is in line with Article 3 of the Berne Convention.

¹⁶² Copyright and related rights law of 2013, Article 47, (a).

¹⁶³ *Ibid*, Article 47, (b).

¹⁶⁴ This is despite the fact that Article 48 (h) entitles the Minister of Culture to set the conditions under which a licence might be granted.

¹⁶⁵ See in general Article IV (1- 6) of the Appendix of the Berne Convention and Article 15 (2) of the Rome Convention.

be concerning as copies of their work have the potential to spring up without warning nor opportunity to object or negotiate terms.

The State of Syrian Copyright: Some Observations from Afar

Reflecting on the Syrian legislation as a whole a number of themes emerge. The first of these is the apparently pro-author position that is reflected in a number of decisions taken by the Syrian drafters. The absence of a fixation requirement lowers the threshold for protection while the existence of reversion rights protects authors somewhat from bad deals by allowing them to recover ownership in certain circumstances. Additionally, authors are given strong moral rights under the 2013 law including perpetual protection (in contrast to the Anglo-American position, where such rights expire) and rights to not only to be named as the author but also to prevent others falsely attributing works to them. For the creator of copyright works therefore the package of measures contained in the 2013 law mark a welcome strengthening of protections.

It isn't only authors who benefit under the new law however: users also appear to gain significantly. Most notably the personal use exception, as discussed above, is *prima facie* very broad allowing users to make copies for personal use with very few limitations. The exceptions for computer programs are more balanced but still offer users valuable rights when it comes to backing up and adapting works. In particular, the lack of any restrictions on disabilities that qualify for the right to adapt computer programs under this exception is very welcome, although it is unfortunate that this right is not extended to other categories of copyright works as well.

Indirectly users are also likely to benefit from an increased availability of works thanks to the detailed compulsory licencing provisions of the new law. These should, if taken full advantage of, increase both the number of works available in the Arabic language as well as increasing the availability of works that have already been produced. However, while it is encouraging to see Syria take advantage of the measures available to developing countries under international treaties the lack of strong safeguards for rights holders does raise some concern. Without any requirement for the licence applicant to at least try to contact the original rights holder there is a very real chance that foreign parties could find their own efforts at translation undermined by already existing copies of which they were completely unaware.

Also concerning is the apparent inconsistencies in the 2013 law when considered as a whole. In terms of the scope of protection Syria has adopted the minimum standards

of protection required under international obligations in a large number of cases, but has extended these in others. There appears to be no consistent approach to copyright terms. Furthermore, the attempts made to strengthening protection, including the improved position for authors discussed above and the strengthening of penalties for infringement, are undermined by the wide personal use exception granted to users which, we argue, has effectively (if perhaps unintentionally) made a huge portion of online piracy non-infringing.

Additionally, while attempts have been made in the 2013 legislation to modernise the law through the express inclusion of additional categories of works (such as databases) other provisions have struggled to cope with technical change. The provisions on temporary copying, for example, apply only to broadcasting and therefore ignore the pivotal role of temporary copies in the basic functioning of the internet. Along similar lines, the wording of the anti-circumvention provisions seems to have overlooked the actual use of these tools, perhaps assuming that such use wouldn't be possible without first possessing them. With web based services and remote computing facilities becoming increasingly available however there is a very real risk that Syria's anti-circumventions will become obsolete in the near future. When it comes to technology therefore Syria's measures seem short-sighted at best and incompetent at worst.

A concerning lack of clarity also runs throughout the 2013 law. In several places the meaning of the language used is unclear: In regards to the resale right, for example, the law simply states that the author's royalty can be 'up to 10%'. Who determines what figure is used here, and what's to stop every qualifying author from simply demanding the maximum of 10%? What is the mechanism for collecting these payments? Such confusion can be contrasted with the European approach which, while markedly less generous, nonetheless sets out very clearly what royalty rates apply, to which transactions and at what values.¹⁶⁶ With the Syrian courts generally reluctant to take an active role in developing meaning through jurisprudence the lack of clarity in the legislation raises concerns about its consistent application.

Also, while it would appear that the new Syrian law has drawn heavily from international treaties for the wording of many of its provisions this approach has led to conceptual confusion when the law is taken as a whole. Intellectual property inherently involves a balancing act between the competing interests of the various stakeholder's involved – content creators, copyright holders, and the general public. By adopting wording from international treaties piecemeal however Syria appears to

¹⁶⁶ Article 3(2) and 4 of Directive 2001/84/EC, (Resale Rights Directive).

have lost this balance. On the one hand the new legislation includes some welcome elements, such as strengthening rights for authors and additional copyright exceptions for technical fields like computer programs for users. On the other however many of these advances are undermined elsewhere in the law: The improved rights for authors are undermined by broad infringement exceptions; the position of copyright holders is threatened by the omission of international treaty safeguards from compulsory licencing provisions; and the rights of users in an internet-dominated age are endangered by the limitation of temporary copying exceptions to broadcasters alone.

Overall, therefore, we would suggest that the 2013 Syrian copyright law is an example of one step forward, one step back. While the attempts at modernisation are welcome their implementation, and in particular notable omissions from the law, are concerning and risk undermining both the aims of the law and Syria's admissions for increasing international trade through WTO membership.

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Interview with Jamil Ammar



Jamil Ammar is an Assistant Professor in Law, with teaching interests in intellectual property, e-commerce and business law at Rutgers Law School. He holds an LL.B. and an LL.M. from the University of Damascus Law School, an LL.M. from the University of Wales Swansea and a Ph.D. from the University of Edinburgh Law School. He is involved in several projects both nationally and internationally including the United Nations Development Programme in Syria.

NRV: Can you tell us a little about your back ground and your work at Rutgers University.

Dr. Ammar: I hold an LL.B. and an LL.M. from the University of Damascus, an LL.M from the University of Wales Swansea and a PhD from the University of Edinburgh. Before joining Rutgers Law School-Newark I served as a Post-Doc at the Edinburgh Law School. Previously, from 2012-14, I was appointed Head of Management Department, the School of Business Administration, the AIU. At the same time, I also worked as an assistant professor at Damascus University, School of Law. During this period of time, I was involved in several projects both nationally and internationally including the United Nations Development Programs in Syria.

My teaching interests include intellectual property law, IP management, E-Commerce and business law. Research wise, I am currently involved in two projects to address (1) the legal and economic implications of 3D printing in the medical sector, and (2) to tackle the use of social media by Jihadist Groups. My latest essay ‘Yesterday’s Ideology Meets Today’s Technology: A Strategic Prevention Framework for Curbing the Use of Social Media by Radical Jihadist’ is currently under review.

NRV: Your article concerns copyright laws in Syria. For those of us who are unfamiliar with this can you give us a general overview of copyright laws in the country and, how it fits into the international IP set up, how many Syrian patents there are and so on.

Dr. Ammar: A significant number of intellectual property-related laws have been updated recently in Syria. Patent Law No 18 of 2012, Law of Electronic Transactions No 3 of 2014, Trade Mark Law No 8 of 2007, and the Law of Online Communication and Cyber Crimes No 17 of 2012 are mere examples. Some of these newly enacted laws do fit well into the international IP norms such as Trade Mark Law of 2008. This law steps up protection of well-known trade marks in line with Syria's obligations under the Paris Convention and the Madrid Agreements. By stark contrast, in a clear violation of IP norms, read together, Articles 60 (b) of the Syrian Media Law and Article 2 of the Law of Online Communication and Cyber Crimes hold Internet intermediaries in general including Internet Service Providers responsible for the contents posted on their sites. Even worse, if ordered by the relevant governmental agencies, Internet intermediaries are required to provide information to identify the identity of individuals who posted information online. The Syrian government is entitled to take measures and to co-operate with intermediaries in order to trace those responsible for criminal acts only. Copyright law should not be used to impose online surveillance or to suppress free expression of information and ideas. The Syrian government should respect the will of Internet users not to disclose their identity. This security-driven approach has in fact stifled competition in the Syrian market where only a few intermediaries loyal to the Syrian government can in fact act free of fear of imminent execution.

On a different note, generally speaking, it is safe to say that the Syrian economy is not IP depended. Apart from branding, few Syrian firms produce effective and competitive IP-related products. For example, according to the Department of Industrial Property Protection in Damascus, from 1990 up to the end of 2012, the number of registered trademarks reached 92,990. By stark contrast, during the same period of time, 14,262 industrial designs were registered and only 1,629 patents were granted.

NRV: How does copyright in Syria effect medicine and is this a concern in the country?

Dr. Ammar: Drugs are typically the domain of patents law rather than copyright law. Apart from few cases such as the use of exclusive or non-exclusive copyright licensing agreements or the use of digital rights management to control access to copyrighted materials, copyright law has a relatively moderate impact on the medical sector. Syria is not a WTO's member. The Syrian Patent Law No 18 of 2012 explicitly excludes drugs and pharmaceutical production manuals from the scope of patent law. This lack of patent protection has served the Syrian economy well. Before the war, Syria enjoyed a fairly solid pharmaceutical sector. According to a report submitted to the World Health Organisation, 91% of drugs were produced locally. Expensive cancer treatment drugs are usually provided free of charge by the government. After five years of war however, this has completely changed. Besides the sever lack of all basic drugs, there is an acute shortage of pharmaceutical staff and medicines expertise in general. The lack of patent protection therefore could, I argue, have an impact on slowing down the recovery process of the Syrian pharmaceutical sector. Few pharmaceutical companies would be willing to lend help and support to a country that does not recognise patents as a form of protection for patentable drugs.

NRV: You mention at the start of the article that Islamic Jurisprudence is a major source for legislation in the law of the country. Can you give us some examples of this and how in particular this informs property ownership in general?

Dr. Ammar: Article 3 of the 2012 Syrian constitution declares Islamic jurisprudence one of Syria's main sources of legislation. It reads: 'Islamic jurisprudence shall be a major source of legislation'. While Islamic jurisprudence regulates a wide range of issues including, but not limited to, marriage (a Muslim man can get married up to four women), inheritance (a non-Muslim cannot inherit from a Muslim), evidence (the testimony of two women equals the testimony of a man) and civil procedures, it does not directly impact the ownership of IP rights. According to Article 8 of the Syrian copyright law, transfer of copyright ownership is subject to the general rules of law. For example, a transfer of copyright ownership, other than by operation of law, is not valid unless is in writing and signed by the owner of the rights conveyed and provided that the scope and the subject matter of the assigned right are clearly identified.

NRV: The article explores quite extensively some of the copyright that is afforded to IP in Syria. In real life how much are these copyright laws adhered to?

Dr. Ammar: Piracy is a serious problem in Syria. Even the most respectful local academic institutions are not immune. It is one thing to consider an individual's lack of ability to pay for software, games or movies or to adapt a free and open source of education systems where students/researches can access copyrighted materials easily, but it is quite another to turn a blind eye to piracy in such a way that even the most academic gross plagiarism cases are sometimes tolerated. Unsurprisingly, this unguided 'blind eye' approach has led to the fact that pirated, counterfeit or knock off designer goods are becoming increasingly ubiquitous. In theory, the current Syrian IP system reflects, to a good degree, the needs of rights holders. The real impact of this system however is anything but certain.

NRV: The new collective licensing body is a welcome step. How developed is this body? Is it functioning right now?

Dr. Ammar: Establishing a new collective licensing body is one of the major achievements of the copyright law of 2013. This idea however is neither well-developed nor functioning right now.

NRV: The law pertaining to computer programmes allows for a backup copy and up to 3 copies for 'lawful use'. Can you elaborate on the impact of this law? Does it not open the door for wide scale piracy?

Dr. Ammar: By the European or the American scheme of things, enabling a lawful user to make up to three backup copies may appear as a one-step too far. Within the Syrian IP context however, the mere fact that the new copyright law limits the right to make backup copies to the 'lawful' user is by itself an improvement. This is particularly significant considering the fact that Article 33 of the 2013 law grants a remarkably broad personal use exception under which it is permissible to make a single copy of a 'legitimately published work' irrespective of media, provided that this is done solely for personal use. Unlike the exceptions for computer programs, Article 33 does not stress the need for acquiring a 'lawful copy' of the work in the first place. As such, it seems that, in many cases, online downloading of copyrighted materials is non-infringing.

NRV: In regards to sentences and penalties handed out to offenders, how effective is this system? Are infringers caught and penalised frequently?

Dr. Ammar: Curtailing infringement requires a combination of properly enforced laws, clear and transparent litigation processes and, equally important, a culture of innovation and creativity without which the enforcement of IP rights would be wishful thinking. To a fair degree, trademarks infringement cases are treated properly and in a timely fashion. Syrian judges are acquainted with this type of litigation. When it comes to curbing other copyright, patents and industrial designs infringements however, things are less promising. Among many other reasons, due to the lack of effective penalties, patents related cases are in particular very scarce. In all types of IP infringement cases, compensations granted are moderate and thus not effective in curbing infringement.

NRV: What recommendations would you make for improving copyright issues in the future of Syria?

Dr. Ammar: This question rests on the purposes of copyright law in the first place. Only with clear ideas of what the Syrian legislator is trying to achieve one may be able to provide some specific recommendations. That said, it is safe to assume that technology is perhaps amongst the many major developments which have brought copyright reform in Syria. For this reason, we provide the following technology-related recommendations:

1. The personal use exception under Article 33 is very broad and opens the door for a wide range of online piracy. Amongst many other examples, file-sharing through unlicensed peer-to-peer networks seems to be non-infringing. The personal use exception in fact undermines all attempts made by the law to strengthening the penalties for copyright infringement. For this reason, the personal exception under Article 33 should only apply to ‘lawfully’ acquired copies.
2. The broad right allowing disabled people to adapt computer programs is a good first step. Perhaps it should be extended to other categories of copyright works.
3. Provisions on temporary copying are limited to broadcasting. Considering the significance of transitory copying for the functioning of the Internet, perhaps, an exception should be included to exclude temporary copying from the scope of copyright infringement.

4. The effectiveness of anti-circumventions provisions which give too much weight to the question of 'possession' is already undermined by the wide availability of web based services and remote computing.

NRV: Are you hopeful for the future of the country?

Dr. Ammar: Yes, I am. However, after all this bloodshed, Syria should be united in refusing all types of autocracies and theocracies. Replacing one form of dictatorship by another simply does not make sense. The Syrian war will end with a very long list of losers. There would be no winners. The sooner Syrians realise this frustrating, if not terrifying fact, the faster the healing processes may start.

NRV: What are your plans for your academic future?

Dr. Ammar: For most Syrian scholars in exile, certainty and stability are currently beyond reach. I just hope that the war will stop soon and I would be able to go back to my country. Until that time, I can only plan for a few months or a year ahead at the farthest.

I have been studying the deficiency of Internet intermediaries in curbing the use of social media by radical groups. The goal has been to outline a number of steps the implementation of which would tackle the spread of radical ideologies particularly in the Arabic language social media. During the coming few months, I would like to move this project one step further and thus explore the possibility of utilizing state-of-the-art computational content analysis algorithms to identify and ultimately remove ideologically charged materials from social media without violating free speech principles. On a different note, I would like to explore the interaction between intellectual property laws and 3D printing, in particular, the patentability of 3D printed organs.

The Lesbian Subjectivity in Contemporary Arabic Literature: 'An Absent Presence' Disciplined by the Gaze*

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Introduction and Exploration

The subject of lesbianism is rarely addressed in Contemporary Arabic literature, without inciting prejudice, denial, or repetition of some preconceived ideas about the widely used term, "homosexuality". Even after the emergence of Arab feminism, 'lesbian subjectivity' is totally silenced on the assumption that sexuality is not a 'priority' in a male-oriented world in which 'women' have more vital concerns to fight for than what is seen as 'bodily rights', or rights to 'pleasure'. Some authors presume that there are no lesbians in Arab cultures. Others claim that some women 'become' lesbians due to negative experiences or imposed sexual segregation. Set within the limits of female bonding in heterosexual norms, most Arab writings about intimate same-sex relations among females tend to convey an implicit message that lesbians are women who can be heteronormalized once their circumstances change. All these assumptions and misconceptions regulate the public opinion and subdue any attempt to assert an independent lesbian subjectivity that has different priorities, ethics, rights and politics.

Subjectivity and freedom to assert one's individuality are essential concepts of any philosophy. To this day, lesbian philosophy remains a *'Euro-American and feminist one'* that is rarely approached by Arab scholars. Though lesbian philosophy is still restricted to thought and theories by feminist Western thinkers, it provides me with several theoretical tools to analyze the operation of meaning-making in Arab narratives that use the discourse of deviance and abnormality as a means of consolidating the heterosexualized meanings of subjectivity. While delving into the emergence of lesbian literature and philosophy in Western cultures, I more realized

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that the status of the lesbian as an independent subjectivity in Arab Cultures is more problematic than the Western ones that theorized the concepts of 'gender', 'lesbian' and 'queer' in a manner that is still regarded as alien to Arab values.

According to Lillian Faderman, "'Lesbian' describes a relationship in which two women's strongest emotions and affections are directed toward each other. By preference the two women spend most of their time together and share most aspects of their lives with each other (Faderman, 1981). Such a definition, if applied to female same-sex relations in the normalized homosocial closets of Arab cultures, might make all types of female bonding appear to be lesbian. Nevertheless, I find many of the definitions that are available in Western lesbian studies to be of central importance to my analysis of the concept of the lesbian subjectivity as some abstract *a priori*, and intuitive core that precedes intentionality, signification, literary representation and self-identification.

One of the most difficult tasks confronting lesbians in the Arab region is inscribing themselves/ourselves as speaking subjects. In the narratives of Arab writers, the lesbian dissolves in the realm of fiction as a fuzzy and illusory figure. Such a portrayal makes it almost impossible for any lesbian to express one's peculiar and most intimate feelings to the outside world. Deprived of the means of self-expression in the system of meaning, excluded from discourse and confined in it at the same time, how can a lesbian subjectivity become a speaking subject?

Within the Arab symbolic logic, the female body is produced and re-produced as a heterosexual object for the public gaze. Hence, when Arab authors discussed 'female homosexuality', they did that through what I call "the heterosexual gaze". In other words, they saw all females through eyes and glasses that serve the interests of typical male-oriented structures. In this paper, I focus on the power of "the heterosexual gaze" from a lesbian perspective that recognizes the discrete layers of oppression that face signification and self-assertion. The principal focus of this paper is on the literary representations of lesbianism and the lens through which the lesbian is depicted. I show how same-sex intimacies in Contemporary Arabic narratives are shaped in accordance with the dominant heterosexual expectations. The lesbian, as represented in such narratives, becomes a woman who might be able to 'surpass the love of men', but cannot surpass the power of their heterosexual gaze. I try in this article to propose new ways of approaching the absent presence of the 'lesbian subjectivity' by deconstructing the available diagnosis of female same-sex relations in Contemporary Arabic literature.

Despite the necessity of writing about lesbian issues, the paper demonstrates the complexities inherent in giving voice to lesbian experiences by non-lesbian authors. According to Bonnie Zimmerman's definition, contemporary lesbian fiction must be written by self-declared lesbians, because "the nature of lesbian fiction makes it impossible to separate the text from the imagination that engenders it" (cited in Haggerty, 1995, p. 52). The lesbian novel places "love between women, including sexual passion, at the center of the story" (cited in Haggerty, 1995, p. 15). Zimmerman's definition reveals the absence of lesbian literature in Arabic, especially when one can hardly find an Arab female writer "who declares herself to be a lesbian" (cited in Haggerty, 1995, p. 15).

Seen in the above light, the lesbian novel does not exist in Arabic literature. Though 'Lesbian literature' in Arabic has no officially recorded history, the topic of lesbianism recently emerged as part of literature on women. Most of the writings about lesbianism reflect a concern with the lesbian as a "pure physicality", not as "the carrier of self/identity". The emergence of Arabic literature on 'female homosexuality' during the past few years constitutes a leap in sexuality studies. However, most of the works written about female same-sex relations seem to be motivated by a tendency to stigmatize lesbianism, or invest it as a radical feminist tool for women's liberation. By confining same-sex practices to an obscure private sphere, Arabic literature exposes the lesbian to a heterosexist and male-oriented gaze that makes it difficult for her to become visible, public and comprehensible. In Terry Castle's *The Apparitional Lesbian: Female Homosexuality and Modern Culture* (1993), the lesbian is a spectral figure....she appears as something incidental, impalpable, fleeting, or obscured, not as something solidly in the world" (cited in Hesford, 2005, p. 228). Hence, analyzing the unrecognized position of the lesbian in Arabic literature requires a thorough analysis of some literary texts that reveal the link between the intimate and the social on the one hand and the enduring and pervasive nature of the hegemonic heterosexual gaze on the other hand. In *Heterosexual Plots and Lesbian Narratives* (1996), Farwell repeats the words of "Judith Roof and Elizabeth Meese [who] ask whether it is possible to narrate lesbian in a plot system which is already overdetermined as male and heterosexual" (p. 9).

Despite the "death of the author" in the twentieth century, the meanings given by Arab authors remain historically and socially determined. Even when the role of the author disappears as a producer of truth in Foucault's "What is an author?", Arab authors still play a role in recycling conventional ideology through a cautionary narrative that "is governed by paradigms and codes that are not innocent" (Faderman, 1981, p. 15). Hence, it is important to show how the discourses of lesbian sexuality are negotiated

and contested through the production of particular interpretative literary works which are key parts in the construction of the collective discourse about lesbianism as a "sexual deviance", "social disease" and "sinful practice" in Contemporary Arabic literature.

A closer look at one of the so-called "censored poems" of Nizar Qabbani, renowned as "the poet of love", reflects the power of the male heterosexual gaze to penetrate a discrete place. In "The Evil Poem", Qabbani is praised by many Arab critics as being worthy of his nickname "the evil boy", for "invading the harem and defying sexual taboos" (cited in Nasrallah, 2003, pp. 113-114). By describing an eroticized encounter between two female lovers in a rainy night; a lustful encounter that nobody witnesses but the "I" of the poem and the "lamplight", the poet asserts the powerful role of the author, not only as the one who sees what takes place in the dark, but also the one who knows the subjective feelings of lesbian lovers. The two female bodies are erotized in "a dialogue between four breasts, sucking wolves, birds, nails, hair, nipples, silky heaps..." (cited in Nasrallah 2003, pp. 114-118). Qabbani's voyeuristic attitude towards the encounter between two female bodies asserts the omnipresent male-oriented perspective that has the power to unlock the closed door of the fantasized 'harem' and to liberate it in his own words, or to close it and to control it whenever he wants, for he seems to be the owner of the 'key' that allows him to enter any space at any time. In other words, he can be the jailor and the liberator at the same time. Hence, Qabbani's use of sex is "as little more than a tattered cover for the affirmation of male power, imposing a male-oriented 'sexual liberation' on women" (Weeks, 1995, p. 35).

The concentration on the feminine contours of the female body, and the maternal image of suckling put the poet in the position of the desiring male who looks at this scene while fantasizing his place in it. Female lovers appear as silent hostages in a fantasized harem. They are turned into fetishistic love objects for voyeuristic male audience/readers via a phallic gaze that imposes a new form of heterosexual regulation and control of lesbian love. Using a male tongue to give voice to an imagined feminine *jouissance*; "an 'instinctual economy' that cannot be identified by a man" (Cixous, 1986, p. 88), the poem becomes a phallic narrative of the most intimate and inexpressible feelings between two female lovers. The gaze of the author is so profound that the lesbian body becomes the object of desire to a wider penetrative heterosexual gaze. At the end of the poem, the male narrator becomes impatient with the process of love-making that does not lead to penetration. Therefore, the phallic voice of the male narrator intervenes and demands in an orderly manner: "Tear off the silk/ ye lover of silk" (cited in Nasrallah, 2003, p. 118). It is worth noting that silk

exists in the 'erotic imagination as a feminine source of pleasure, genital erection and female orgasm' (Rosario, 1997, p. 113). In this context, the poet appears as a director of a scene that fulfils the phallogocentric identification of a desiring heterosexual gaze.

Obviously, the relationship between the male poet and the two female lovers is portrayed in a manner that asserts the desiring position of the poet as the one who sucks their breasts. By comparing them to 'she-wolves' suckling each other, the poet "produces a hallucinatory metaphor. There is fear and fascination" (Kristeva, 1982, p. 45); fear of the female body and fascination with maternal love. Hence, the male poet becomes the "representative of the paternal function [who] takes the place of the good maternal object that is wanting" (Kristeva, 1982, p. 45). Unlike typical patriarchal cultures that exclude the feminine, Qabbani does not exclude the maternal; rather he successfully integrates the maternal body in the construction of his own patriarchy, as much as he invests lesbianism in the assertion of heterosexuality. In such a discourse, lesbianism is equated with womanhood, femininity and self-regulating heteronormative assumptions associated with the female body. The male author becomes the one who does not only know what women want, but what lesbian lovers want.

Similarly, Nihad Seeras' *Halett Shagaff* (i.e. *A Case of Passion*, 1998) depicts all-women's parties in Aleppo as wild ones in which women get involved in obscene affairs. Details about women kissing, dancing, rubbing and scrubbing the bodies of each other from underneath the covers are narrated by a male peeper. The female dancer is perceived as a potential heterosexual love object for a male viewer and narrator. Even when the male narrator is told that the dancer is 'lesbian', he continues to pursue her, disregarding her lesbian sexuality which does not seem to make any sense to him. Within the system of meaning in which the female body is bound up with heteronormative assumptions, the lesbian 'riddle' is typically fantasized as an excessively erotic body, and is made visible by an omnipresent male viewer who reproduces it as a source of pleasure to heterosexual viewers.

The portrayal of lesbianism an 'obscene practice' that results from an oppressive past is repeated in Ammar Abdulhamid's *Menstruation* (2001). By attributing lesbian sex to the suppression of heterosexual desires and the separation of the sexes in fundamentalist societies, the lesbian subject is projected to the public gaze as a heterosexually oppressed woman. All women in the novel are seen as willing to be engaged in 'group sex' with each other, even when they have no feeling of love or commitment to one another. Batul, the woman who is defined as being 'lesbian' is depicted as a bizarre sex worker who admits making love on a daily basis to many women of all types; "married, single, traditional, liberal, and all of them very normal,

and not necessarily unhappy with their lives" (Abdulhamid, 2001, p. 101). Women's obsession with sex is attributed to "the ideologically repressive nature of their societies" (Abdulhamid, 2001, p. 154). The author's assumption that lesbian sexuality is imposed not chosen establishes lesbianism in the collective consciousness as an outcome of a conservative social structure that forbids women enough access to men.

However, since the so-called oppressed women of the novel manage to invite an inexperienced young man to have sex with, it becomes hard to understand the writer's assumption that "the religious condemnation of non-martial sex" is the major cause of homosexuality in "the fundamentalist-conservative society" (Abdulhamid, 2001, p. 149). When the narrator imposes a sense of guilt on homoerotic practices among women, the writer does not only stigmatize female same-sex relations; he also creates a prohibitive discourse that might make many lesbians internalize the imposed sense of guilt and shame. This kind of discourse constructs the lesbian in the collective public gaze as a mere example of 'repression' in a conservative religious framework. According to Butler in *The Psychic Life of Power* (1997), "social and psychic realities are connected in such a way that the social structure of discourse determines the character of interior psychic space" (cited in Magnus, 2006, p. 84). In such a context, the lesbian subjectivity is reduced to a shameful and immoral effect of the subordinating social and political circumstances in a society in which "morality was little more than a tool of political oppression" (Butler in Magnus, 2006, p. 93).

In women's writings about lesbian issues, the lesbian sexuality is similarly perceived as the outcome of the heterosexual oppression of women in traditional socio-political contexts. Despite the limitations and restrictions imposed on women's writings about women, some women writers managed to provide an understanding of the ways in which society works to disadvantage women. However, none of these writings exposed enough sensitivity towards lesbian lovers. The discourse of female homosexuality was introduced to give an impression that 'lesbianism is imposed on women' in a patriarchal society. Instead of providing positive lesbian images that can give authority to the multiple demands and needs of lesbians, lesbians were merely used by heterosexual women authors to legitimize the demands of heterosexual women.

Despite the fact that the Saudi author Siba Al-Harz's *The Others* (2006) appear to be written about lesbians, the writer does not identify herself as a lesbian author, instead she regards the lesbian practice as imposed on the members of her sex due to the sexual segregation in a religious society. Her use of a pseudonym to tell stories about female same-sex relations stigmatizes lesbianism. The novel deals with the struggle of a young Saudi woman in the context of a religious fundamentalist background.

Having sado-masochistic relations with women, feeling disgusted with women, and breaking the hearts of many, including her own heart are shown as representatives of her ways of breaking away from social values and traditions. Her first and only heterosexual relationship takes place with a Lebanese man she used to chat with on the Internet; her "virtual homeland" (Al-Harz, 2006, p. 226). Heterosexual love is portrayed as the most desired end; an end that matches the socio-sexual expectations of her sex. The protagonist confesses that despite the fact that she has homosexual relations, she refuses to define herself as 'lesbian'. Her erotic relations with women are for her "an expression of a lustful desire for a man who will not come" (Al-Harz, 2006, p. 179). Hence, her longing to offer her virginity to a male lover: "take it! I don't want it! Take it!" (Al-Harz, 2006, p. 285) establishes lesbian sex as a socio-political need for protecting heterosexual women from losing their virginities. Keen on abiding by the rules that pertain to preserving her chastity till the day of marriage, Al-Harz' female protagonist underestimates her affairs with women as 'meaningless'.

In some Arab women writings, the lesbian is subjected to a feminist compassionate gaze that seems to be provoked by the desire to reunite women through lesbian love. In Elham Mansour's novel *Ana Heya Anti (I Am You)*, 2000), Irigaray's extended metaphor of the "two lips speaking together" as opposed to the singular, rigid, and phallic standard that characterizes masculinity is recalled in the title of the novel. In Irigaray's words:

"You/I: we are several at once..., [but] you/I become two, then, for their pleasure. But thus divided into two, one outside, the other inside, you no longer embrace yourself, or me. Outside, you try to conform to an alien order. Exiled from yourself, you fuse with everything you meet." (Irigaray in Price, 1999, pp. 85-86).

In Mansour's text, the lesbian body is portrayed as an exiled feminine body that pre-exists the separation between the "you" and the "I". Lesbian love is seen as a narcissistic attempt to return to the first maternal body which is exemplified in the unique sensations that engulf Siham when she recalls the touches of her mother. As Ruth Vanita observes, this model of the mother-daughter relationship, "anticipates Freud's insight that the mother is the first love object for all babies (implicitly, then, love for a woman is the primary experience of all women" (Vanita, 1996, p. 12).

The feminine body language that is used by Irigaray in re-creating the mother-child dyad is repeated by Seham the lesbian protagonist. The bodily discourse of Seham is encountered by the psychological discourse of her teacher, Layal who treats her lesbian student as a psychological case worthy of investigation. Seen in this light, the

lesbian is subjected to the gaze of the teacher and the mother who find female same-sex attraction as "natural" among girls at a certain phase, "but that would become pathological if it persists" as the female teacher says to her student (Mansour, 2000, p. 28). Apparently, even when the act of looking takes place by a female author, lesbianism continues to be seen as a form of perversion or narcissism.

In Mansour's novel, the sexual encounter between women and the only self-declared lesbian character is treated as an encounter between vaginal bodies and a clitoral/phallic body. The problem with this discourse is that it can turn the lesbian body into 'a pseudo male', and a 'phallic' body that replaces the male during times of sexual deprivation. Appearing as a 'butch' makes the lesbian appear as a phallic body that is attractive to heterosexually deprived women. Many women in the novel regard the lesbian as a potential love-maker that replaces their absent men during the Lebanese civil war. The novel establishes lesbianism in the public fantasy as a safe haven for all women during the absence of men. Despite the fact that the lesbian butch affirms that femininity is not attached to an outfit, she continues to be seen as a phallic body that fulfils a heterosexual need for "fuck" (Mansour, 2000, p. 166). Adopting the Freudian psycho-analytical discourse, Mansour's lesbian protagonist Seham is portrayed as "a true invert" who has never been attracted to men (Mansour, 2000, p. 75), but who is constantly subjected to a hetero-normalizing gaze and heterosexual expectations.

In most literary works written about lesbian issues, lesbian sexuality is perceived as a mere experience, and a sign of sexual oppression. In Samar Yazek's *Raehatul Kirfa* (i.e. The Smell of Cinnamon, 2008), the author uses the Damascene culture as a means of asserting stereotypes, and repeating some pre-conceived ideas about female same-sex relations. In a sub-cultural context, the concept of '*banat al Ishra*' was most probably used in Damascus during the thirties to refer to upper middle class single females who refuse to marry men, and live with other females in a strong and intimate connection. The concept of '*banat al ishra*' exists in the collective memory of some old Damascenes as a euphemistic reference to 'lesbians'; a neutral expression that is free of the heterosexual suggestions implied by the word 'woman'. However, Yazbek uproots the potential 'lesbian code' of '*banatel al ishra*' (girls of co-habitation) from its sub-cultural context and linguistic specificity and places it in a different era. In Yazbek's novel, the majority of '*banat al ishra*' are mainly married, and each one has a girlfriend or inamorata, and most of them get married early, and few people know about them, for their meetings are allocated to women only, and men feel assured when their wives are with other women, even if they feel that there is something suspicious in that friendship. The engagement remains acceptable if the woman's

affair remains secret. As soon as gossips begin, the husband breaks the affair between his wife and her girlfriend. (Yazbek, 2008, p. 97.)

By turning single females who exclusively have loving relations with other females into wives who come from various social and sectarian backgrounds, the writer subverts the oral Damascene culture and incites a different official memory that totally excludes any possibility for a lesbian to identify herself as *'bint al ishra'*. Yazbek's women are united through their marital relations with influential men, not by mutual love or co-habitation, let alone the fact that Yazbek's women are not *'banat'*/'girls' on the basis that they are married to men. Placing men at the center of lesbian sex, Yazbek's discourse alienates lesbians from a distinguished local expression, and makes it difficult for lesbians to find refuge in the past. The unofficial voices of *'banat el ishra'* are silenced by an official heterosexual discourse that turns them from independent females into dependent heterosexual women. Thus, by heterosexualizing the coined term of *bana tal ishra*, the lesbians of the past who might have had some roots in the oral culture, are deprived of the vocabulary and the linguistic tool that could enable lesbians in the present to constitute themselves/ourselves as speaking subjects, without feeling totally estranged from language and culture.

In Hala El-Badry's *A Certain Woman* (2003), lesbianism seems to be something unheard of by the women of the novel who deny it both physically and spiritually. One of her female characters compares a relationship with a woman to a relationship with an impotent man. By treating lesbianism as an impaired heterosexuality and a result of male impotence, desire is established as essentially heterosexual and penetrative. By the end of the novel, Nahid discovers for the first time that she never knew women or got close to any woman's body. She "strongly resented gatherings of women only because they reminded her of mandatory segregation which she totally rejected" (El-Badry, 2003, p. 195). Women's alienation from women's bodies can be attributed to the fact that women's private and public lives seem to be shaped by men's laws and values. By referring to the imposed policy of silence, isolation and segregation, El-Badri's novel makes an adequate connection between the inhibition that surrounds women's sexual lives and the inhibition that locks people's tongues in the political domain. The social life of people is historically surrounded by fear of "informers and spies", a fear that creates a sort of a deathly silence and divides people by feelings of hatred and suspicion. (See Al-Ghafari Review, H-Gender-MidEast, 2006). Nevertheless, this tendency to politicize female solidarity and intimacy might turn the lesbian into a chosen feminist tool that can be invested by heterosexual women during the absence of potent men.

The emergence of the lesbian character in women's literature is often weakened by discussions about the need to subordinate inter-cultural and sectarian differences for the sake of establishing a hegemonic national identity. In Kolette Al-Khoury's *Ayam ma'al Ayam (Days with the Days, 2004)*, the female author narrates her experience as a revolutionary journalist after the "the ominous war of June 1967" (p. 23). In a post-war era, manhood, masculinity and nationalism appear as arbitrary and inseparable terms, whereas lesbian sexuality is treated as alien to one's national commitment to one's country, and as "an unconscious reaction against the absence of real men" (Al-Khoury, 2004, p. 207). In this novel, the hetero-nationalized gaze is used as means of silencing lesbian voices. Lesbianism is treated as a phase that is similar to the political phase that "bent the heads of men" (Al-Khoury, 2004, p. 207) after the Arab-Israeli War in June 1976 which is referred to as '*nakset huzayran*' in Syria, or 'the Setback of June' in Arab political contexts. It is related to men's loss of war and their failure in the political domain. This association turns lesbianism into an experience that is attributed to the non-existence of 'true men' who can defend the land.

The application of a hetero-nationalistic discourse turns the lesbian into a phase that symbolizes the social and political disappointments of the era, and asserts the typical association between the masculinity of men in the political domain and their heterosexuality in the private sphere. The lesbian relation is described as a sign that symbolizes the defeat of men who "could not shoulder their responsibility" (Al-Khoury, 2004, p. 207). It is also exposed as a temporary experience that should not last. When Faten confesses to Suha that she had a love story of a different kind; an affair with a woman, Suha who is the mouthpiece of the narrator is shocked, exposing an unjustified homophobic reaction to the lesbian voice. When Suha was asked to provide her opinion regarding Faten's affair with a woman, the narrator was incapable of providing any support, rather she felt inclined to 'carry a lantern in the daylight to look for a man' (Al-Khoury, 2004, p. 207). This reaction silences Faten and forces her to promise not to repeat that experience; she resumes: "I don't think I'll repeat it, though I can't but say it had been a terrific experience... a frightening one" (Al-Khoury, 2004, p. 206). The narrator's interpretation of the lesbian affair forces Faten to finally admit that her going out with a woman could have been an unconscious reaction to that feeling (Al-Khoury, 2004, p. 207). In several instances in the novel, love is seen from a heterosexual light as "that natural relationship between a man and a woman" (Al-Khoury, 2004, p. 122). The assertion of the naturalness of heterosexual relation is repeated several times in a manner that denies the possibility of asserting other natural kinds of love and relationships in a positive manner.

In Hanan Al-Shaykh's *Misk Al-Ghazal* (i.e. *The Musk of the Gazelle*, 1996), the traditional heterophobic gaze in separatist cultures is replaced by a homophobic gaze. Even though the novel repeats the inherited idea which claims lesbianism to be an outcome of a conservative social structure in which opposite-sex relations are controlled, the narrator adopts an arbitrary homophobic ideology to defend her privileged Lebanese character against the 'charge' of lesbianism. Though it is common for women in female-segregated communities to dance together, dancing women in this novel are exposed to the homophobic gaze of the Lebanese narrator that finds the sight of two women dancing together as "weird" and "unnatural" (Al-Shaykh, 1996, p. 47). By making an association between 'lesbian bar' in Berlin which is referred to as "the bar of deviant women in Berlin" (Al-Shaykh, 1996, p. 62) and all-women's parties in the Saudi culture, the Lebanese character unites a Western sub-culture with an Eastern sub-culture by a globalized homophobic gaze that seems rather awkward when applied to a closeted culture that tolerates women dancing together more than men and women doing the same. Her moral judgment of the dancing women, which imposes a series of expectations and meanings on women's gatherings, is detached from the various emotions of the women themselves and the meaning of their dance in their local cultures. When all scenes of women dancing together are projected by the gaze of the narrator as 'deviant', female intimacies in general and lesbian ones in particular are projected to a wider homophobic gaze as equally deviant. Eventually, in equating lesbianism with deviance, the narrator inserts a regulating discourse that forces lesbians to internalize the stigma and see themselves through the eyes of their disgusted beholder.

In Salwa al-Nuaimi's *Burhan Al-Asal* (i.e. *Evidence of Honey*, 2007), lesbianism is seen by one of the female characters as "an experiment [that each woman] must go through, at least once in a lifetime, just for the sake of exploration" (Al-Nuaimi, 2007, p. 85). This experimental discourse is rejected by Nuaimi's protagonist who describes herself as innately heterosexual. She could not return the flirtations of the woman who kept on pursuing her for years, as much as she could not enjoy being rubbed by a woman, because her mind was filled with heterosexual reflections that could not be gratified by a female rubber. The experience of being rubbed at the hands of a woman does not give vent to a heterosexual woman's fantasies. According to the heterosexual protagonist, "[h]ad the masseuse been a man massaging her, [her hetero-erotic fantasies] would have made her blood boil" (Al-Nuaimi, 2007, p. 86). Aware of the historical meanings associated with the act of rubbing, the female protagonist acknowledges that she is not "lesbian by instinct" (Al-Nuaimi 2007: 86), and the fact that she was rubbed by a woman for thirty minutes might make her "'*suhaqeyya*' for thirty minutes" (Al-Nuaimi, 2007, p. 86).

In Al-Nuaimi's text, the physical act of a woman 'rubbing' another woman is deconstructed as not necessarily lesbian because its meaning differs according to the woman's inner desires and fantasies towards the sex of the one who performs the act of rubbing. The author suggests that if the rubbing act is performed by a male masseur in the bath, she would enjoy it in a heterosexual manner. In this context, the self-assertive heterosexual narrator reveals a subtle fear of the potential presence of a desiring lesbian gaze that might frame her as lesbian, because she is being rubbed by a female masseur. Therefore, she asserts that she is not lesbian, because she desires men and she prefers to be rubbed by a man. By diverting the attention from the physical act of rubbing to the implicit desire of the woman who is being rubbed, and her feelings towards the sex of the rubber, the author deconstructs the traditional gaze that judges desires on the basis of the performed acts. By doing that, she also reveals a conscious awareness of the potential presence of a lesbian gaze that might be incorporated within the sensations of the female masseuse herself to whom she remains sexually detached. Her focus on the unseen desire reduces the significance of the visible act of rubbing and the temporary experience. It also subdues the power of the gaze as an identity-maker. However, her fear of the act of being rubbed by a female masseuse that might frame her as 'lesbian' makes her adopt a self-defensive heterosexual discourse that exposes the innateness of heterosexuality for a heterosexual woman and the necessity of categorizing the heterosexual desire as an 'emotional, mental and erotic love for men'. This essentialized heterosexual discourse shows the need for a counter self-affirmative lesbian discourse that asserts the innateness of the lesbian desire for many lesbians and the necessity of transcending the rubbing act as a means of defining subjectivities.

In *Bareed Mista3jil* (i.e. Urgent Mail, 2009) which is supposed to be "a collection of true stories by non-heterosexual women living in Lebanon", one of the anonymous lesbian speakers rejects the '*sou7aq*' as a means of self-expression. Though she names herself '*Sou7aqiyyah*', she expresses her confusion at the contradictory connotations of the Arabic label that is "supposed to denote sexual acts between two women in the form of 'grinding/rubbing... [when]... the verb also means to crush" (*Sou7aqiyyeh*, 2009, p. 35). Hence, she mockingly inquires: "how in the world is the verb 'to crush' supposed to signify anything related to a woman loving or making love to another woman?" (*Sou7aqiyyeh*, 2009, pp. 35-36). Seen as an improper means of identity formation, the physical act of 'rubbing/grinding' that had been historicized as a lesbian one is rejected. The speaker in *Sou7aqiyyeh* rejects both the Arabic label and its multiple associations of 'grinding', 'rubbing', and 'crushing'. Instead of de-stigmatizing the label, the speaker exiles herself from language. The fact that the text is written in English can be seen as an attempt to come out of the closets of Arabic language and

culture. Refusing to see herself through the eyes of her beholders, the modern lesbian speaker rejects the Arabic label as a socio-political means of visibility. Instead of liberating the Arabic label from the confining power of the gaze, the Arabic label is re-asserted as an offensive marker of self-definition, disregarding the fact that any other label can be similarly stigmatized, or abused by the hegemonic discourse of meaning-makers in any other culture or language.

Although the newly emerging lesbian voices in *Bareed Mista3jil* exemplify a break from the past, the fact that the 'queer' speakers appear as nameless voices coming out of nowhere makes it difficult to find a way to re-invent language, to re-name desire, and to name the nameless subjectivity. Such a disguised 'coming out' might make lesbians internalize the globalized homophobia; it might also lead to reinforcement of the politics of invisibility as a cultural norm and political necessity. *Bareed Mista3jil* can be read as a collective plea for understanding the feelings and dilemmas of many modern lesbians. However, this collectively anonymous discourse embodies a new split between the lesbian body and the voice. Even while obtaining the power of articulation, the lesbian body as a physical presence remains powerless. Despite the fact that this text can be seen as an attempt to 'kill' the Arab author, in order to enable lesbian voices to exist, it cannot be seen as a lesbian text, because its author/authors are anonymous. According to Roland Barthes (1967), "once the Author is discovered, the text is 'explained'" (p. 5). Because the lesbian author is not discovered as a living person, the lesbian text remains unexplained. By preventing the lesbian author/s from appearing as real and tangible beings, *Bareed* did not only kill its own authors; it also buried the lesbian voices in an apparently virtual space.

Clearly, most of the Arabic narratives establish lesbian desire as a 'taboo pleasure', and 'forbidden sin' that is akin to prostitution. Despite the fact that lesbian sexuality is rarely mentioned in religious books as anything or even predicted to be a possible sin, there is a tendency among modern male writers to establish it as being a 'sinful practice' that is pursued by sexually frustrated wives and suppressed heterosexual women. Lesbian images in female-authored texts are as negative and disempowering as they are in male-authored texts. In women's writings about lesbians, one encounters sexually obsessed figures, erotic bodies, cruel creatures, oppressed wives, psychologically disturbed women, or angry freaks. Such representations of lesbians in women's texts are not meant to give voice to a lesbian subjectivity, as much as they seem to be directed towards doubling the stigma or investing it for 'a so-called feminist cause' which mainly revolves around the presumed needs/desires of heterosexual women. Hence, the lesbian is not only the desired other to male writers; she is also the desired and abused other to many women writers.

Conclusion

In examining several available discourses about lesbian relations, I became aware that Arabic literature plays a major role in structuring the dominant system of values in a manner that would make readers in general and lesbian ones in particular internalize the cultural implications contained in language. Contemporary Arabic literature about lesbian issues does not contain any interrogation of womanhood as a cultural or political construct, but uses the 'woman' as a means of referring to any lesbian subjectivity, leaving no chance for lesbians to assert their own differences from other women and among themselves/ourselves. Rather, the image of the lesbian is distorted, heterosexualized and politicized by several Arab writers to promote what they see as a need for liberating women. The dominant discourse in contemporary Arabic literature gives an impression that once heterosexual freedom is maintained to women, 'homosexuality' will fade away. The logic of a lesbian selfhood as being innately different from womanhood does not exist in the collective Symbolic order. Hence, the lesbian 'I' cannot assert her a unique subjectivity or become a speaking self, without confronting the constraining discourse and the heterosexual gaze that treats her as a 'woman' with all the heterosexual implications associated with womanhood. As Monique Wittig argues, "Lesbian is the only concept that I know of which is beyond the categories of sex (woman and man), because the designated subject (lesbian) is not a woman, either economically, or politically or ideologically" (cited in Shaktini, 2005, p. 69).

Because the imagined homosexual practices in Arab cultures have historically been subsumed within a seemingly tolerant homosocial order that does not defy the heterosexual institution of marriage, lesbianism came to be defined in accordance with the fantasized acts in the heterosexual and homosocial closets. Apparently, Contemporary Arabic literature does not make enough distinction between outing the fantasized homosexual acts to the public gaze and outing the single lesbian subjectivity as an authentic core that seeks recognition and as an unacknowledged selfhood that transcends both the heterosexual gaze and all its closets. Henceforth, Joseph Massad's anti-Western discourse in *Desiring Arabs* (2007), which equates between "outing the closet" and the "colonial propaganda" of "the Gay International" (Massad, 2007, pp. 375-6), creates a paradoxical situation for the voiceless subjectivities. Massad's denial of the need for identity politics in Arab contexts might lead to hetero-normalizing the subdued lesbian subjectivity as relational, provisional, meaningless, anti-Arab and Westernized, before she even aspires to become a speaking subject.

Clearly, contemporary Arabic literature does not distinguish between 'compulsory homosexuality' and lesbian subjectivities. Rather, it presents female same-sex relations in an illusive and non-sympathetic manner that over-stigmatizes lesbian self-assertion. Many male and female writers treat the female body as a dependent heterosexual construct that shares a common desire and that has no independent will or autonomy. Such an oppressive image sustains the stereotypical female sense of inferiority and helplessness. Men's writings about 'women' and women's writings about 'other females' play a role in combining the existing heterophobic gaze that surrounds opposite sex relations with a new homophobic one surrounding same-sex relations. While most Arab women's writings on lesbian issues offer no liberating perceptions of lesbianism, they show the need to add a new gender-sensitive dimension to women's studies and Arab feminism. Consequently, what is needed is the autobiographical form of lesbian storytelling by self-declared lesbians. Autobiography is indeed "the final guarantee that we read is true account" (Morris, 1993, p. 64).

Thus, asserting the autonomous lesbian subjectivity as a speaking subject requires surpassing the domineering heterosexual gaze, which is accompanied in certain instances with a nationalistic gaze that invents and re-invents lesbians in accordance with heterosexual norms of sex, romance, womanhood and nationhood. In order to give voice to a more concrete and empowering concept of the lesbian subjectivity, lesbians need to be liberated from the repetitive scripts written about them/us and the opportunistic politics of separatism that might risk locking the peculiar self in a feminist harem in which lesbians are neither given the right to "be different" nor "be equal". Obviously, asserting the lesbian 'I' is an exhausting lifelong process because it entails confronting all systems: historical, social, sexual, religious, linguistic, and political.

Clearly, the independent lesbian subjectivity that constantly defies the heterosexual gaze and surpasses its expectations remains absent from the hegemonic gaze of the Arabic narrative that disciplines, abuses, misinterprets or manipulates the female body. Consequently, "the lesbian body.... as a spiritual body that exists prior to the material practice of sex, as a sensual body that speaks a different body language, as a mental body that has its own ethics, and as a virgin autonomous body" (Al-Ghafari 2013, p. 165) is not perceived by the dominant ways of looking. Hence, the "lesbian as an infinite sensual, mental, spiritual, and sexual awareness that is incarnated in a female body" (Al-Ghafari, 2013, p. 145) is still unintelligible to the hegemonic heteronormalizing gaze. The lesbian subjectivity as a genuine and intuitive core that pre-exists experience, intentionality and the spoken word, and as "a tenacious lesbian soul

that steadily defends its lesbian specificity throughout her entire life" (Al-Ghafari 2013, p. 145) does not seem to be recognized by most Arab authors. Using Butler's 'epistemological paradigm' that "there need not be a 'doer behind the deed'" (Butler, 1990, p. 142), it becomes obvious that the lesbian subjectivity does not seem to have a recognizable position in Arabic literature, because there is a decisive intention to regard lesbianism as an accidental deed without an intentional doer, or reduce it to a meaningless act of an oppressed doer. The issue at stake is how can a self-defined lesbian assert one's subjectivity, when both the 'deed' and the 'doer' are entangled within the limiting heterosexual codes of intelligibility?

Endnote

¹ *Suhaqeyya*: is the Arabic dictionary word for lesbian.

Biographical Note

Dr. Iman Al-Ghafari is a University professor, an academic researcher, a writer and a literary translator. She has written extensively on gender studies, feminist theories, queer theory, and lesbian issues in media, culture, and literature. Iman Al-Ghafari received her Ph.D. with first class honours from the English Department in Cairo University on "The Quest for Identity in the Poetry of Sylvia Plath: A Feminist Approach". She lectured widely on feminist poetry in the 20th century at the Department of English Language and Literature in Syria. She also taught several courses on translation, writing and methodology. She received several grants, awards, honorarium, and fellowships. She was invited by several Universities worldwide to be a visiting scholar and a guest lecturer. As a researcher, she published academic articles in refereed journals. One of her studies was published as a chapter in a book on Sexuality in the Global South. In 2011, she won a short story writing contest about the theme of exiles that was organized by the Forum Femmes Méditerranée in France. She was the guest editor of a special issue in *Al-Raida*. Her published paper was entitled "The Lesbian Subjectivity in Contemporary Arabic Literature: An Absent Presence Disciplined by the Gaze". From 2012 till 2014, she was hosted as a post-doctoral researcher and a research fellow in Amsterdam Research Centre for Gender and Sexuality at the University of Amsterdam. During these two years, she was invited to be a guest lecturer in numerous courses, conferences and symposiums about sexualities, democracy and anthropology in Middle-Eastern Cultures. Her public lecture about "'Lesbian Subjectivity' in Arab Cultures" was highly acknowledged.

Later on, she was invited to be a guest researcher at the Department of Media and Culture Studies in Utrecht University. Currently, she is developing a book manuscript based on her own analysis of lesbian theories and practices. In her ongoing research which is entitled "Lesbian Issues in Contemporary Arab and Middle-Eastern Cultures: Between Theory and Practice", she exposes the dilemma of asserting the lesbian subjectivity as an identity within the dominant socio-sexual politics.

References

Abdulhamid, A (2001). *Menstruation*. London: Saqi Books.

Al-Ghafari, I. (2006). *Review of Badry, Hala, A Certain Woman*. MidEast, H-Net Reviews. August, 2006. URL: <http://www.h-net.org/reviews/showrev.php?id=12089>

Al-Ghafari, I. (2013). "The 'Lesbian Existence in Arab Cultures: Historical and Sociological Perspectives", in S. Wieringa and H. Sivori (eds), *The Sexual History of the Global South: Sexual Politics in Africa, Asia, and Latin America*. London & New York: Zed Books.

Al-Harz, S. (2006). *Al-Aakharoon (The Others)*. Beirut: Al-Saqi.

Al-Khoury, K. (2004). *Ayam ma'al Ayam (Days with the Days)*. Damascus: Dar Al Farisah.

Al-Nuaimi, S. (2007). *Buhan Al-Asal (Evidence of Honey)*. Beirut: Reyad El-Rayyes Books. S.A.R.L.

Al-Shaykh, H. (1996). *Misk al Ghazal (Musk of the Gazelle)*. Beirut: Dar Al Adab.
n.a. (2009). *Bareed Mista3jil: True Stories*. Heinrich Boll Stiftung Middle East. Beirut: Meem.

Barthes, R. (1967). "The Death of the Author". (Richard Howard, Trans.). Source: UbuWeb Papers:
http://www.tbook.constantvzw.org/wp-content/death_authorbarthes.pdf

Butler, J. (1990). *Gender Trouble: Feminism and the Subversion of Identity*. London: Routledge.

Cixous, H. (1986). 'Stories', in Helene Cixous and Catherine Clement, *The Newly-Born Woman*, trans. Betsy Wing. Minneapolis, MN: University of Minnesota Press.

El-Badry, H. (2003). *A Certain Woman*. Translated by Farouk Abdel Wahab. Cairo, New York: The American University in Cairo Press.

- Faderman, L. (1981). *Surpassing the Love of Men: Romantic Friendship and Love Between Women from the Renaissance to the Present*, New York: William Morrow & co.
- Farwell, R. Marilyn. (1996). *Heterosexual Plots and Lesbian Narratives*. New York & London: New York University Press.
- Haggerty, G. & Zimmerman, B. (Eds.). (1995). *Professions of Desire*. New York: The Modern Language Association of America.
- Hesford, V. (2005). "Feminism and its ghosts: The spectre of the feminist-as-lesbian". *Feminist Theory*. SAGE Publications (London, Thousand Oaks, CA and New Delhi) vol. 6(3): 227–250. 1464–7001. <http://fty.sagepub.com/content/6/3/227>
- Irigaray, L. (1999). "When Our Lips Speak Together". In J. Price & M. Shildrick, (Eds.), *Feminist Theory and the Body: A Reader*. New York: Routledge.
- Kristeva, J. (1982). *Powers of Horror: An Essay on Abjection*. Translated by Leon S. Roudiez. New York: Columbia University Press.
- Magnus, Kathleen Dow (2006). "The Unaccountable Subject: Judith Butler and the Social Conditions of Intersubjective Agency". *Hypatia*, Volume 21, Number 2, Spring 2006, pp. 81-103 (Article) Published by Indiana University Press. <http://muse.jhu.edu/journals/hyp/summary/v021/21.2magnus.html>
- Mansoor, E. (2000). *Ana Heya Anti (I am You)*. Beirut: Dar El-Rayyes.
- Massad, J. (2007). *Desiring Arabs*. Chicago & London: The University of Chicago Press.
- Morris, P. (1993). *Literature and Feminism: An Introduction*. Oxford & Cambridge: Blackwell Publishers.
- Nasrallah, N. (2003). *Nizar Qabbani and the Poems that were Censored*. Damascus: Al-Awaeel.
- Rosario A. Vernon, (1997). *The Erotic Imagination: French Histories and Perversity*. New York, Oxford: Oxford University Press.
- Shaktini, Namascar, ed. *On Monique Wittig: Theoretical, Political and Literary Essays*. University of Illinois Press, 2005.
- Seeras, N. *Halett Shagaff (A Case of Passion)*. (1998). Beirut: Dar Attiya publishers.
- Vanita, R. (1996). *Sappho and the Virgin Mary: Same-Sex Love and the English Literary Imagination*. New York: Columbia University Press.

Weeks, J. (1995). "History, Desire, and Identities". In *Conceiving Sexuality- Approaches to Sex Research in a Postmodern World*. Edited by Richard G. Parker and John Gagnol. New York, London: Routledge.

Yazbek, S. (2008). *Raehatul Kirfa* (Smell of Cinnamon). Beirut: Dar Al-Adab.

Procedural Techniques for Simulating the Growth of Plant Leaves and Adapting Venation Patterns

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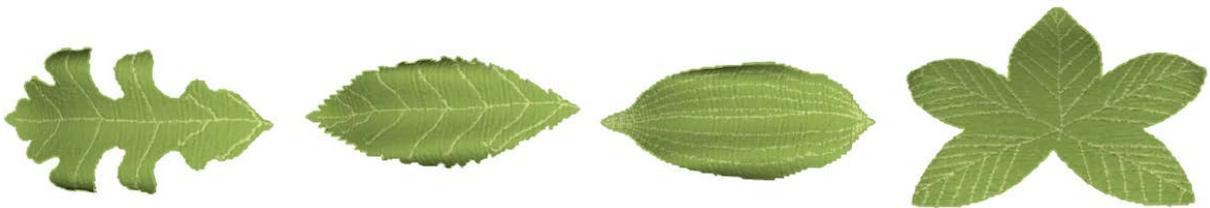


Figure 1: Our system allows for the simulation of various types of leaves including different venation patterns and complex leaf shapes

Abstract

This paper presents a biologically-motivated procedural method for the simulation of leaf contour growth and venation development. We use a mathematical model for simulating the growth of a plant leaf. Leaf tissue is regarded as a viscous, incompressible fluid whose 2D expansion is determined by a spatially varying growth rate. Visually realistic development is described by a growth function RERG that reacts to hormone (auxin) sources embedded in the leaf blade. The shape of the leaf is determined by a set of feature points within the leaf contour. The contour is extracted from photos by utilizing a Curvature Scale Space (CSS) Corner Detection Algorithm. Auxin transport is described by an initial auxin flux from an auxin source to an auxin sink that is gradually channelized into cells with high levels of highly polarized transporters. The leaf is presented as a triangulated double layer structure that consists of a Voronoi-Diagram that is discretised along the vein structures.

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Introduction

Realistic modeling of growing plant leaves has received only a limited attention in computer graphics. This is interesting since it also has a long history in bridging biology, theoretical studies of morphogenesis, and visualization. In this paper a mathematical model is presented to simulate the growth of leaves. The tissue of the leaf is regarded as a viscous, incompressible fluid whose 2D expansion is caused by a non-zero growth rate that differs locally (Wang et al. 2004). We propose a physically-based approach to model growth based on the corresponding expansion rate (Coley et al., 2006). We ignore body forces such as gravity and only assume surface forces.

Leaf form and vascular patterns provide some of the most impressive examples of the complexity of biological shapes generated in nature. In multicellular organisms, boundaries have the role of preventing the intermingling of two different cell populations and in organizing the morphogenesis of organs and the entire organism. Plant leaves have two different cell populations, the adaxial (or upper) and abaxial (or lower) cell populations, and the boundary is considered to be important for lamina growth (Nakata and Okada, 2013).

In this paper we will character the growth by growth tensor field at X and Y and Z coordinates (Hejnowicz and Romberger, 1984; Nebelsick et al., 2001; Coen et al., 2004). The growth tensor allows full characterization of the rate of growth in length, area, and volume, as well as rates of angular change between elements, and of vorticity in the growing organ. The growth tensor is a generalization of the relative elementary rate of X Coordinate growth $RERG_x$, Y Coordinate growth $RERG_y$, and Z Coordinate growth $RERG_z$.

Furthermore, the morphology of leaves is highly determined by wide variety in leaf venation patterns that has been classified for example in Nebelsick et al. 2001. We use this system and adopt its terminology. This classification system does not only consider the geometric arrangement of different vein classes but also their relation to other architectural features of leaves. Figure 2 gives an overview of our proposed method. We simulate the interplay between different processes and use a mathematical model to simulate the growth of a plant leaf. (i): we developed a method for classifying a plant leaf by utilizing features of the leaf contour. A simple image of the contour can be extracted by utilizing a Curvature Scale Space (CSS) Corner Detection Algorithm. (ii): A model generates visually realistic development using the growth function RERG that lets the leaf grow towards sources of the hormone Auxin which are embedded in leaf blade. The growth rate of plant organ a scalar of a quantity vector, that depends on the level of rigor with which we scrutinize our

perception of growth. *(iii)*: a auxin transport canalization-based model describes a process in which an initial auxin flows from a source to a sink while it is gradually canalized into files of cells with high levels of highly polarized transporters. Our model is expressed in geometric terms and uses proximity criteria to determine new vein locations. *(iv)*: The leaf is presented as a triangulated double layer structure that consists of a Voronoi-Diagram discretized along the vein structure and its corresponding diagram. The leaf mesh is mapped to deformed saddle-like mid-surface and rippled contour.

Related Work

Related work for our approach encompasses biology as well as modeling methods in computer graphics.

Biological Modeling: In literature, repeatedly a basic module was used to simulate the development of common feature of the leaf lamina and vein networks. The vascular system of plants consists of a network of cell files (vascular strands) that extends through all organs (Scarpella et al., 2010; Rolland-Lagan and Prusinkiewicz, 2005; Bilsborough et al., 2011). Over the past 20 years, genetic approaches have led to substantial increase in our understanding of leaf and vascular development, and have provided good evidence that the growth regulator auxin provides important spatial cues for this. Since inhibition of auxin transport affects the formation venation patterns, auxin is likely to be part of the involved signal (Scarpella et al. 2010). In this paper we want to utilize auxin for the visual formation of plant leaves.

Liang and Mahadevan (2009) produce a model that uses geometric and growth control parameters to determine the shape of finite laminae. This allows for a comparative study of elongated leaf morphology. In Liang and Mahadevan (2009) a shape space for a growing elastic leaf is designed by using a combination of scaling concepts, stability analysis, and numerical simulations. This combination is considered as increased relative growth strain. A long flat lamina deforms to a saddle shape and/or develops undulations that may lead to strongly localized ripples as the growth strain is localized to the contour of the leaf. Liang and Mahadevan (2011) use a combination of surgical manipulations and quantitative measurements to confirm this hypothesis and provide a simple theory for changes in the shape of a doubly curved thin elastic shell subject to differential growth across its plan-form. This functional morphology suggests new bio-mimetic designs for deployable structures using boundary or edge actuation rather than the usual bulk or surface actuation.

Xiao and Chen (2011) establish phenomenological buckling models to explain the curled configuration of dried leaves, where the driving force is the differential contraction strain field. In the minimalist model, through a systematic study, the averaged buckling curvature is correlated with the aspect ratio and normalized size of the leaf, as well as the magnitude of the differential strain. Ming Xu and Jian He (2012) propose a method for modeling curly plant leaves that is based on venation skeletons driving leaf surface deformation. A 2-D leaf silhouette was extracted from a scanned leaf image. The algorithm computed the primary veins (medial axes) of a leaf, along which secondary veins were branched out automatically. Jeong et al. (2013) simulates the whole leaf surface to capture the fine details of desiccated leaves. In this paper we will present the whole leaf surface as a triangulated double layer structure that consists of a Voronoi-Diagram discredited along the vein structure corresponding diagram. The leaf mesh is mapped to deformed saddle-like mid-surface and rippled contour.

In Computer Graphics, different approaches have been proposed for modeling plants leaves: image-based modeling, particle systems, implicit contours, and L-systems (Peyrat et al. 2008).

Image-based modeling: a first paper for modeling leaves uses image-based modeling. Such methods reproduce a real shape of a leaf provided by the user. Quan et al. (2006) use a semi-automatic technique for modeling plants leaves directly from images. The approach has the advantage that the resulting model inherits the realistic shape and complexity of a real plant. The user provides several pictures taken from different angles, then a point cloud is built and the segmentation of individual leaves (via a graph) is done with the image information. After this the user can manually refine the segmentation in order to bypass errors due to overlapping leaves. A generic and deformable leaf model is then applied based on this information.

Particle systems: Rodkaew et al. (2004) propose a particle transportation algorithm for modeling plants in different colors and with complex venation structures. The algorithm is initiated by randomly scattered particles inside the blade of a leaf. Each particle contains energy. A transportation rule directs each particle toward a target. When particles are in close proximity, they are combined. The trails of moving particles are used to generate the venation patterns. Runions et al. (2005) introduced a biological algorithm in order to build leaves; they use the shape of the leaf, then build veins via simulation of hormone distribution inside the leaf.

Implicit contours: a method designed by Hammel et al. (1992) in models compound leaves using implicit contours. This model creates a planar scalar field in the

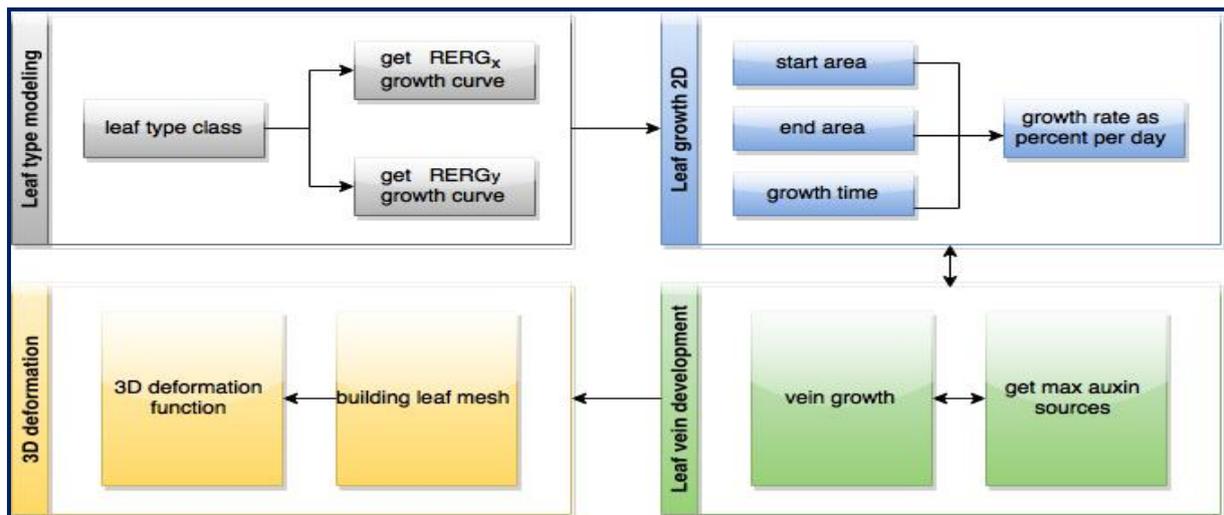
proximity of the skeleton. The margin is represented by a contour, defined as the locus of points with a given field value. The area bounded by this contour forms the surface of the leaf. Mundermann et al. (2003) in designing a method for modeling lobed leaves. This method extends the concept of sweeps to branched skeletons.

L-systems: The first methods to simulate certain patterns in nature found in plant development are L-systems (Prusinkiewicz and Lindenmayer 1996; Rodkaew et al. 2002]. These methods are very efficient to simulate plants organs and branching structures. Prusinkiewicz and Lindenmayer (1996) proposed many methods based on L-systems. In Terraz et al. (2009) an extension of L-systems is proposed, based on three-dimensional (3D) generalized maps that allow an easier control of the internal structure of 3D objects.

Simulation of Leaf Growth

Photosynthesis is a process used by plants and other organisms to convert light energy coming from the sun into chemical energy that can be later released to fuel the organisms' activities. In order to obtain realistic leaf growth, we develop a system using five processes to simulate leaf and leaf growth. The system is summarized in Figure 2.

Figure 2: Our system for leaf development



Leaf Type Modeling

The shape of the leaf blade and the type of leaf margin are important characteristics that help to identify plants (see Figure 3). Leaf blades vary to a large extent, they may be simple (apple, oak) or compound (divided into several smaller leaf like segments, as in honeylocust). The smaller segments are called leaflets and are attached to a stalk (rachis) with a petiolule. Leaflets can also be arranged palmately (horse chestnut) or pinnately (ash). Pinnately compound leaves are said to be odd pinnate (ash) when ending in one leaflet and even pinnate when ending in two leaflets (locust). This terminology is important in identifying plants by their leaves.

Figure 3: Different leaf shapes found in nature.

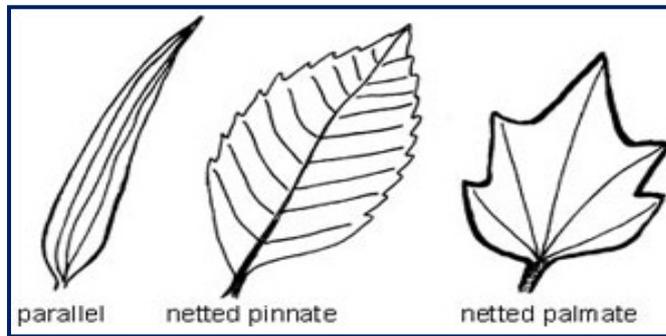


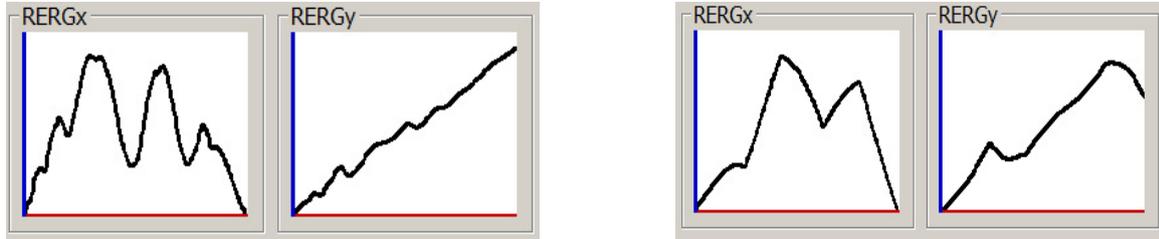
Figure 2 shows the schematic modeling processes for our leaves. Our modeling system provide the user with the ability to select one leaf type from various given leaf classes. After that, the modeling processes start to get the 2D silhouette of a leaf from a given input photography which is derived from the selected leaf type. Then the relative elementary axis-aligned growth rates REG_x and REG_y are computed using the 2D silhouette. The relative elementary growth rate $REG_{l(\zeta)}$ is the rate at which an infinitesimal distance $\Delta\zeta$, measured in the direction of growth line at a point on growing silhouette, increases over time. REG is mathematically defined as (Hejnowicz and Romberger, 1984):

$$REG_{l(\zeta)} = \left(\frac{1}{\Delta\zeta}\right)\left(\frac{d\Delta\zeta}{dt}\right) \quad (1)$$

Using the relative elementary growth rate, we create a growth curve (vector) for the X and Y coordinates of each leaf type (see Figure 4). The growth rate of a leaf on X or Y is a scalar or a vector quantity. In order to produce different growth curves (vector) for same leaf type we used merge algorithm between two growth curve(vector) which

belong to same leaf type. For example, when i have two growth rate vector REG_{x1} and REG_{x2} for one leaf type, can i get new growth rate vector REG_{xn} by apply a merge (inheritance) algorithm on both vector REG_{x1} and REG_{x2} .

Figure 4: Axis-aligned growth curves (vector) that define a leaf.



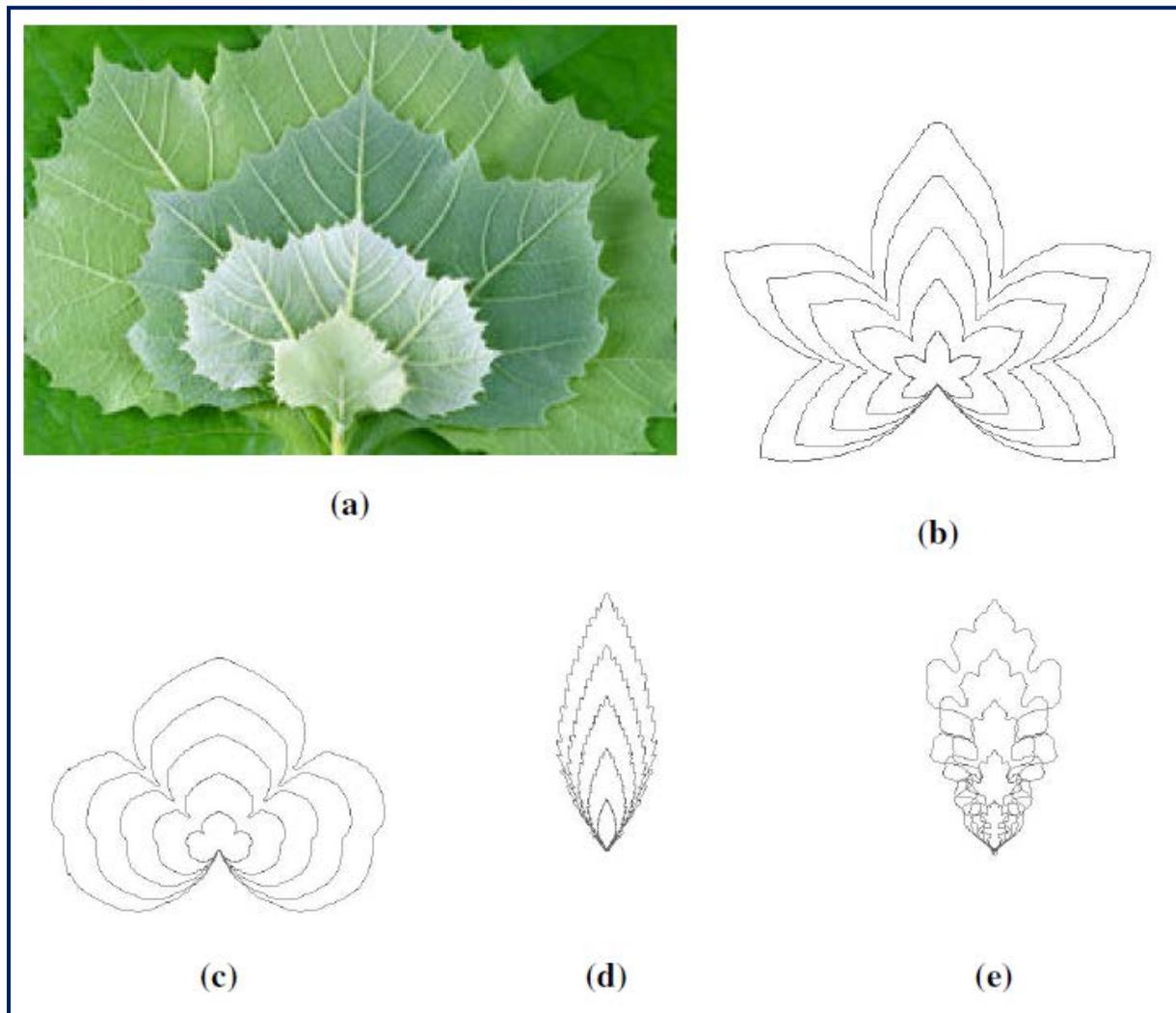
Leaf Expansion

To simulate leaf growth, we use a two-dimensional model since the thickness of a leaf can be considered negligible compared to the growth of its surface. Under these assumptions, the surface Expansion can be modeled by expansion rate as percent per day GR (Coley et al. 2006).

$$GR = 100 * [e^{(\ln(Sarea/Earea)/t)} - 1] \quad (2)$$

where $Sarea$ and $Earea$ are leaf area at two different measurements and t equals the number of days between measurements. The growth model used in this paper has been tested on the growth of several types of leaves. We observed that various parts of the leaf's lamina expand at different rates, depending on their distance from the tip and the age of the leaf. Figure 5(a) illustrates the growth of a natural leaf while in 5(b)-(e) computer simulations are shown using the expansion rate GR . Our results faithfully resemble the natural growth.

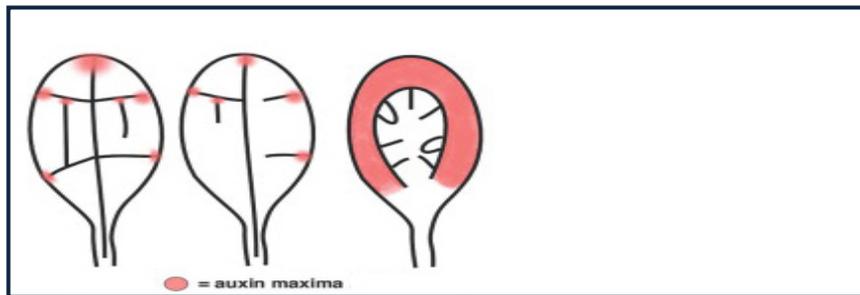
Figure 5: Growth of a plant leaf in a time period. Natural growth of a plant leaf (a). Computer simulated growth of a plant leaf (b-e).



Determination of Auxin Sources and Maxima

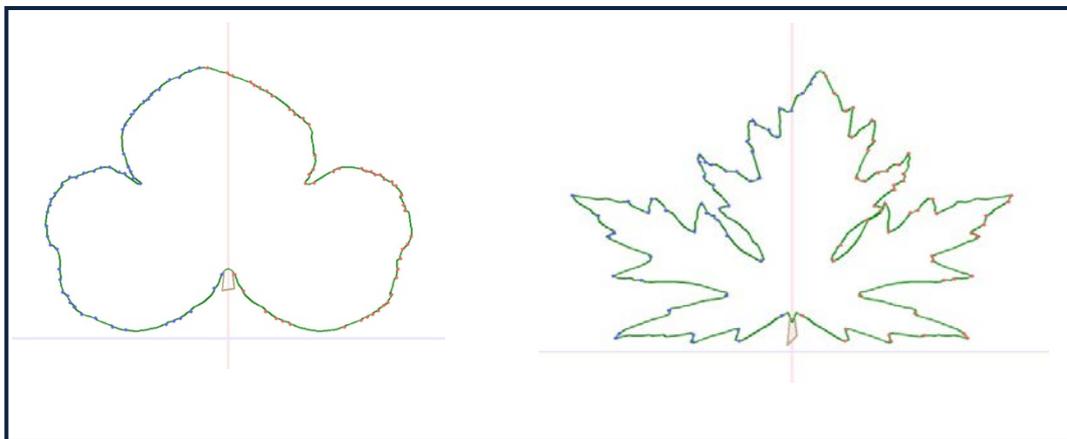
Our algorithm distributes Auxin sources at leaf edges and then we simulate the venation process based on the Auxin level and consumption. Strong auxin sources are assumed to exist at edge locations that grow stronger than others (Stanko et al. 2014). Figure 6 illustrates the relationship between the venation patterns and maximum Auxin sources.

Figure 6: Illustration of the relationship between auxin maxima and primary and secondary venation processes.



In this paper, we used the Shi-Tomasi corner detector and good features to track the max auxin placement at the leaf contour which we get from the input photography (Shi and Tomasi, 1994). The growth in each leaf corner must be larger than for other leaf locations. Therefore, we deduce Auxin maxima to be located at leaf corners. In Figure 7 the red and blue circle represent such sources.

Figure 7: Maxima for the Auxin distribution in several leaf types.



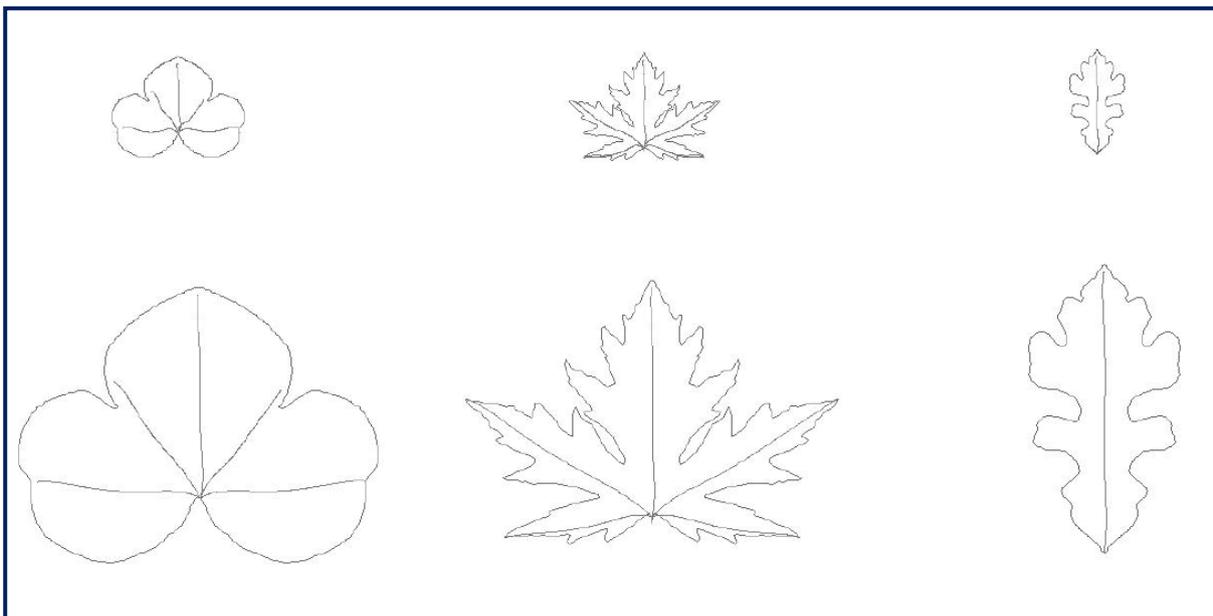
Generating and Growing the Venation System

The plant growth regulator Auxin seems also to be responsible for the development of the venation patterns (Scarpella et al. 2010). For most leaves, the primary and secondary veins are not only the most obvious features but also play the most significant role in leaf deformation. Therefore, in this paper we concentrate on simulating growth and development of primary and secondary veins. Our algorithm, however, can also simulate third and subsequent levels of veins.

During initial leaf growth, a small primordium becomes visible at the flanks of the SAM (the shoot apical meristem). Epidermal Auxin flow converges to form a maximum of Auxin activity at the tip of the primordium. It is drained through the center of the primordium, marking the position of mid vein of the new leaf. In primary morphogenesis, leaves grow predominantly via cell division to acquire their shape and vascular pattern. Auxin maxima at the margins of the leaf correlate with sites of lateral vein formation and positions of serration development.

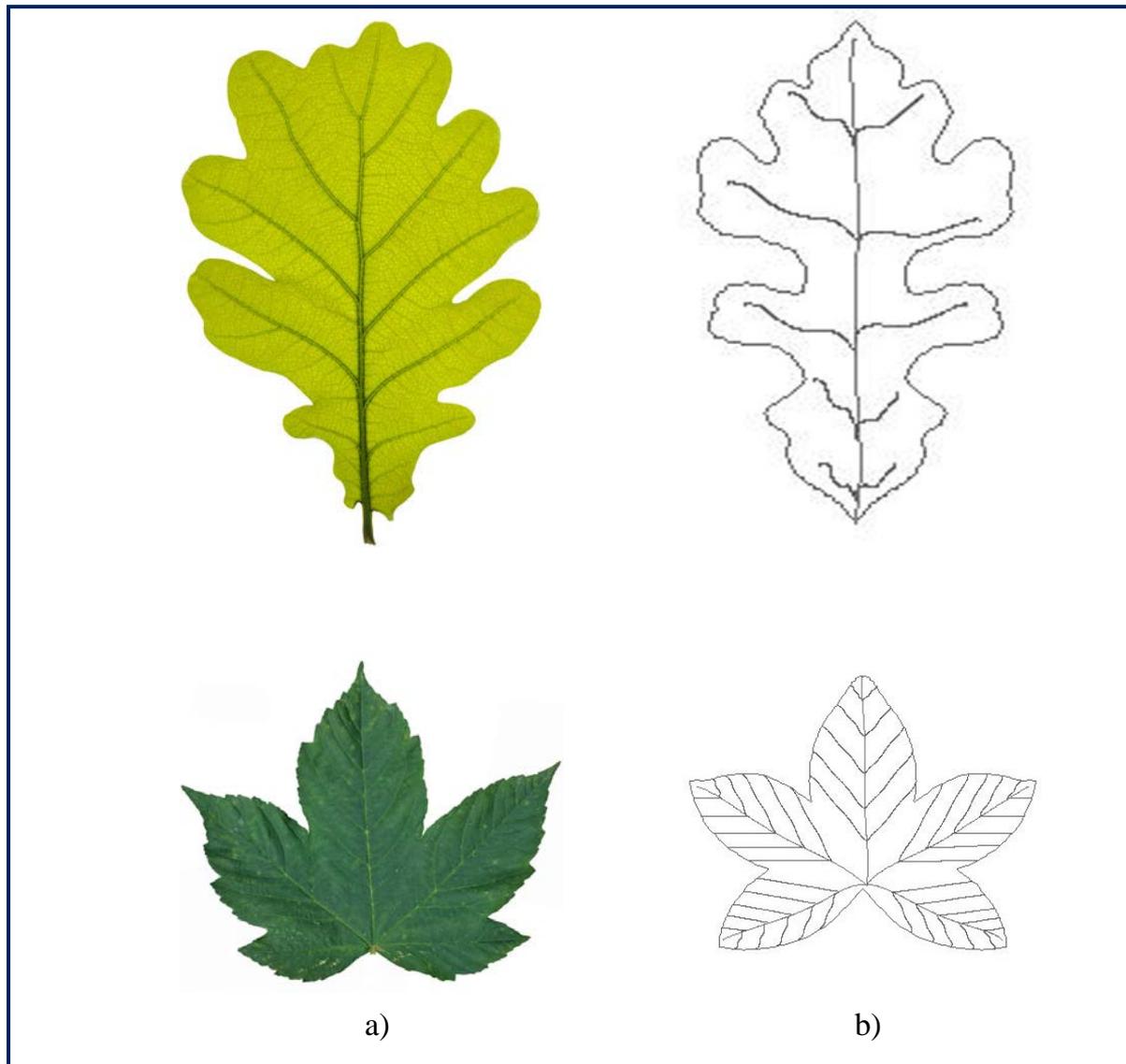
We generate the primary veins related to the given leaf type and the maximum of auxin sources placement. Maximum of auxin are assumed at locations that are growth rate farther than a threshold. Then canalized between maximum auxin and the nodes that are related on the leaf type. Figure 8 illustrates the development of primary veins with respect to the localization of maximum of Auxin at leaf margin.

Figure 8: Development of primary veins with respect to localization of max auxin. In first row illustrated canalization process for primary veins at first step. While the second row illustrated the development of primary vein after growth time.



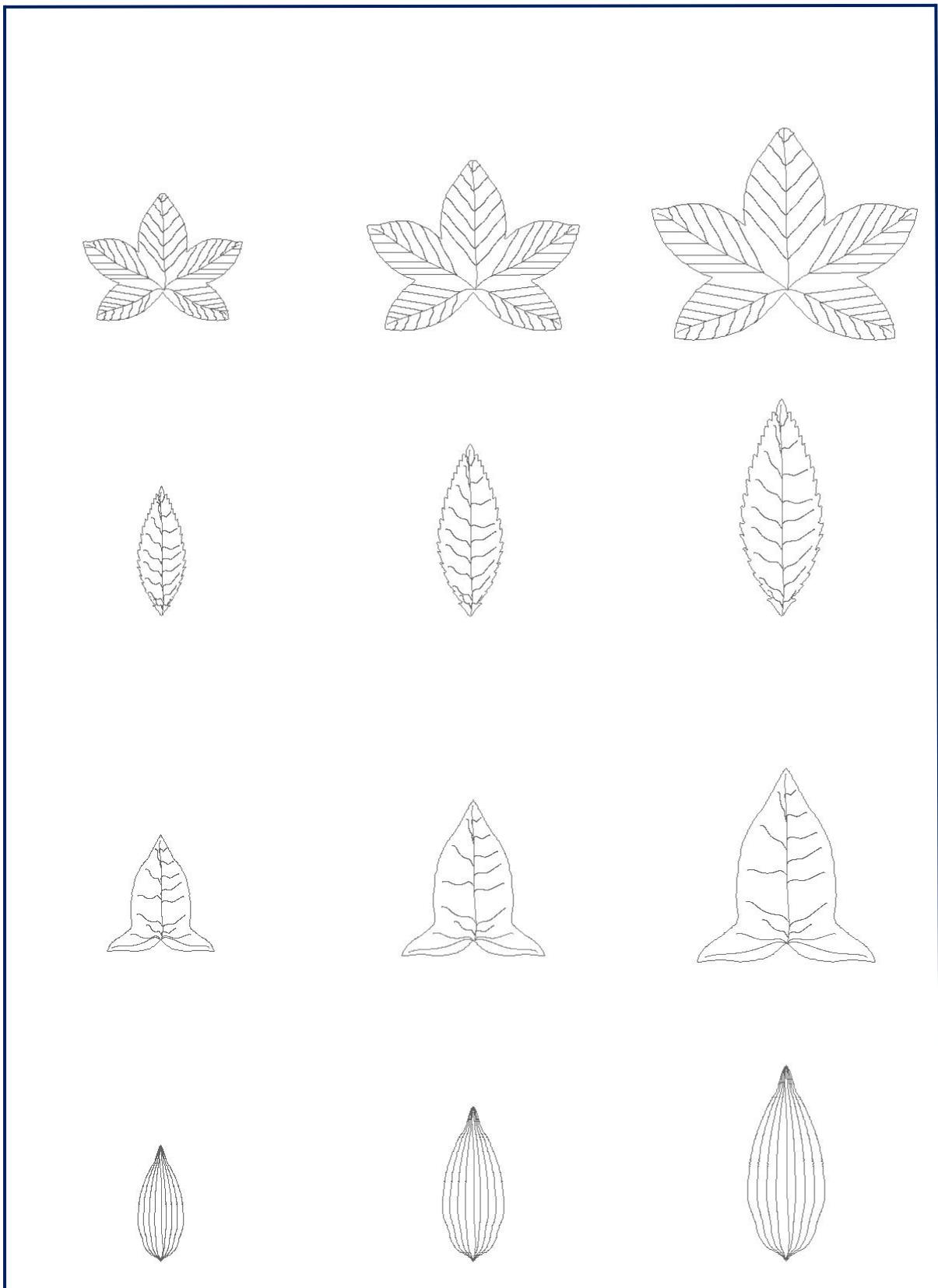
In order to generate the secondary veins, we firstly develop a function to choose a parametric number n of nodes in each primary vein. Then we find n Auxin sources in the leaf margin. Each Auxin source is now assumed to join the vein node that is closest to it. In Figure 10 we simulate the development process of primary and secondary veins with respect to localization of Auxin maxima at leaf margin.

Figure 9: Illustration of natural venation system and our venation system. (a) Natural leaf. (b) Computer simulated leaf venation.



For our needs, we developed an interface for automatic generating venation systems from a leaf skeleton. The Venation skeleton is introduced for 2D shapes in order to provide a symmetry-based shape representation for perception and recognition, see Figure 10. As shown in Figure 9 the natural venation systems in column (a) and our computer simulated venation systems in column (b) are quite similar.

Figure 10: Development of primary and secondary veins with respect to localization of max Auxin for several leaf type.

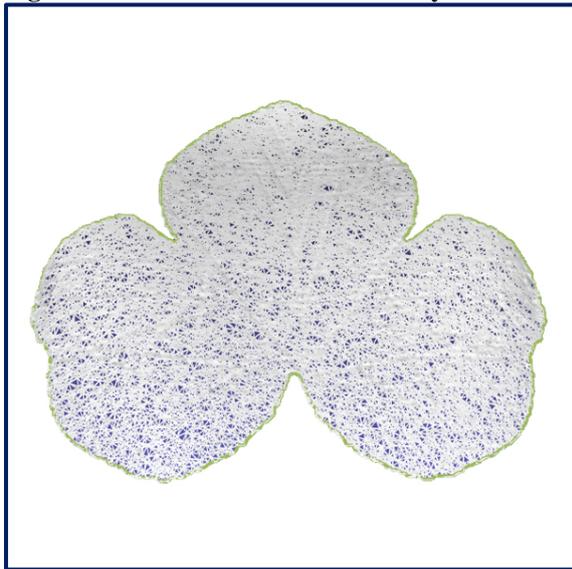


Building the Leaf Mesh

We have constructed a leaf skeleton with two boundary curves and midvein curve. To mesh the void area within these boundary curves, we employ Delaunay triangulation scheme, because it can deal with the problem of concave area in the leaf blade, see Figure 11. For example, lobed leaves often have irregular silhouette characterized by a number of concave outline.

In this paper each initial leaf is formed from two layers of meshes in order to regard the thickness of leaf. Generally, each vein-point is inserted as a new vertex in the leaf mesh in order to link mesh triangles with veins system. The leaf mesh is textured with different colors such that each color is related to the position and the type of the vertex. In addition to that, the leaf contour is prepared separately, and then it is linked to leaf mesh. The objective is to get more control on the deformation of the leaves contour and on their colors.

Figure 11: Characterization of two-layer leaf mesh.



3D Deformation Function

Leaves and flowers usually have a typical, saddle-like mid-surface and a characteristic rippling pattern at their edges. To produce a perfect saddle shape, we propose the function:

$$\tau(x, y) = \lambda(x + y)^2 - \mu(x - y)^2, \quad (3)$$

where $0 \leq \lambda \leq 1$ and $0 \leq \mu \leq 1$ are constants. It fulfills all the arithmetic conditions, and its plot has the shape of a saddle, as in Figure 12. To investigate the

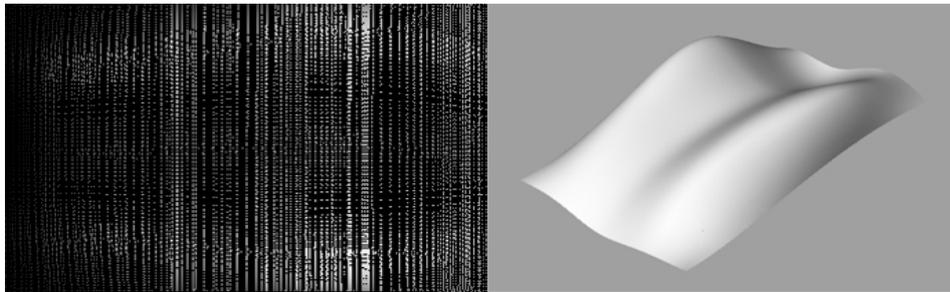
mechanistic basis of rippling behavior and its physiological role during leaves growth, we use a function φ for periodic rippling (Liang and Mahadevan, 2009):

$$\varphi(x, y) = \delta(y)\sin(kx). \quad (4)$$

Here k is the dimensionless wave number, and $\delta(y)$ is the cross-sectional profile of the surface.

In Figure 12 we show the resulting 2D and 3D deformation shapes from saddle and rippling functions. In order to get the 3D deformed leaf surface we utilize the deformation function illustrated in Figure 12. Our system can create several deformation shapes from different deformation function. In addition to that, each leaf type has its own deformation function.

Figure 12: Characterization of 2D and 3D deformation shape function.



Modeling Results

In order to implement our method, we programmed an intuitive system using Microsoft Visual Studio 2013 c++, OpenCV, OpenGL, and QT library.

Firstly, we produced the growth curve for several leave types. Figure 4 shows different photos of growth curves used to simulate the growing of leaves. Eq. (1) represents a growth curve (DNA growth) on the x and y coordinates for each leaf type. the surface expansion is modeled by expansion rate as percent per day GR , see Eq. (2). The growth of a plant leaf in a time period is simulated in Figure 5, which shows in (a) the natural growth of a plant leaf, and in (b-e) computer simulated growth of a plant leaf.

Our algorithm detects the placement of maximum auxin sources at leaf edges using Shi-Tomasi corner detector. Figure 7 illustrates the algorithm to determine the max auxin distribution for several types of leaves. After identifying the leaf type, max auxin placement, and number of primary veins we generate the primary venation development system for several leaf types. Figure 8 illustrates the development of

primary veins with respect to localization of max auxin at leaf margin. Our system uses a sophisticated function in order to generate the secondary veins. The development of primary and secondary veins is simulated in Figures 9 and 10.

We mesh the void area within boundary curves using Delaunay triangulation scheme to generate 3D leaf form. In order to regard the thickness of leaf we simulate each leaf with two layers of mesh, see Figure 11. Our system creates several deformation shapes generated from many different deformation functions used to deform the leaf shapes, see Figure 12. Then we texture the leaf with different colors, see Figure 1.

Compared to previous related work on modeling and simulating growth of leaves, our method is motivated by all growth stage from biology and ecology science in order to get a natural modeling of several leaf development types.

Future Work

We presented a technique for constructing realistic leaf models for several leaf types; automatically, without any manual interactions. We showed how to model 2D natural growth for several types of leaves, and we illustrated 3D renderings of deformed results of each leaf Type. In the future we plan to develop our modeling system to include the simulation of different outer or inner effects on the leaves. Various effects, such as cracks, insect attacks, and growing spots, will be incorporated into the simulation to improve realism. Finally, there are many natural phenomena that happen with leaves which we plan to simulate.

Acknowledgements

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References

Rolland-Lagan, A.-G. and Prusinkiewicz, P. (2005). Reviewing models of auxin canalization in the context of leaf vein pattern formation in Arabidopsis. *The Plant Journal*, 44(5), 854-865.

- Bilsborough, G. D., Runions, A., Barkoulas, M., Jenkins, H. W., Hasson, A., Galinha, C., et al. (2011). Model for the regulation of *Arabidopsis thaliana* leaf margin development. *PNAS*, *108*(8), 3424–3429 .
- Coley, P. D., Bateman, M. L., & Kursar, T. A. (2006). The effects of plant quality on caterpillar growth and defense against natural enemies. *Oikos*, *115*(1-2), 219-228.
- Coen, E., Rolland-Lagan, A.-G., Matthews, M., Bangham, J.A., & Prusinkiewicz, P. (2004). The genetics of geometry. *Proceedings of the National Academy of Sciences*, *101*(14), 4728-4735.
- Hammel, M., Prusinkiewicz, P., & Wyvill, B. (1992). Modelling compound leaves using implicit contours. *Computer Graphics International* *92*, 119-212.
- Hejnowicz, Z., & Romberger, J. A. (1984). Growth tensor of plant organs. *Journal of Theoretical Biology*, *110*(1), 93-114.
- Jeong, S., Park, S.-H., & Kim, C.-H. (2013). Simulation of Morphology Changes in Drying Leaves. *Computer Graphics Forum*, *32*(1), 204-215.
- Liang, H., & Mahadevan, L. (2009). The shape of a long leaf. *PNAS*, *106*(52), 22049–22054.
- Liang, H., & Mahadevan, L. (2011). Growth, geometry, and mechanics of a blooming lily. *PNAS*, *108*(14), 5516–5521.
- Ming Xu, H., & Jian He, D. (2012). Venation-Skeleton Based Curly Leaf Modeling. *Advances in Information Sciences and Service Sciences*, *4*(6), 52-60.
- Mundermann, L., MacMurchy, P., Pivovarov, J., & Prusinkiewicz, P. (2003). Modeling lobed leaves. *Computer Graphics International, 2003. Proceedings* (pp. 60-65). IEEE.
- Nakata, M., & Okada, K. (2013). The Leaf Adaxial-Abaxial Boundary and Lamina Growth. *Plnts*, *2*(2), 174.
- Nebelsick, A. R., Uhl, D., Mosbrugger, V., & Kerp, H. (2001). Evolution and Function of Leaf Venation Architecture. *Oxford Journals*, *87*(5), 553-566.
- Peyrat, A. Terraz, O., Merillou, S., Gallin, E. (2008). Generating vast varieties of realistic leaves with parametric 2Gmap L-systems. *The Visual Computer*, *24*(7-9), 807-816.
- Prusinkiewicz, P. (1994). Visual Models of Morphogenesis. *Artificial Life*, *1*(1-2), 61-75.

- Prusinkiewicz, P., & Lindenmayer, A. (1996). *The Algorithmic Beauty of Plants*. New York, NY, USA: Springer-Verlag New York, Inc.
- Quan, L., Tan, P., Zeng, G., Yuan, L., Wang, J., & Kang, S. B. (2006). Image-based Plant Modeling. *ACM SIGGRAPH 2006 Papers* (pp. 599-604). New York, NY, USA: ACM.
- Rodkaew, Y., Chongstitvatana, P., & Siripant, S. (2004). Modeling Plant Leaves in Marble-Patterned Colours with Particle Transportation System. *Modeling Plant Leaves in Marble-Patterned Colours with Particle Transportation System*, 391-397.
- Rodkaew, Y., Lursinsap, C., Fujimoto, T., & Siripant, S. (2002). Modeling Leaf Shapes Using L-systems and Genetic Algorithms. *In International Conference NICOGRAPH (April)*, (pp. 73-78).
- Runions, A., Fuhrer, M., Lane, B., Federl, P., Rolland-Lagan, A.-G., & Prusinkiewicz, P. (2005, #jul#). Modeling and Visualization of Leaf Venation Patterns. *ACM Trans. Graph.*, 24(3), 702-711.
- Scarpella, E., Barkoulas, M., & Tsiantis, M. (2010). Control of Leaf and Vein Development by Auxin. *Cold Spring Harbor Laboratory Press*, 2(14), 4728-4735.
- Shi, J., & Tomasi, C. (1994). Good Features to Track. 1994 IEEE Conference on Computer Vision and Pattern Recognition (CVPR'94), (pp. 593-600).
- Stanko, V., Giuliani, C., Retzer, K., Djamei, A., Wahl, V., Wurzinger, B., et al. (2014). Timing Is Everything: Highly Specific and Transient Expression of a MAP Kinase Determines Auxin-Induced Leaf Venation Patterns in Arabidopsis. *Molecular Plant*, 7(11), 1637-1652.
- Terraz, O., Guimberteau, G., Merillou, S., Plemenos, D., & Ghazanfarpour, D. (2009, #jan#). 3Gmap L-systems: An Application to the Modelling of Wood. *Vis. Comput.*, 25(2), 165-180.
- Wang, I. R., Wan, J. W., & Baranoski, G. V. (2004). Physically-based simulation of plant leaf growth. *Computer Animation and Virtual Worlds*, 15(3-4), 237-244.
- Xiao, H., & Chen, X. (2011). Modeling and simulation of curled dry leaves. *Soft Matter*, 7(48), 10794-10802.

The Jamiya Project – Syrian Higher Education in Exile: Reconnecting Students and Academics

This Syrian Academics in Exile volume has brought together a small selection of Syrian academics to provide a vignette into the world class research and academic endeavours that the Syrian academic community offers. Despite the unimaginable adversary that they have faced in their country, and the struggle they face to continue their work in exile, these academics are testament to the power of education to overcome. The Syrian academic community offers one of the best hopes to provide a stable and prosperous future for the country. As a conclusion for the volume, and to point towards a brighter future, NRV is pleased to promote the Jamiya project.

The Jamiya Project – Ben Webster

During a recent research trip to Gaziantep – a city in south-eastern Turkey where one in five are refugees from Syria – I sipped strong Turkish coffees with Syrian students whilst discussing the challenges they face in accessing university after being forced to flee their country. Despite these difficulties, however, not only had several of them succeeded in continuing their studies, but they had also setup a network across the whole of Turkey to support other Syrian students facing similar challenges. This remarkable display of energy and determination in adversity underlines how refugee communities are a crucial and willing part of solutions to the difficulties they face.

The reality is that many young Syrians are facing similar challenges to those I met in Gaziantep. Since the start of the Syrian revolution, hundreds of thousands of Syrian university students have had their education disrupted by civil war and continue to do so. The barriers they face are many and difficult to overcome: insufficient language skills to access Turkish or English-based courses; prohibitively high tuition fees; family commitments preventing overseas travel to access scholarships.

Prior to the civil war, 25% of Syrians went onto further training or higher education. Five years later, **there are approximately 100,000 Syrians currently missing out on university** – the equivalent of ten Oxford Universities worth of students.

The disruption and displacement resulting from the Syrian conflict disturbs the networks and institutions that would have previously provided university education for a whole country. Yet, if given the platform on which to build, refugees are more than capable of creating their own solutions, much like those students in Gaziantep.

The Jamiya Project aims to use technology and the capacity of existing institutions to reconnect networks of Syrian academics and students to restart higher education despite mass displacement. The Project will bring together partner universities in Europe to provide content, a cadre of Syrian academics to design and teach courses in Arabic, and local IT centres in the Middle East, along with an Arabic-based online learning platform, to connect all these partners with a rich learning environment. This allows for courses and learning methods that are designed around the specific situation of Syrian refugees, enabling education with and through their community.

This will not be the first time exiled academic communities have come together to continue their work despite the tragedy of conflict and mass displacement. **The examples of German and French academics arriving at the New School in New York in the 1930s and 40s having fled World War II and Nazi occupation of Europe are fantastic inspiration.** Seventy years later, we now possess the technology to not only sustain academic communities, but also to reconnect them to their student communities, to do so at scale and with rich online learning environments.

Much like the exiled academics in early 20th century, Syria's current academic community are more than willing to be a part of the solution. Dr. Oula Abu-Amsha, one of the Syrian academics working on the Jamiya Project, left Syria in 2012: "I was fulfilling my obligations as a mother in protecting my children. But until now I feel a great bitterness about leaving my students and my colleagues behind. I keep telling myself that during a crisis the circle of influence hugely reduces, I was only able to save my own children. To overcome this feeling of culpability I tried from the beginning to give a hand to all my colleagues and students who ask for help. I supervised the work of several students until they got their master degrees."

"Leaving my academic network in the country made me feel lost and alone, I had very few contacts outside Syria that I tried to put to work. I wanted to be involved in giving back education to Syrian youth but... things don't work this way! Even if you feel that you have something to give, the global system that pretends to take care of my people in distress won't let you in. I've met many wonderful people in the last few years. They are all willing to help, but the system doesn't easily makes place to outsiders like me."

“I believe there are many Syrian academics like myself who are striving to get back to their role of educators. The Jamiya project intends to build on the energy of these people to offer a relevant and decent higher education options to our students so that we don’t have this “lost generation” that the global system is deploring instead of doing its best to prevent it from getting larger and larger.”

Not only does the current situation prevent young Syrians from continuing with their lives and achieving their goals, but it also makes the future efforts to rebuild Syria after the civil war even harder.

It is imperative that international universities, Syrian academics – and other Arabic speaking academics – and the international community work together in finding solutions to the current crisis. Each has value to bring to the table. By engaging Syrian academics, we enable a community to be part of creating the solution and continue their education service by making courses accessible and relevant to the situation of students.

To get involved with the Jamiya Project as an academic, a student, a university, or just to keep in touch with progress, visit www.jamiyaproject.com or contact the team members below.

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Submission Call: Migrant Students in Exile



June-July 2016

Increasingly, higher education is being recognised as one of the best opportunities to assist integration and equip migrants and refugees with the skills they need for successful lives. As the international education community begins to take a stand, many new scholarships are being offered to those that have come to our shores to seek better lives. This coming Autumn will see hundreds of universities opening their doors and welcoming new comers with education lifelines which promise to equip migrants with the skills they will need for successful lives and to rehabilitate their own countries.

To assist in the transition to life at Western universities, NRV will publish a volume of stories and interviews with migrant students. As such we want to hear from migrant and refugee students around the world who are willing to share their stories, to offer advice to prospective students and raise awareness of the struggles migrant students face. We will collect these stories and publish them along with an integration guide in July. If you want to offer your voice, please contact info@newresearchvoices.org

For more information, please see www.newresearchvoices.org

Who We Are

Paul O’Keeffe



Paul is a Doctoral Candidate at La Sapienza University of Rome where his research looks at the developing higher education system in Ethiopia. He has degrees in Psychology, Marketing, and International Economics and Political Studies, and various certificates in Training and Development and International Development Studies. He has previously worked with Voluntary Services Overseas with Burmese exiles in Thailand, on the management of the Irish Aid Fellowship Programme, as an Inter-cultural Awareness Trainer with the Irish Council for International Students and as a Lecturer at Charles University in Prague and University College Dublin. He has also contributed to the Guardian newspaper and ESAT television’s coverage of development in Ethiopia. His main interests are international development, human rights and education.

Zsuzsanna Pásztor



Zsuzsanna is a Research Consultant on migration issues with an interdisciplinary academic background. She has a degree in Intercultural Psychology, a degree in Economics and Non-profit Management, and is currently a Ph.D. Candidate in Sociology at La Sapienza University of Rome where her research focuses on the socio-economic determinants of international migration. Zsuzsanna gained field experience in Hungary where she worked as a Psychologist and a Social Assistant in the Shelter for Unaccompanied Minors run by Hungarian Inter-Church Aid. Since 2009 she has participated on several research projects in collaboration with Italian, Hungarian and other international institutions. She has conducted numerous semi-structured and in-depth interviews with vulnerable groups (refugees, unaccompanied minors and Roma youth) about sensitive issues. She has also worked as a Project Coordinator on various migration projects and as a Consultant with the European Migration Network at IDOS Research Centre in Rome.



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International Journal of Research from the Front-line

NRV is an online community space empowering researchers to support each other, share their work and contribute to a better understanding of the world we live in. This platform aims to connect researchers, publish articles and interviews with researchers and academics to promote norm-challenging, sensitive and innovative issues. NRV is a free and open resource created by researchers. We believe in dialogue, collaboration, critical thinking, independence, sharing, openness and freedom in academia.

Starting in January 2016 NRV will publish and promote research covering different themes. We will also publish interviews with the researchers involved in order to give a better insight into their work. These interviews are contained in each research volume and available for download as podcasts on our website. For more information about NRV please consult www.newresearchvoices.org.



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