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Waves and forms: constructing the cultural in design

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Abstract

While research in HCI on dealing with cultural issues when designing ICTs tended to adopt fixed and taxonomic views, recent theoretical perspectives closer to the social sciences have called for attending to the contingent, fluid, and dynamic aspects of the notion of culture. In this article, we contribute to translating these perspectives into an approach for informing design. We focus on abandoning prior conceptions of culture to allow the discovery of cultural differences through inductive field research while engaging with the target community. This allows a view on cultural difference that is generative for design: it is unique to each case, and it also remains close to the concerns of community members. We base our approach on Basile Zimmermann's (2015) *waves and forms* framework, and we illustrate it through our engagement and design with VOICI, a local voluntary community of tech-savvy university students in Syria between 2011 and 2015.

Keywords: culture, HCI design, waves and forms, Syria, voluntary community

1. Introduction

In recent years, research in Human–Computer Interaction (HCI) and the design of Information and Communication Technologies (ICTs) has increasingly referred to the issue of cultural diversity. These works generally base the concept of culture on the broad idea of ways of living and thinking of groups of people, which pertains to various elements such as values, views, beliefs, or behaviors (e.g., Salgado et al. 2015; Merritt and Stolterman 2012). Whatever is called “culture” is understood as a strong shaper of contexts that affect the outcomes of design, and where cultural diversity and difference among certain groups of individuals is considered both a challenge and an asset that can enrich the process of design (Salgado et al. 2015; He et al. 2015).

These studies however face a specific challenge. Since Edward Tylor's seminal work in 1871, "culture", as a generic term to describe the ways of thinking and living of human beings, has become famous for being too broad a concept in many academic disciplines. Sometimes used to talk about high art or a cultivated person, in most cases the word refers to the notion of shared knowledge and what is specific to a group of people when it is compared to another group. For instance, one speaks about "French culture" as an entity perceived as different from "American culture" or "Arab culture". It is often linked with the issue of language (e.g., "French language" is part of "French culture"), but it is also used to refer to other kinds of shared knowledge, such as in "youth culture", "work culture", "drug culture", and so on. Intriguingly, it indeferently describes artefacts (e.g., a "book written in Arabic" contains "Arab culture") and human beings (e.g., a "French person" contains "French culture").

The problem arises when one looks for a reliable definition. Indeed, after its initial birth as a scientific concept in the work of Tylor, scholars quickly found themselves fighting with an elusive object of study. More discussions and definitions followed, and the debate around the concept of culture became characterized as a systematic failure to reach a common ground. Among the most ambitious contributions in this regard, one can point out Kroeber and Kluckhohn's influential book (1952), which reviewed and synthesized more than 160 definitions of culture, and the more recent attempt by Baldwin et al. (2006) to update the former, which has taken this exercise to over 300 definitions. To this day, no common agreement has been reached among specialists working on this topic.¹

Scholars interested in how cultural diversity can inform ICT design, probably influenced by research procedures in the natural sciences, have tended to focus on adopting or producing taxonomies to describe and evaluate their hypotheses (e.g., Kayan et al. 2006; Reinecke et al. 2013). Following a similar path to their fellow anthropologists about a century ago, they are now faced with difficulties impossible to resolve, and new theoretical perspectives are attempting to deal with such difficulties by calling for more fluid and dynamic understandings of culture (e.g., Clemmensen and Roese 2010; Irani et al. 2010).

In this article, we share the interest of fellow researchers about understanding the role of "culture" in HCI and design, particularly with the consequences of the propagation of online technology and its appropriation in contexts that can be considered as distant from the dominant use-case (e.g., geographically, economically, linguistically, or organizationally). In so doing, we contribute to the translation and integration of current perspectives into an approach for informing design.

Our position is grounded in Zimmermann's (2015) framework of *waves and forms*, which focuses on the materiality of expressions and interactions, and attends to the circulation of cultural elements among people and physical media (Zimmermann 2010, 2013). Consequently, we pay special attention to the material manifestation and movement of cultural elements to render visible how humans and non-humans are involved in shaping and mediating their interactions. By drawing from this understanding of culture, which is both dynamic and grounded in concrete materiality, we aim at abandoning prior conceptions of culture to discover similarities and differences between groups of people and artifacts

¹ In anthropology, see Kuper (1999). Descola (2013) also provides an interesting solution as he suggests moving beyond the nature-culture binary. For a recent discussion on definitions of "culture", see Jahoda's (2012) reflections where he argues about the futility of attempts to define culture in a definite way.

through inductive field research. We argue that this allows constructing a view on cultural difference that is both generative for design and unique to each case.

In the following paragraphs we start with a general overview of how HCI design deals with culture. In so doing, we classify current approaches in two major perspectives: a taxonomic perspective, that seeks the devising of general categories and classifications of cultural traits of certain predefined groups of people; and a contingent perspective, that views culture as dynamic and hybrid, often constructed through interaction. We subsequently describe how the *waves and forms* framework allows one to bridge the taxonomic and contingent perspectives. We illustrate our use of the framework with a case study of our engagement and design with VOCl, a local voluntary community of tech-savvy university students in Syria between 2011 and 2015.

2. How HCI design deals with culture: two perspectives

2.1. A taxonomic perspective on culture

To account for the cultural, some scholars in HCI consider culture as associated with identifiable configurations of habits, mentalities or preferences. We will refer to these works as the “taxonomic perspective”. Attempts to render human ways of living and thinking into a finite set of elements sorted into categories have a long history in human and social sciences, which goes back to the nineteenth century. By drawing on these lines, HCI scholars have been developing frameworks with the specific goal of informing design.

Among the most popular models in this category of works is the framework conceived by Hofstede (1991), which has been very influential in HCI research (Clemmensen and Roesse 2010). Based on interviewing IBM employees from 53 countries, Hofstede identified commonalities and patterns in what he defined as the attitudes, feelings, actions, and processes of meaning-making performed and experienced by individuals. He subsequently framed his findings in five dimensions of culture: collectivism vs. individualism, femininity vs. masculinity, long- vs. short-term orientation, power distance and uncertainty avoidance.

Hofstede’s framework is still frequently employed. For instance, in their study on cultural influences on mobile data service design, Choi et al. (2005) draw from the works of Hofstede (1980) and Hall (1976) to characterize culture with a set of dimensions: “uncertainty avoidance”—the degree of feeling threatened by ambiguity and the will to avoid it; “individualism vs. collectivism”—the extent to which people tend to their individual interests as opposed to their preference to live in tightly-knit social groups; “context”—the amount of reliance on shared context and conventions in communication, leading to the exchange of implicit messages when people communicate in “high-context” cultures, and of explicit messages in “low-context” cultures; and “time perception”—where people in “monochronic cultures” carry out a single task at a time, while people in “polychronic cultures” carry out several tasks at once concurrently. Based on qualitative interviews with Korean, Finnish and Japanese participants, the authors identify 52 technical attributes rated in terms of preference (for instance that 90% of both Korean and Japanese participants preferred having a variety of fonts, while 90% of Finnish participants didn’t).

Another example can be found in Honold's (1999) work, which examines the effect of culture on learning how to use cellular phones. Basing her study on works from cross-cultural psychology (including those of Hofstede and Hall), she devises a set of cultural dimensions related to learning objectives. Relying on a deductive mode of research (a hypothesis followed by a demonstration), the author argues for instance that the group of Chinese users she selected mainly knew and used only the basic functions in their phones (thus confirming the influence of "pragmatism" in China), while the group of German users she selected often sought to thoroughly explore and learn about the various functions in their phones (thus confirming the influence of "idealism" in Germany). Following a similar thread, Marcus and Gould (2000) outline guidelines for web-based interface design for users from different countries. The authors take all five dimensions from Hofstede's work (1991) and generate a list of recommendations derived from each dimension to inform web-design. For instance, regarding "individualism vs. collectivism", the authors suggest that web interfaces would focus on the goals and experiences of the individual in "individualist cultures", while such interfaces would underplay personal achievement and focus on group achievement in "collectivist cultures".

Taxonomic views of culture have been increasingly criticized in the HCI community. While they fit well into experimental, quantifiable approaches to studying culture, they are accused of relying on an overly simplistic and essentialist view of "culture". For instance, Clemmensen and Røse (2010) describe as surprising the fact that most studies in the emerging area of culture and HCI depend on lab experiments instead of relying on ethnographic work and field studies. Such a perspective seems to assume that culture is contained within the participants, and that it accompanies them to the lab to be measured. Another related issue with this line of research is the tendency to assume that countries can be used as categories to define boundaries of cultures (e.g., France defines French culture, China defines Chinese culture, etc.). This type of assumption seeks national averages and it is then criticized for ignoring, almost by definition, contingencies and constructed, interactional and dynamic aspects (Clemmensen and Røse 2010; Irani et al. 2010; Jagne and Smith-Atakan 2006).

2.2. A contingent perspective on culture

Typically defined in opposition to the aforementioned taxonomic views of culture as a potentially limited list of stable elements, another broad perspective among HCI scholars consists of looking at culture as dynamic, constructed, and interactional phenomena. We will refer to this second category of works as the "contingent perspective." This perspective usually calls for ways to achieve close encounters, empathy, and partnership between researchers and stakeholders that have an interest in design (e.g., Irani et al. 2010; Merritt and Stolterman 2012).

Irani et al. (2010), for instance, in their work on postcolonial HCI, embark on a critique of the rigidity, timelessness, and averaging positions of taxonomic views of culture (particularly those of Hofstede and Hall). They report that dimensions of taxonomic views have been found "analytically weak in explaining conflicts (Easterbrook et al. 1993) or difference in technology use (Ess and Sudweeks 2006)", and that "'averages' are of limited use for design (Marsden et al. 2008)". They further note that cultural categories which adopt geographical boundaries do not account for technologically enabled interactions that challenge these very boundaries as they facilitate cross-geographical communication and collaboration. Instead, the authors propose what they call a "generative" view inspired by contemporary anthropology

and postcolonial studies where culture “is a lens through which people collectively encounter the world—a system of interpretive signification through which the world [becomes] inter-subjectively meaningful”.

Another recent example is the short paper by Merritt and Stolterman (2012), where the authors couple concerns regarding cross-cultural participatory design with the issue of balancing power. They push forward the notion of “cultural hybridity”, from postcolonial studies, to account for the dynamic hybridization of culture and for the role of power and dominance in coining cultural identities. Based on the work of Baaz (2001), the authors adopt a definition that challenges the view of culture as separate, bounded, or existent in a canonical or unspoiled state. Instead, they understand culture as situated, “negotiated, malleable, and intertwined with power relationships”.

The main difficulty, when taking more aspects and dynamics into account, is to find oneself unable to say much beyond how complex and changing reality is. To still be able to do something concrete, Merritt and Stolterman introduce a set of practical recommendations to designers: to attend to “hybridity as pretexting”—the existing history of intercultural interactions; to consider “hybridity as unavoidable”—the formation and changing of hybrid cultural identities during the design process of both designers and participants; and to understand “hybridity as traversable”—the blending of cultural identities and the possibility for participants to move freely between these identities.

In a similar attempt to prescribe a concrete approach to account for culture in design, Jagne and Smith-Atakan (2006) advise designers against using existing cultural models—a practice which leads to stereotyping target markets (this, they point out, has the additional disadvantage of portraying designers or companies as ignorant and useless). They suggest that “researchers and designers should engage with the cultures directly, to get a better understanding of the indigenous people”. The authors propose a methodology to design digital services guided by their real-world counterparts, thus envisioning digital designs as “metaphors” of offline spaces and activities (for instance, one can design an online shopping service targeted for a certain group of people by studying how these people shop on the street). This method involves four stages, which are reminiscent of classic design approaches: investigation (ethnography); translation of observations to draw a local model of practices, interactions and values; implementation; and testing. Here, like in the so-called generative perspective of Irani et al. (2010), the focus is on the local and everyday interaction of users, and the understanding of what needs to be labeled as “cultural” is constructed within the study.

To sum up, HCI studies which we group under the label of a contingent perspective tend to view culture as something that is produced, reproduced and changed through everyday interactions rather than preserved unspoiled within ideal types. They also position culture across the interactions among individuals rather than embed it solely within the minds of those individuals. They acknowledge the multiplicity and hybridity of whatever is at stake, and they also reposition the designer within the research project as an actor seeking intervention while being involved in the intercultural encounter. This challenges the taxonomic view of culture sketched above, which tends to overlook hybridity, intervention and change—aspects that are actually central to designers’ concerns as they seek change through technological innovation.

3. *Waves and forms*: bridging taxonomic and contingent perspectives on culture

The approach we propose here shares the concerns of both the taxonomic and the contingent perspectives on culture outlined above. It is based on a framework named *waves and forms* developed by Basile Zimmermann (2015), the second author of this article. In short, the idea is to rely on materiality in the observations made by researchers. By focusing on a specific understanding of the physical world based on the notion of shape of matter, one can develop categories (in the spirit of the taxonomic perspective), while at the same time taking into account the subjectivity, the locality, and the dynamics of the data collected (in the spirit of the contingent perspective). However, unlike the taxonomic perspective, the categories that are built are specific to the group researchers are engaged with during the research, and they are based on observations rather than conceived a priori. Also, unlike the contingent perspective, it doesn't give up on building dichotomies and classes, but it attempts to connect them closely with the concrete situations motivating them as well as the actors delineating their boundaries.

Zimmermann's perspective is inspired by theoretical frameworks in anthropology, area studies, and science and technology studies (STS). The waves and forms framework (WF) relies partly (but not only) on a positivist approach: "culture" can be dealt with if it is understood as in relation to material phenomena. It involves expressions and practices that are located in physical media (e.g., sound waves in the air; electrical signals along a wire; pigment molecules on paper sheets; movements of the human body; synaptic traces in a human brain), which are created, conserved, or dissipated as they circulate from one place to another. This view of culture is inspired by Zimmermann's fieldwork on electronic music in China, where he observed how electronic music records and software circulated from musicians and their studios in Europe, in Japan, and in the US, on various physical media and over the Internet, to the hands of musicians in China, where musicians remixed and repurposed them to produce new music (Zimmermann 2006, 2015). Thus, a piece of culture, so to say, was created, then was conserved as it circulated from one site to another, shifted, took a new shape, and sometimes even disappeared. Along this movement many actors were involved, both humans and non-humans, and parts of this movement were traceable by investigating its material traces.

The WF framework is based on the generic notion of shape, and the idea that no qualitative observation is possible if there is no material trace left of the phenomenon of interest. The focus on shape is inspired by Zimmermann's observations of how sound can be transmitted to vinyl records where it becomes an inscribed, modulated spiral groove, as a way to describe the general transformations which matter goes through in time. Then it relies on the two more specific concepts of *waves* and *forms*. The term "wave" is used to describe the *smallest level of shape that matter can take* (e.g., what makes a dot on paper, a bit in a computer, or even the arrangements of electrons constituting that bit). Waves can be multiple (i.e., one wave can have multiple instances, which means it can be located simultaneously in different places at a same time), and they can be created, conserved while they circulate from one medium to another, or dissipated as they are added to or subtracted from each other. The term "form" describes an *aggregate of waves that is identified by a human being* (such as a word printed that one looks at on a sheet of paper or

displayed on a screen; a sand castle made of grains of sand that we see on a beach; a song made of movements of air particles that we listen to, and so forth).

Culture then involves the *circulation of forms*, i.e., the aggregation of waves and their subjective interpretation by human beings, as the content of waves is being created, dissipated, or conserved while circulating on various media. Here, the notion of shape of matter is particularly crucial in that it implies (a) that a description of the cultural in the real world pertains to entities that are not unique but multiple and (b) that these entities can be created, dissipated, or conserved. For instance, a sentence in French or a specific pattern of behavior such as the habit for men to kiss to greet each other can be internalized by an individual in Beirut, by another individual in Paris, and at the same time written inside a book in Beijing. This sentence or that habit can circulate, be forgotten, erased, modified, or replaced as one individual teaches the sentence or the pattern to someone else, or pass away without doing so, or when the book is destroyed or copied.

WF has two main implications. First, locating culture in material phenomena implies that any observation of people, objects or processes must be closely related to a specific part of the real world (this is why the data cannot easily be generalized, because it cannot easily be separated from the piece of the real world it is based on). To remain accurate, any scientific attempt to deal with the notion of culture must explicitly state where, when, and how observations have been conducted. In short, since the data collected is based on unique pieces of physical matter, the research is in risk of losing its reliability every time its intimate connection with the physical world is not detailed enough.² Second, it requires attention to tracing and documenting processes of circulation with creation, conservation or dissipation of waves content across media to explain how expressions and practices are learned, encoded in the physical world, modified, or rendered obsolete.

By relying on the concepts of waves and forms, and on this understanding of materiality (i.e., a physical world made of *unique* matter particles which are used to create *multiple* shapes), we believe that it is possible to come up with a framework that takes advantage of both taxonomic and contingent perspectives. The taxonomic perspective is useful to discuss multiple instances of the same form (such as a similar musical structure included in different compositions, or a similar pattern of behavior among a group of people). It allows one to classify these forms in different categories. The contingent approach, on the other hand, is useful to discuss the dynamic changes of forms. How a form is created, conserved or dissipated, when it is located at various places or circulating from one place to another, at the same time or at different times, and how several instances of a form can be considered similar while remaining located on different physical entities.

In brief, WF accounts for the contingent and constructed status of practices by attending to the physical traces of human interactions and artefacts. It situates these traces in everyday interactions among people, the tools and technology they use, the materials they repurpose and the spaces they occupy. WF also deals with the difficult question that faces taxonomic views which tend to consider culture as something

² In the context of an HCI design-oriented study, these descriptions can (and rather should) be based on conversing with actors in the field. What is required is a detailed account of those actors, their locations, and how they situate themselves vis-à-vis the context in which they are active.

static, bounded and essentialized. Since it focuses on *forms* (aggregates of waves identified by human beings), it presupposes from the start a multiple, dynamic structure of reality, constructed subjectively.

The perspective we advocate here is not a fixed methodology or a recipe: waves and forms are mainly sensitizing concepts. They encourage taking an ontological position that welcomes contingency and calls attention to processes of formation and transformation rather than predefined categories.³ In this sense, it is a sensibility which has methodological implications but that is “pluggable” in other frameworks. Specifically, and through adopting it in our own work, we think it goes along well with approaches that allow closeness to the field, its materials, and its actors and that enable gathering considerable empirical detail.

We will now illustrate our argument with a case study on VOICI, a local voluntary community in Syria which the first author observed in 2012–2014. Our goal is to show how one can approach design issues by combining the interest in applicability and concreteness from what we called the taxonomic perspective, and the interest in dynamic, negotiable and hybrid movements of culture from what we called the contingent perspective. To do so, we will demonstrate how WF may be integrated with (without being limited to) approaches which have already found steady footing in the fields of HCI and design: ethnography and participant observation, grounded theory (GT), and for STS, the actor-network theory (ANT) and the social construction of technology (SCOT).

To do this, we elaborate on various aspects of our fieldwork in Syria, organizing our demonstration in three sections. We start with the broad context in the area at the time and its implications on voluntary community building. Then, we focus on those processes of community building and organization within VOICI, and on a specific situation of conflict between core members of the community. With this staged narrative, we want to show how WF can be used at multiple levels of reasoning about data. At each of the three levels, we start with a data-driven description while moving progressively to weave an analysis informed by the WF framework.

4. VOICI: a local voluntary community in Syria

In 2011, Ammar Halabi, the first author, engaged with VOICI,⁴ a community composed mostly of student volunteers from the University of Damascus, for an ethnographic study to learn about the collective use of ICTs. VOICI members were mainly interested in new collaboration practices made possible by modern Internet technology, and collaborating with this community seemed appropriate for Halabi’s nascent PhD project in HCI.

By conducting an ethnography along the lines of what Harry Collins (1984) coined as “participant comprehension”, Halabi conversed with other members, followed online interactions, participated in moderation, and also contributed to the organization and realization of activities (including collaborative online authoring, sharing of resources, brainstorming for new activities, and discussing management

³ For a similar ontological argument with a focus on issues relevant to the sociology of knowledge, see Collins and Evans (2015).

⁴ VOICI is short for “voluntary community”. We keep the real name of the community as well as its members anonymous throughout this study.

practices). In a nutshell, from 2012 on, up to the time of writing these lines, Halabi has been active as a contributing member and moderator of VOCI. Between 2012 and 2014, he gathered the main body of observations and data, which we will discuss below.

4.1. Community building in modern-day Syria

To situate VOCI in a wider context, as well as to grasp what is particular about its members and their practices for an audience interested in reading about culture, we start by describing the situation in Syria around the time of their activity.

In late 2011, the uprising was in its early days, and there was much anticipation and excitement among the youth about the potential for shaping the future of Syria. This was evident in the great number of political initiatives, new coalitions, and a wide movement to learn about the country's recent history and to contribute to the political discourse and debates on the past and the future of the country.

Progressively, the government stepped-up the use of military force, while various factions started to form armed rebel brigades, and Syria increasingly became a zone for regional and then international conflicts.⁵

With the violent turn in events and the escalating crisis, numerous humanitarian aid and relief groups formed in response. This proliferation of political, activist, and humanitarian grouping was paralleled with a strong online presence on social media (Salem and Mourtada 2011; Lynch et al. 2014; Halabi 2014; also, on problematizing the role of social media in the Syrian uprising, see; Wolfsfeld and Sheafer 2013). In this wider context, the founders of VOCI started in 2011 to organize peer-based talks in Damascus, which rapidly became their core activity. During these meetings, community members typically introduced topics related to collaboration and technology, which they in turn discussed together (e.g., how to collaborate using GitHub, wiki platforms, open source hardware, or social media). Many members saw their participation in VOCI as an opportunity to get together, learn new skills, and enrich their personal and professional lives in ways that the university did not offer.

ICTs clearly had a specific impact on the unfolding of events, particularly in relation to ways of association and assembly, as access to civic institutions in Syria was restricted and the capacity to self-organize was stifled. In lines with the classical debate in social sciences around technological determinism, we don't believe that ICTs had a simple cause-and-effects role in Syria;⁶ however, it seems obvious that prior to 2011, it was difficult for local initiatives, be they political or not, to gather and organize activities to serve common interests. The Syrian Law on Associations put various obstacles to free association, and the procedures to follow were tedious and lined with heavy scrutiny and control by the government and its security apparatus (see Bosman 2012; Syria Needs Analysis Project 2013). Furthermore, unannounced

⁵ It is impossible to do justice to the heavily charged and rapidly changing the Syrian situation in these few lines. On the socioeconomic roots of the Syrian crisis, see (Nasser et al. 2013; Abu-Ismaïl et al. 2011). For discussions that problematize the role of sect and religion, see (Berti and Paris 2014; Phillips 2015). On the more recent involvement of multi-regional and international forces, see (Kinninmont 2014). An article by Max Fisher in the New York Times gives an accessible account on the recent situation as of August 2016: <http://nyti.ms/2bnApQa>, accessed on 04/10/2016.

⁶ For canonical discussions that go beyond the social constructivism and technological determinism, and which acknowledge the roles of people, meaning-making and social interactions, as well as technical and material structures, see the edited volume of Bijker et al. (1987), and the introduction of Mackenzie and Wajcman (1999). For recent overviews, see Sismondo (2010, Chaps. 6 and 9) and Wyatt (2008).

assemblies and ad hoc forms of organization were restrained by the authorities who closely monitored public life.⁷ This situation severely restricted the space for allowing people to come together and self-organize, while the new digital spaces, made possible with the gradual spread of ICTs since the early 2000s in Syria, were making it somewhat possible to gather, discuss and organize action in different ways.⁸

VOCI's volunteers, moderators and active members included a few professionals (e.g., a teacher, a lawyer, a researcher); however most of them were university students in their late teens or early twenties. This was a significantly formative period of time for many of them. As young adults, they were establishing their character and voice, and as Syrians, they were witnessing a national crisis on an unprecedented scale. They attempted to understand what was happening around them, and their activities within VOCI can be seen as a way of doing something about the situation in Syria at that time. Active members in VOCI were often tech-savvy individuals, mostly coming with technical backgrounds, and many of them displayed an affinity to the ethical ideals of fairness and sharing that characterize open source movements. These members were among the first generation to grow into the recent proliferation of computers and the Internet in Syria. They wanted to contribute to shape their reality with the means they knew well, and which they were interested in exploring further.

VOCI members had access to various narratives through the Internet on how to organize collective activities. These included initiatives with idealistic goals: Wikipedia, which bore the promise of advancing knowledge through a pluralistic approach to authoring and sharing, or the Free Software movement that advocates for the right of unhindered access to viewing and modifying software source code. This discourse about ICTs was recognizable in the terms that active members were using while exchanging in their events, as well as in the content they were authoring and publishing about new ways of collaboration enabled by ICTs. In brief, VOCI members were involved in communicating, organizing and adapting ideas of collaboration through the Internet, and they actively reproduced them and published them online in Arabic.

VOCI members, including its core founders, but also the larger group of active members, appeared to us mostly cosmopolitan in their views and awareness, and at the same time interested in crafting a vision for local change in Syria through the potential of ICTs. To them, organizing a talk on the Open Hardware movement could empower local industry, and holding a workshop to learn working with Arduino would enable local communities to act in ways unseen before.

In their own words, VOCI's founders and moderators labeled their endeavor as a "community" (مجتمع) and often expressed criticism of "traditional institutions" (المؤسسات التقليدية). In this sense, VOCI's self-labeling was close to the notion of community used in the works of Kavanaugh et al. (2005) and Carroll and Rosson (2006). This notion refers to local geographical groups of members living in proximity, motivated

⁷ Most reports on Syria's civic and public life point to the state's persecution of informal gatherings, mainly documenting cases of groups explicitly expressing political dissidence (e.g., Human Rights Watch 2007, 2010). According to Halabi's experience, this goes beyond such iconic cases and applies to lower-profile gatherings which can be perceived as bearing political undertones (for similar reasoning, see Halabi 2016, ch.1 and 2).

⁸ This dynamic started well before the uprising. Halabi had witnessed a number of local initiatives which exploited early internet forums to solve many practical issues for finding arenas necessary to interact. By the time of the uprising, Facebook was already becoming a widely-spread social platform, which further helped establish new arenas for communication and self-organization.

by shared interests, with groupings that range from formal (e.g., local NGOs) to informal (e.g., book clubs), characterized by heterogeneous affiliations and roles when compared to corporations or governments, and by having no central authority.⁹

Here, as we describe the general situation of VOCI, the type of reasoning that we sketch is already inspired by *waves and forms*. Namely, it involves an attention to materiality and, most importantly, circulation (Zimmermann and Nova 2015). In this description specifically, it allows us to discuss a *form*, in this case a practice or a pattern for controlling civic self-organization, set up by the authorities in Syria, as being engraved in civic law and mechanisms of enforcement. This form circulates down to localities and translates to a lack of capacity to establish local interest groups.¹⁰ At the same time, the spread of ICTs, planned by the authorities in an agenda for modernization, brings with it relatively unmoderated spaces for social interaction. This other form, which we deem distinct from the control of civic self-organization, also circulates down to localities and translates into a capacity to establish local interest groups. For instance, waves contents of what the Facebook developers in California were coding,—say, the structure of Facebook groups—, circulates over network connections and web servers, governed by internet protocols, and makes it possible for many in Syria to create new areas of assembly and communication with different rules: they allow some degree of autonomy and avoidance of centralized control.¹¹

In the next section, we elaborate on the relationship between the making of VOCI and the materiality of its activities. Specifically, we will consider how the moderators relied on ICTs to structure and govern the groups that they were in charge of. Our goal is to rely on this piece of data to show how WF can be used to construct the cultural, starting from the observations in situ towards the analysis and design.

4.2. Using ICTs to strongly organize in a weak state

By 2013, VOCI's overall membership base reached more than 5000 online members, including several hundred members who organized and attended on-ground meetings. Some of these activities included collaborative hardware making workshops, wiki-writing sessions, peer-based talks, and software development meetups. Along with on-ground meetings, members also used online tools to communicate, coordinate and collaborate. Since its establishment, VOCI had gradually grown in membership and diversified its scope, it had also differentiated into several interest subgroups: VOCI.Techie (on software development); VOCI.OH (on open source hardware); VOCI.Medicine (on new medical practices facilitated

⁹ Of course, VOCI's understanding and realization of the term had its own nuances, and we attempt to take into account how its members established differentiated roles of authority, structured their organization, and engaged in processes of construction of fuzzy community boundaries (see Lamont and Molnár 2002 on a review on the study of boundaries in the social sciences).

¹⁰ An analysis based on waves and forms can have different degrees of detail. The link we describe here from the general situation in Syria to the use of ICTs to self-organize is coarse, and it certainly merits more attention to the minute detail of the circulation of forms and their waves content. Our study was mainly focused on interactions inside VOCI, hence the analysis coming next has a higher resolution.

¹¹ It is important not to over simplify here and avoid assuming that online spaces are structureless or without rules. Instead, the rules of online interaction are different and depend on the platform(s) under question. There is an increasing public attention as well as a growing body of literature on how digital technology contributes to framing and governing everyday action (see for instance Woolgar and Neyland 2013; Neyland 2016; Ziewitz 2016).

by modern Internet tools); and so on. In WF terms, each of these activities or each of these entities, as identified either by VOCI members or by our research team, is a *form*.¹²

One set of forms that Halabi became especially interested in was when VOCI members used ICTs to announce events, to discuss the organization of these events, and to share relevant resources. Facebook groups played an important role, but also custom wikis were used as collaborative documents to write articles in Arabic or to coordinate various projects, as well as private messaging which was often used to discuss organization (mainly over email, Facebook, and text chat). Among these tools, Facebook clearly served as a central node where content and discussions made on-ground or online on other platforms were aggregated and referred to.

Let's examine one specific form, in this case a set of practices that VOCI moderators established gradually to organize their activities. As VOCI evolved, and as members diversified their interests and created multiple groups, subgroups in VOCI grew in size (e.g., the VOCI.OH group eventually hosted over 3000 online members). With this development, it became necessary for the moderators to establish a parallel space to discuss organization. For this purpose, the moderators of VOCI.OH created a private Facebook group (a "meta-space", see Halabi et al. 2013), where they could brainstorm, deliberate on choosing and refining activity ideas, and then coordinate practical tasks (e.g., preparing the content of a talk; listing possible hardware projects for a workshop; or designing a poster to announce the event).

In WF terms, these observations describe how waves content circulated between Facebook, the Internet, computer hardware and VOCI members. We view such interactions as: (1) a feature that was latent within the material properties of Facebook, but also (2) as a pattern of interaction created by VOCI moderators when they explored and enacted the technical feature as the need arose. In WF's perspective, this pattern of interaction is a new form in VOCI that is noted by our research team as we observed the moderators' management activities. With time, and after successfully experimenting with meta-groups, this form circulated through moderators who helped other moderators in other VOCI sub-groups, who in turn ended up creating a meta-group on Facebook for each subgroup in VOCI.

The discussion we sketch here is a small snippet of what can be unpacked about VOCI's activities and their entanglement with the materiality of infrastructure and people using it.¹³ To further our argument on approaching cultural issues for design, we will now focus on a specific episode in the life of VOCI. We

¹² As we noted earlier, when using the WF framework we move freely between expressions and interactions as they circulate through people, media and physical objects. Therefore, we do not construct a distinction between what is material and what is not—in the WF perspective everything is material. This applies to our treatment of the digital, to which we do not assign a special category in this paper. The digital has enjoyed a number of discussions recently, with various positions on its materiality or other characterizations of its nature (such as "informational"). An attempt to sort out the different notions of materiality of the digital can be found in Leonardi (2010). For a perspective on the digital as non-material, see Faulkner and Runde (2011); about the importance of accounting for the materiality of the digital and "modes of analysis grounded in the stuff of computing [emphasis by the author]", see Blanchette (2011). For a similar perspective to ours, see the recent edited volume by Pink, Ardèvol, and Lanzeni, where the authors abandon "a priori definition about what is digital and what is material", and "prefer to understand digital materiality as a process, and as emergent, not as an end product or finished object." (2016, p. 10).

¹³ For example, consider the common circulation of the practice of making posts and comments on Facebook, which travels both through users and through interfaces from personal walls to private groups, to event pages, etc. For further exploration on VOCI's practices and how they circulated, see Halabi (2016, Chap. 4).

briefly present a part of our study about a conflict that occurred between the founders and moderators of VOCI between 2012 and 2013.¹⁴

4.3. Conflict in VOCI

In November 2012, a post on VOCI's main Facebook page announced that nine core moderators¹⁵ were forming a new "management team" to officially represent the community. The announcement emphasized a forthcoming exciting initiative to establish a hackerspace that would function as a permanent space, representing a physical manifestation of VOCI's collaborative vision and practices. To the surprise of many members, this new management team neither included nor mentioned Salem,¹⁶ who was one of the three main founders of VOCI in 2011 and one of the community's active figures. Later within the same day, in bewilderment and shock, Salem protested that he had been blocked from all digital spaces that belonged to VOCI (its Facebook groups, online social media accounts, blog accounts, and website hosting services).

As VOCI members quickly understood, Salem had been excluded from the community's main digital platforms. In response to the increasing questions from members, the management team eventually announced their reasons for excluding Salem a few days later on VOCI's main Facebook page. Their argument focused on two aspects. First, they believed that Salem was taking decisions about organization and activity in the community without due consultation with other moderators. Second, they argued that Salem had been obstructing the hackerspace initiative, which they considered central to VOCI's future development. Consequently, justifying their action by what they considered Salem's previous history in publicly inflaming discussions when confronted, they decided to block him out of all VOCI's digital spaces. They demoted his status on the Facebook groups from admin to an ordinary member, blocked him, and changed the passwords to the website hosting service.

A few days later, VOCI members noticed that despite Salem's digital suspension, the management team had overlooked a technical aspect of their online activities: since Salem was the one paying for the registration of their domain names and for maintaining their website hosting service, he had the means to prove to the corresponding technical support that he was the legal owner. Salem did not wait long. Within a week, he managed to regain access and control of VOCI's websites and domain names. This time, it was his turn to change the passwords and to block the new management team out. At that moment, VOCI's online spaces were split into two different entities: the management team controlled the Facebook groups and social media accounts, and Salem controlled VOCI's website and the related domain names.

The conflict in VOCI, which continued long after this first episode, involves many other aspects which we do not discuss here. For instance, members had different points of view and reactions. Many wished to

¹⁴ Above we noted the processes of organizing and constructing community boundaries, but the notion of "community" merits further problematization. Importantly for us, referring to a group as "community" might implicitly conceive it as a positive category (Averweg and Leaning 2011), which tends to consider communities as homogeneous and characterized by common will, and overlooks issues of conflict and power (Goodwin 2008; Carroll 2001).

¹⁵ Community moderators were those most active and present in its events and those who mainly contributed to decisions and management. Their number ranged between 10 and 15 during the life of VOCI, and they were members who knew each other personally and professionally in the university and in everyday life.

¹⁶ Fictitious name.

find a resolution to this issue, and the attempts to mediate between Salem and the new management team, or the consequences of this conflict in terms of stagnating activity and exhausting those involved, were numerous.¹⁷ However, this brief summary is sufficient to illustrate how emergent cultural issues can be analyzed on the basis of this type of observations.

In VOCI, each side blocked the other out of a part of the digital spaces that they occupied, controlled and shared. First Salem was blocked from the websites and online groups by the new management team, then he managed to block them from accessing the websites. We also noted earlier that community members had developed their own practices in management over time. In this regard, we can say that up until the moment of the conflict, blocking was not a conventional practice among VOCI moderators. Blocking is a specific practice – in WF terms it is a *form* that consists of a new pattern of management in VOCI that the new team of moderators created at a certain moment; when they deemed that Salem should not be kept as a moderator and an administrator in VOCI.¹⁸

In a similar way to the practice that VOCI moderators developed in creating meta-spaces for coordinating sub-groups, the actions that the management team took to block Salem out of VOCI's digital spaces, by changing admin privileges and passwords, were latent within the design of the technology. These features were enacted when the management team saw suitable. Similarly, Salem's subsequent takeover of the websites was also a latent possibility in the ICT infrastructure that he utilized as he struggled to regain control. In other words, these actions were embedded in the technology, as they were made possible by features embedded in the various digital platforms. For instance, on Facebook, group settings allowed demoting an admin and blocking him or her out, and similarly, a specific feature in the ICT infrastructure admitted only one user as an owner of a domain name and therefore made it possible for Salem to take control of VOCI's websites. Could this situation be envisioned differently?

5. Using waves and forms to inform design

Design is about the future. Moving towards design is a matter of framing a tension between a present state and a desired one. It is also about framing an intention to change the status quo towards what is envisioned in an attempt to resolve the tension. In other words, design does not automatically follow from some understanding of a phenomenon, but it is necessarily associated with the subjective interests and evaluation of the actors involved, including designers. Design is an endeavor of an interested (and potentially multiple) self.¹⁹

To tease the tension we are interested in from our WF-oriented analysis of VOCI's case, we look at the circulation of forms across various human and non-human entities, and we ask the following question: what happens when a design element of the Internet infrastructure —an aggregate of *waves*— circulates

¹⁷ For an ethnographic account on VOCI and its conflict, see Halabi (2016, Chaps. 4 and 5).

¹⁸ In contrast with the other forms we have been discussing so far, the form of blocking an administrator in VOCI's management is striking not because it was recurring (it wasn't), but precisely because it was unprecedented in what we observed. One strength of WF is that by focusing on similarities and differences among forms, it allows attending both to recurring patterns and unique ones.

¹⁹ For a thought-provoking account on framing design intention, see Nelson and Stolterman (2012). Also, for discussions on pluralizing the engagement of various actors in community settings to frame a common intention, based on shared (or not so shared) interests, see Heeks and Stanforth (2015), Halabi et al. (2015), and Andrade and Urquhart (2010).

through communication infrastructure, computing devices and people, and gets appropriated by local voluntary communities in Syria? In the account above, and by attending to the design of digital tools, we elaborated on two dynamics about how ICTs relate to local practices. The first involves enabling alternative spaces for grassroots initiatives to organize (the *form* we outlined here is “to allow relatively unmoderated spaces for gathering and self-organization”), where the cultural that we highlight in the case of the VOCI community relates to a prolonged lack of capacity to self-organize in Syria, contrasted with the local appropriation of ICTs to construct alternative spaces.²⁰ The second is characterized by the implications of a specific design element on shaping conflict in the local community (the *form* we outlined here is: “to allow any single user to control all access”). In other words, the cultural that emerges in these two examples is less related to the distinction between, say, “western” and “Syrian”, as much as it relates to the tension between the “global design and governance of the Internet and applications running on it” and “the functioning of a local voluntary community in Damascus”. This tension is our design point of departure.

In the main study from which these snippets of VOCI’s case are taken, we discuss in detail the viability of options and features available on Internet infrastructures to support managing shared ownership. We examined the potential of using ICTs for organization in grassroots initiatives, while at the same time we recognized the limitation of options available for managing shared ownership in a context with weak legal support for civic institutions. In response, we explored design alternatives for modes of ownership that make blocking less feasible and promote alternative negotiation mechanisms.

This led us to the concept of Modus, a collaborative platform that enables sharing and management of shared digital assets with specific attention to cases of breakdown and conflict (see Halabi 2016, ch. 8). In a nutshell, Modus is an attempt to delegate the responsibility of ownership management to the group founders and moderators in a way different from what existing implementations of digital ownership for the World Wide Web currently allow. Upon starting a new community such as VOCI, group members can rely on Modus to decide on which kind of governance they want to embed in the tools. For instance, they can adjust Modus parameters so that an administrator would not have the power to remove another administrator against that person’s will. Or, Modus can impose physically on the level of the ICT infrastructure that a new administrator will gain administrator’s privilege only once all the other administrators have approved adding her or him. In other words, a legal, peer-based type of management is embedded in Modus and it is activated through the software platform’s physical infrastructure. In the presence of Modus, many aspects of VOCI’s conflict described above would not be possible, and a different pattern of interaction would have to take place.

To initiate a conversation on different modes of ownership and governance, we created an early prototype of Modus and shared it with community members and moderators of VOCI, as well as a test group of students from the University of Fribourg in Switzerland. This provoked diverse views on how various accounts should be owned and how disputes should be settled. We then consolidated those views

²⁰ Several Syrian thinkers and activists have suggested that with the stagnation of political and civic life in Syria in the recent decades, local communities have grown unable to maintain trust and form coalitions to pursue common interests (“political desertification” *التصحّر السياسي*, has been a frequently used term to discuss this topic). On the other hand, one can note that many groups self-organize, including community councils that assemble outside of government control to run local services (such as healthcare, education, provision, security, and courts of justice).

and implemented an interactive prototype.²¹ In brief, these features introduce a mode of peer-validation through discussion and voting when managing digital assets such as domain names, website hosting accounts, and social media accounts (Fig. 1).

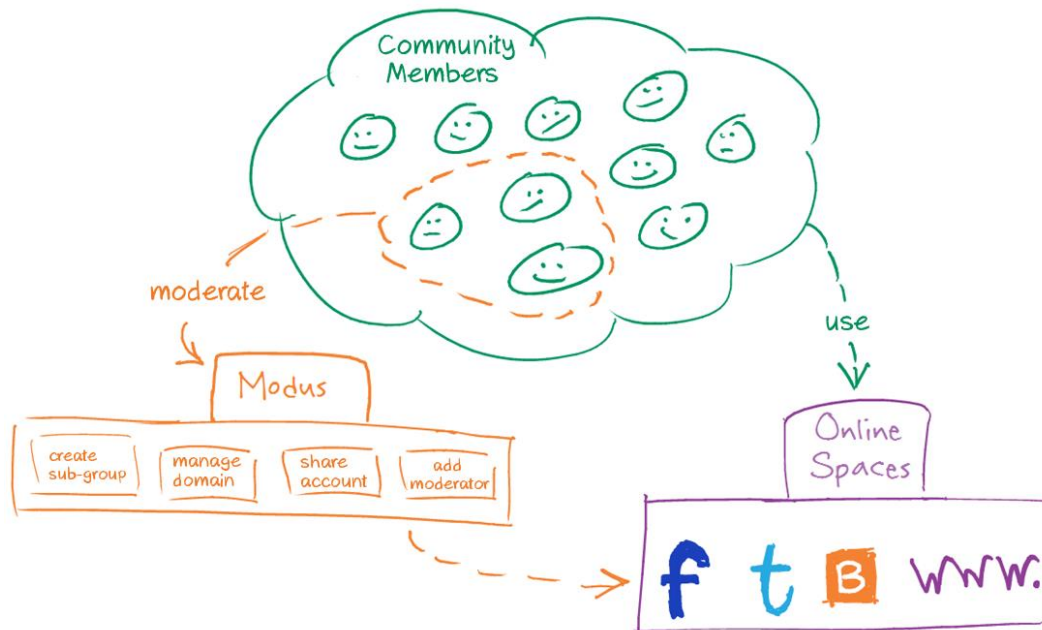


Fig 1. Modus as used by moderators to manage shared digital assets. Note that all actions indicated inside the orange box representing Modus are regulated by a peer-based decision-making process that involves voting and deliberation. Source: Halabi (2016)

In a research project such as Modus, the WF framework enabled us to think of the various constraints imposed on and enforced by VOCI members as forms circulating from the US to Syria, and from Damascus to Europe (where Salem was based at the moment when the conflict occurred), being created, conserved, or dissipated along the way. Relying on such a dynamic perspective, we considered several routes of design that contributed to shaping Modus, such as governing ownership through network protocols (see Musiani 2016), developing alternative social networks with different rules of operation (see Narayanan et al. 2012), creating new communication tools that facilitate online negotiation (e.g., Vlachokyriakos et al. 2014), or crafting other legal means that guarantee shared ownership rights (we explored how Modus could run as a non-profit association based in Switzerland). Most of these aspects in our analysis were teased by attending to the circulation and dissemination of forms, as a perspective on the materiality of tools, conventions or practices.

6. Discussion and conclusion

In this paper, we show how the WF framework provides a refreshing view on the difficulties raised by the fuzziness of the concept of culture in social sciences. We discussed how WF bridges between taxonomic and contingent perspectives of culture in HCI research. WF allows the construction of cultural categories

²¹ For a documentation of the various views that came from discussing the prototype and the details of the design, see Halabi (2016, Chap. 8).

to inform design, but it also takes into account the dynamic, generative and hybrid aspects of culture and the locality and volatility of the categories constructed.

We have shown how the cultural in design is to be constructed for each case and through serious engagement with the field and the people. In this regard, the WF perspective is especially helpful in making invisible issues more visible, as it argues that “[c]ultural means *shaped*”; technical objects are not neutral entities but always “embody information, choices, values, assumptions, or even mistakes that designers have voluntarily or involuntarily embedded in the technology” (Zimmermann 2015, p. 3, 222).

In the case study of VOICI described above, we have framed two main themes. The first one concerns the context and ways that community building happens in modern-day Syria. This theme is close to the common orientation to understanding culture as related to the specific ways of thinking and living of this community (in this case, invoking an understanding of “authoritarian culture” brought forth by the state and the distribution of power). The second theme that we framed concerns how voluntary communities in general use ICTs to govern their activities in a situation of a major disagreement between core members. Here we didn’t note a form that we would describe as a traditional habit, belief, or value that would be attached to a common pool of knowledge or know-how of Syria’s inhabitants. In some sense, this is not a surprise, since VOICI members were cultural nomads, tech-savvy, young and cosmopolitan in their outlook.

We argue that the analysis remains in both themes culturally sensitive, even when, especially in the second theme, the issue of conflict and the role of technology do not immediately subscribe to culture in what is sometimes called the anthropological sense of the term (i.e., with a focus on the habits, beliefs, or values shared by a group of people). We have thus, purposely avoided defining “Syrian culture”, and decided to focus on general processes of transformation and becoming. The reason for doing so is that we take the cultural to be established locally, in the frame of the study and the interests of the actors involved, and only through close contact with physical data. With this view, one might as well ask here if the category of culture is needed at all in design. Indeed, it seems possible, maybe even desirable, to achieve culturally sensitive design without resorting to the label “culture”, as long as the design effort is based on categories grounded in patterns observed in the field and its actors.

This contrasts with the position of taxonomic views of culture in HCI and design research. In such studies, potentially motivated by corporate management, marketing interests, or an inclination towards generalizability, it makes sense to segment observations and to characterize them by measurable preferences. We understand these concerns, but we suggest that such interests should be made clear from the start, and defined methodologically with more grounded terms (such as “national average”), rather than analytically unstable categories (such as “Korean culture”), to preserve an understanding of culture as the dynamic circulation of forms. We believe that if one adopts a notion and scope of culture such as “western culture” vs. “Syrian culture”, one risks missing the particularity of issues such as the ones we faced in VOICI. This could potentially steer the attention of our work to directions that are not relevant to the actors with whom we engaged.

Consequently, using the WF framework in HCI research is both simple and complex. Simple, as the goal is to abandon categorizations of culture at the beginning and to commit to the case at hand. Complex, because then the work involved to devise a notion of the cultural becomes open-ended. Indeed, the

various aspects highlighted by the waves and forms framework depend on the goals, interests, and circumstances of each research. In the case of VOCI illustrated above, we could have easily expanded the analysis further. For instance, we could have compared it to other cases in other communities, and then end up with an issue of ownership and conflict relevant in a wide array of cases. In that case we would speak of a certain cultural feature—a *form*—that is present in various communities that use the Internet.²² Or, on the contrary, if we had found that VOCI's case was particular to its members, we would have framed it as a form specific to that group of people.

Regarding the scope of WF, and since it involves an ontological position, it is visible in the case we present at various moments during the research: in gathering data while attending to movements of forms, in analyzing the data with the same sensibility, and in writing an account where such dynamics are made visible. Seen this way, the methodological implications of the ontological position in WF involve groundedness in data; attention to processes, temporality, and change; and analytical techniques that are sensitive to similarities and differences.²³

Furthermore, while WF puts primary focus on materiality and circulation of cultural forms, it invites integrating with approaches that prioritize processes of meaning-making through social interaction. WF stresses accounting for the subjectivity of interpretation of forms, recognizing that cultural categories are performed through our engagement with other stakeholders, their interests and ours, and hence those actors at work should be explicated in the account. This cannot be achieved, at least with our current research capacities, by a pure and singular focus on material dynamics. We need tools to account for subjectivity and interests, to achieve empathy with the actors, improve the reflexivity of the researcher, or discuss ethics or responsibility of research.²⁴ This is exemplified in our account of VOCI, where we use ethnography and participant comprehension, and where we move between statements about people, their interactions, feelings, desires, and how these interactions manifested materially, took place in a material environment, and left material traces for us to account for.

We therefore see the strength of WF in that it brings a sensibility, mainly through the understanding of the physical world that it provides. It adds up to other approaches by shifting the lens, from attending to interactions, expressions and meaning-making among people, towards the material dynamics of these processes. This shift between analytical focuses and integration of the biographies of people as well as objects and material movements enriches the analysis, and encourages firm and concrete grounding for the cultural categories we construct.

In many ways, the WF framework helps researchers attend to mundane details of expressions and practices which are often overlooked. It has been recognized that with the multilayeredness of

²² Indeed, Halabi (2016) has compared VOCI with other cases reported in the literature, where he argues that, as far as we are concerned with conflict, our case relates to contexts where the distribution of digital privileges among members becomes problematic.

²³ These are well established features of various frameworks and methods in qualitative sociology and humanities which have informed Zimmermann's theoretical approach. See for example the work of Corbin and Strauss on Grounded Theory (2007); Becker's work on sociological research methods (1998); Latour's overview of the actor-network framework (2005); Bijker, Hughes, and Pinch on the social construction of technology (1987); and Ragin and Zaret's discussion on the comparative strategies of Durkheim and Weber (1983).

²⁴ Here for instance, we find Brunello's (2015) ecological approach to study and deal with intercultural encounters in ICT for development (ICT4D) projects particularly useful.

technological systems, it becomes necessary to rely on technical infrastructures (e.g., Facebook, or the Internet domain name system in the case of VOICI); a base on which community activities and technologies operate. Such infrastructures become often embedded in various arrangements, invisible, yet carry certain inertia and a capacity to shape practices in the conventions and standards they embody (Star and Ruhleder 1996; Star 1999). WF emphasizes the researcher's role in providing an account of such material structures to render explicit their role in framing interaction (such as the way Internet tools frame modes of ownership and conflict in our case), thus countering the tendency of infrastructure to disappear in the background (see the notion of "infrastructural inversion", Bowker 1994; Star and Bowker 2006). This sensibility of the WF framework, a quality that comes from its roots in STS, is crucial in the context of design research, for otherwise technical aspects of human interactions that relate to infrastructure tend to become confused or taken for granted.

In our view, the specificity of WF is that it provides a new perspective on materiality. By looking at expressions and practices as aggregates of waves, traveling through people's bodies and brains, through buildings and institutions, through documents and digital technologies, and so forth, cultural issues do not become more simple or reified, but they become clearer and easier to trace.

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References

- Abu-Isma  l K, Abdel-Gadir A, El-Laithy H (2011) Poverty and Inequality in Syria (1997-2007). UNDP, Arab Development Challenges Report: 2011/15
- Andrade AD, Urquhart C (2010) The Affordances of Actor Network Theory in ICT for Development Research. *Information Technology & People* 23 (4): 352-74
- Averweg UR, Leaning MA (2011) Visions of Community: Community Informatics and the Contested Nature of a Polysemic Term for a Progressive Discipline. *Information Technologies & International Development* 7 (2): 17-30
- Baaz ME (2001) Introduction: African Identity and the Postcolonial. In: Baaz ME, Palmberg M (ed): *Same and Other: Negotiating African Identity in Cultural Production*. Elanders Gotab for the Nordic Africa Institute, Stockholm, p 5-21
- Baldwin JR, Faulkner SL, Hecht ML, Lindsley SL (eds) (2006) *Redefining Culture : Perspectives across the*

- Disciplines. Lawrence Erlbaum Associates, Mahwah, New Jersey
- Becker HS (1998) *Tricks of the Trade: How to Think About Your Research While You're Doing It*. University of Chicago Press, Chicago, IL
- Berti B, Paris J (2014) *Beyond Sectarianism: Geopolitics, Fragmentation, and the Syrian Civil War*. Strategic Assessment 16 (4): 21–34
- Bijker WE, Hughes TP, Pinch T (eds) (1987) *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*. MIT Press, Cambridge, MA
- Blanchette JF (2011) A Material History of Bits. *Journal of the American Society for Information Science and Technology* 62 (6): 1042–57
- Bosman M (2012) *The NGO Sector in Syria – an Overview*. INTRAC Policy Briefing Papers (30), Oxford, UK
- Bowker GC (1994) Information Mythology and Infrastructure. In: Bud-Freeman L (ed) *Information Acumen: The Understanding and Use of Knowledge in Modern Business*. Routledge, London, p 231–47
- Brunello P (2015) *Broken Premises : Towards an Intercultural Understanding of Bilateral Cooperation in ICT for Education in Burundi*. Dissertation, Royal Holloway, University of London
- Carroll JM (2001) Community Computing as Human-Computer Interaction. *Behaviour & Information Technology* 20 (5): 307–14
- Carroll JM, Rosson MB (2006) The Participant-Observer in Community-Based Learning as Community Bard. *J Community Informatics* 2 (2).
<http://ci-journal.net/index.php/ciej/article/view/345/251>
- Choi B, Lee I, Kim J, Jeon Y (2005) A Qualitative Cross-National Study of Cultural Influences on Mobile Data Service Design. In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems CHI 05*. ACM Press, New York, NY, p 661
- Clemmensen T, Røse K (2010) An Overview of a Decade of Journal Publications about Culture and Human-Computer Interaction (HCI). In: Katre D, Orngreen R, Yammiyavar P, Clemmensen T (eds) *Human Work Interaction Design: Usability in Social, Cultural and Organizational Contexts*. Springer, Heidelberg, p 98–112
- Collins H (1984) Researching Spoonbending: Concepts and Practice of Participatory Fieldwork. In: Bell C, Roberts H (eds) *Social Researching*. Routledge, London, p 54–69
- Collins H, Evans R (2015) Probes, Surveys, and the Ontology of the Social. *J Mixed Methods Research*. doi: 10.1177/1558689815619825
- Corbin J, Strauss A (2007) *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*, 3rd edn. Sage Publications, London
- Descola P (2013) *Beyond Nature and Culture* (trans: Lloyd J). University of Chicago Press, Chicago, IL
- Easterbrook SM, Beck EE, Goodlet JS, Plowman L, Sharples M, Wood CC (1993) A Survey of Empirical Studies of Conflict. In: Easterbrook S (ed) *CSCW: Cooperation or Conflict?*. Springer, London, p 1–68
- Ess C, Sudweeks F (2006) Culture and Computer-Mediated Communication: Toward New Understandings. *J Computer-Mediated Communication* 11: 179–91
- Faulkner P, Runde J (2011) The Social, the Material, and the Ontology of Non-Material Technological Objects. In: *The European Group for Organizational Studies (EGOS) Colloquium*, Gothenburg,

Sweden

- Goodwin I (2008) Community Informatics, Local Community and Conflict. *Convergence: The International Journal of Research into New Media Technologies* 14 (4): 419–37
- Halabi A (2016) Designing ICTs for Conflict in Local Voluntary Communities. Dissertation, University of Fribourg
- Halabi A (2014) The Use of Social Media in Syria.
<http://socialinformaticsblog.com/2014/04/24/the-use-of-social-media-in-syria/>.
Accessed 11 June 2015
- Halabi A, Sabiescu AG, David S, Vannini S, Nemer D (2015) From Exploration to Design: Aligning Intentionality in Community Informatics Projects. *The Journal of Community Informatics* 11 (3).
<http://ci-journal.net/index.php/ciej/article/view/1160>
- Halabi A, Zimmermann B, Courant M (2013) Participate, Collaborate, and Decide: Defining Design Problems in a Syrian Community. In: *Proceedings of the Sixth International Conference on Information and Communications Technologies and Development Notes - ICTD '13*, vol 2. ACM Press, New York, NY, p 49–52
- Hall ET (1976) *Beyond Culture*. Anchor Doubleday Press, Garden City, NY
- He HA, Memarovic N, Sabiescu A, de Moor A (2015) CulTech2015: Cultural Diversity and Technology Design. In: *Proceedings of the 7th International Conference on Communities and Technologies - C&T '15*. ACM Press, New York, NY, p 153–56
- Heeks R, Stanforth C (2015) Technological Change in Developing Countries: Opening the Black Box of Process Using Actor–network Theory. *Development Studies Research* 2 (1): 33–50
- Hofstede G (1991) *Cultures and Organisations: Software of the Mind*. McGraw-Hill, New York, NY
- Hofstede G (1980) *Culture's Consequences: International Differences in Work-Related Values*. SAGE Publications, Beverly Hills, CA
- Honold P (1999) Learning How to Use a Cellular Phone: Comparison Between German and Chinese Users. *Technical Communication* 46 (2): 196–205
- Human Rights Watch (2010) *A Wasted Decade: Human Rights in Syria during Bashar Al-Asad's First Ten Years in Power*. Report, no. 1-56432-663-2
- Human Rights Watch (2007) *No Room to Breathe - State Repression of Human Rights Activism in Syria*. Report, vol 19, no. 6(E)
- Irani L, Vertesi J, Dourish P, Philip K, Grinter RE. 2010. Postcolonial Computing: A Lens on Design and Development. In: *Proceedings of the 28th International Conference on Human Factors in Computing Systems - CHI '10*. ACM Press, New York, NY, p 1311
- Jagne J, Smith-Atakan ASG (2006) Cross-Cultural Interface Design Strategy. *Universal Access in the Information Society* 5 (3): 299–305
- Jahoda G (2012) Critical Reflections on Some Recent Definitions Of 'culture.' *Culture & Psychology* 18 (3): 289–303
- Kavanaugh A, Carroll JM, Rosson MB, Zin TT, Reese DD (2005) Community Networks: Where Offline Communities Meet Online. *J Computer-Mediated Communication* 10 (4): article 3
- Kayan S, Fussell SR, Setlock LD (2006) Cultural Differences in the Use of Instant Messaging in Asia and

- North America. In: *Proceedings of the 2006 20th Anniversary Conference on Computer Supported Cooperative Work - CSCW '06*. ACM Press: New York, NY, p 525
- Kinninmont J (2014) The Syria Conflict and the Geopolitics of the Region. IEMed Mediterranean Yearbook. European Institute of the Mediterranean, Barcelona
- Kroeber AL, Kluckhohn C (1952) *Culture: A Critical Review of Concepts and Definitions*. Harvard University Press, Cambridge, MA
- Kuper A (1999) *Culture: The Anthropologists' Account*. Harvard University Press, Cambridge, MA
- Lamont M, Molnár V (2002) The Study of Boundaries in the Social Sciences. *Annual Review of Sociology* 28 (1): 167–95
- Latour B (2005) *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford University Press, Oxford, UK
- Leonardi PM (2010) Digital Materiality? How Artifacts without Matter, Matter. *First Monday* 15 (6). <http://firstmonday.org/article/view/3036/2567>
- Lynch M, Freelon D, Aday S (2014) *Syria's Socially Mediated Civil War*. United States Institute of Peace, Washington, DC
- Mackenzie D, Wajcman J (1999) Introductory Essay. In: Mackenzie D, Wajcman J (eds) *The Social Shaping of Technology*, 2nd edn. Open University Press, Buckingham, UK
- Marcus A, Gould EW (2000) Crosscurrents: Cultural Dimensions and Global Web User-Interface Design. *Interactions* 7 (4): 32–46
- Marsden G, Maunders A, Parker M (2008) People Are People, but Technology Is Not Technology. *Philosophical Transactions. Series A, Mathematical, Physical, and Engineering Sciences* 366 (1881): 3795–3804
- Merritt S, Stolterman E (2012) Cultural Hybridity in Participatory Design. In: *Proceedings of the 12th Participatory Design Conference on Exploratory Papers, Workshop Descriptions, Industry Cases - Volume 2 - PDC '12*. ACM Press, New York, NY, p 73
- Musiani F (2016) Alternative Technologies as Alternative Institutions: The Case of the Domain Name System. In: *The Turn To Infrastructure in Internet Governance*. Palgrave/Macmillan, New York, NY, p 73–86
- Narayanan A, Toubiana V, Barocas S, Nissenbaum H, Boneh D (2012) A Critical Look at Decentralized Personal Data Architectures. Position paper
- Nasser R, Mehchy Z, Abu Ismail K (2013) *Socioeconomic Roots and Impact of the Syrian Crisis*. Report, Syrian Center for Policy Research, Damascus, Syria
- Nelson HG, Stolterman E (2012) *The Design Way: Intentional Change in an Unpredictable World*, 2nd edn. MIT Press, Cambridge, MA
- Neyland D (2016) Bearing Account-Able Witness to the Ethical Algorithmic System. *Science, Technology & Human Values* 41 (1): 50–76
- Phillips Christopher (2015) Sectarianism and Conflict in Syria. *Third World Quarterly* 36 (2): 357–76
- Pink S, Ardèvol E, Lanzeni D (eds) (2016) *Digital Materialities: Design and Anthropology*. Bloomsbury Academic, London
- Ragin C, Zaret D (1983) Theory and Method in Comparative Research: Two Strategies. *Social Forces* 61

(3): 731–54

- Reinecke K, Nguyen MK, Bernstein A, Näf M, Gajos KZ (2013) Doodle around the World. In: *Proceedings of the 2013 Conference on Computer Supported Cooperative Work - CSCW '13*. ACM Press, New York, NY, p 45
- Salem F, Mourtada R (2011) *Civil Movements : The Impact of Facebook and Twitter*. Arab Social Media Report, vol 1, Dubai, UAE
- Salgado L, Pereira R, Gasparini I (2015) Cultural Issues in HCI: Challenges and Opportunities. In: Kurosu (ed) *Human-Computer Interaction: Design and Evaluation*. Lecture Notes in Computer Science, vol 9169. Springer International Publishing, Cham, Switzerland, p 60–70
- Sismondo S (2010) *An Introduction to Science and Technology Studies*, 2nd edn. Wiley-Blackwell, Malden, MA
- Star SL (1999) The Ethnography of Infrastructure. *American Behavioral Scientist* 43(3): 377–391
- Star SL, Bowker GC (2006) How to Infrastructure. In: *Handbook of New Media: Social Shaping and Social Consequences of ICTs, Updated Student Edition*. Sage Publications, London, p 230–45
- Star SL, Ruhleder K (1996) Steps Toward an Ecology of Infrastructure: Design and Access for Large Information Spaces. *Information Systems Research* 7 (1): 111–34
- Syria Needs Analysis Project (2013) Relief Actors in Syria. Report, The Assessment Capacities Project
- Vlachokyriakos V, Dunphy P, Taylor N, Comber R, Olivier P (2014) BallotShare: An Exploration of the Design Space for Digital Voting in the Workplace. *Computers in Human Behavior* 41: 433–43
- Wolfsfeld GES, Sheafer T (2013) Social Media and the Arab Spring: Politics Comes First. *The International Journal of Press/Politics* 18 (2): 115–37
- Woolgar S, Neyland D (2013) *Mundane Governance: Ontology and Accountability*. Oxford University Press, Oxford, UK
- Wyatt S (2008) Technological Determinism Is Dead: Long Live Technological Determinism. In: Hackett EJ, Amsterdamska O, Lynch ME, Wajcman J (eds) *The Handbook of Science and Technology Studies*, 3rd edn. MIT Press, Cambridge, MA, p 165–80
- Ziewitz M (2016) Governing Algorithms: Myth, Mess, and Methods. *Science, Technology & Human Values* 41 (1): 3–16.
- Zimmermann B (2006) De l'impact de la technologie occidentale sur la culture chinoise: les pratiques des musiciens électroniques à Pékin comme terrain d'observation de la relation entre objets techniques et création artistique. Dissertation, Université de Genève
- Zimmermann B (2010) Redesigning Culture: Chinese Characters in Alphabet-Encoded Networks, *Design and Culture* 2(1): 27–43
- Zimmermann B (2015) *Waves and Forms: Electronic Music Devices and Computer Encodings in China*. MIT Press, Cambridge, MA
- Zimmermann B (2013) Materiality, Description, and Comparison as Tools for Cultural Difference Analysis. In : Hartley J, Burgess J, Bruns A (eds) *A Companion to New Media Dynamics*. Wiley-Blackwell, Oxford, UK, p 439–49
- Zimmermann B, Nova N (2015). Circulation: A Theoretical Toolkit. *Design and Culture* 7(2): 167–84