From Exploration to Design:
Aligning Intentionality in Community Informatics Projects

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ABSTRACT

This article focuses on a particular aspect of research and design processes in community-based projects: the transition from exploratory stages, concerned with knowledge production, to design stages, in which goals for action-taking are formulated and desired directions for change are envisioned. This paper offers a reflection about the methodological processes that underpin this transition, in response to the questions*: How are design goals formulated in community informatics interventions that rely on data-intensive exploratory methodologies, and what factors and dynamics shape them?* Guided by these questions, we shed light on various issues related to this transition by recounting and analysing cases taken from field experiences within three different community projects in Syria, Brazil and Mozambique. The article proposes that the transition is associated with shifts in intentionality, which are elusive and hard to grasp, particularly in participatory approaches. Three analytical categories are put forward to illuminate the dynamics of intentionality shifts along the continuum of transitioning from exploration to design. Reflections based on the empirical cases are contributed.

INTRODUCTION

Community informatics (CI) has a strong problem-solving and pragmatic orientation, being concerned with "effective use" (Gurstein, 2003), action, and contributing to community well-being. The methodological approach of CI "foregrounds social change and transformative action" (Stillman, 2014, p. 201). In such spirit, the most valuable type of knowledge that research can elicit is "actionable knowledge" in the vein of Community-based Participatory Research (CBPR) (Roche, 2008). The relation between eliciting knowledge and designing action appears to be at the core of informed CI research, yet it is more elusive than in other design and development disciplines. By foregrounding communities, CI research distances itself from traditional IT design which focuses on creating and adapting novel technologies and interfaces. CI also aspires for a more inclusive approach, in which different stakeholder visions and a wider set of actions are examined to support the well-being of communities (Gurstein 2007). Therefore, the problem of transitioning from exploration and knowledge production to designing action, which is an acknowledged issue in IT design (Taylor 2009; Rogers 2004), is amplified in CI, as authority over design is distributed among researchers, community members, and organizations. This is especially the case with the adoption of participatory approaches to research and design, which involve forms of collaboration and partnership with target communities (Carroll & Rosson, 2007; Merkel et al., 2007).

This article aims to unravel some of the dynamics of transitioning from exploratory to design stages in community-based design interventions. The article considers all types of CI interventions, but is particularly concerned with two kinds of approaches: first, participatory research and design; second, those approaches involving data-intensive exploratory methodologies such as ethnography.

These approaches present unique challenges, mainly due to the distribution of research and design processes among different stakeholders, as well as to the large quantity of data generated during exploratory phases (e.g. a sizable number of interviews and observations). We empirically build our study on three community-based research cases from our work in Syria, Brazil, and Mozambique. The cases are diverse in their initial goals, locations, methods, structures and stakeholders, yet they all employed qualitative, data-intensive methods, and were committed to collaborative exploration of problems and desired actions through participatory approaches.

The article finds that the transition from exploration to design is most significantly marked by shifting design intentions, which in CI projects are multiple and constantly evolving as they are informed by the knowledge and interests of different stakeholders. The crux of successful CI projects resides in aligning design intentions towards a common vision, manifested in the formulation of design goals agreed by stakeholders. The article discusses the process of aligning design intentions by analysing empirical data from the cases along three analytical categories: *knowledge pathways, stakeholder involvement,* and *conceptual and methodological framing*. It further discusses the resulting framework against relevant participatory research and design literature.

RELATED WORK

The transition from exploratory research to design has been investigated in various disciplines concerned with studying design and action informed by socially-grounded research. Researchers have developed various vocabularies to refer to that transition. In Action Research (AR), this transition has been subsumed in "Action Planning" (Susman & Evered, 1978; Bilandzic & Venable, 2011). In Design Science Research (DSR), moving towards design action is relevant either to the "suggestion phase" (Vaishnavi & Kuechler, 2013) or to "theory building" (Venable, 2006), where technological possibilities are identified and decided. Finally, researchers using ethnography often speak of "design implications" (Taylor, 2009). These labels, however, have different nuances: AR's "action planning", is active, intentional, and involves choices, while "design implications" derived from ethnographic field studies often refer to a range of possibilities that can be inferred without explicit choices being made.

Closer to the AR end of the spectrum, this article focuses on the notion of "formulating design goals" as an intentional, inter-subjective transition from exploration to envisioning change-oriented activities that can be afforded by the research endeavour. The article critically engages with two main observations on the transition from exploration to design in existing scholarship. The first is that design is wicked and emergent, and the second regards the intricate relation between design and knowledge.

Design is Wicked and Emergent

Researchers have frequently pointed out that real-world design problems are wicked and ill-defined: working on design problems involves continuous refining and structuring of those problems (Jonassen, 2000). Moreover, leaping from what is known to identifying a problem and devising a solution involves creativity, which is poorly understood (Vaishnavi & Kuechler, 2011). This "wickedness" in design problems and the "creativity" needed to solve them suggest that talking about the transition from knowledge to action is challenging, which could explain why this transition is still replete with unknowns, despite the contribution of a number of studies which addressed it.

Scholars also argue that design is emergent and contingent upon the social settings it is embedded in (Sein et. al., 2011; Venable, 2006; Horan & Wells, 2005). To harness this emergence, participatory design projects in community contexts have worked on enabling public participation and innovation by creating supporting spaces and settings (Björgvinsson, Ehn, & Hillgren, 2010; Merkel, 2004), connecting publics (Horan & Wells, 2005; DiSalvo et al., 2011; Björgvinsson et al., 2010), and creating supporting tools for communication and consensus (Bodker & Iversen, 2002). These works look at design/planning/action as an object that requires participatory learning and

participatory expression to come into being, and suggest creating suitable environments to support its emergence.

In this article, we go a step further to examine how this emergence unfolds and we analyse various pressures and choices involved in formulating design goals in community-based research.

The Connection(s) Between Knowledge and Design

It is widely acknowledged that design and planning of action should be informed by rigorous knowledge of the situation. This applies to various design- and action-oriented disciplines, and is as well emphasized in community-based research and design (Pipek et al., 2000), where the importance of garnering socio-cultural understanding is stressed (Bilandzic & Venable 2011; Horan & Wells 2005). Authors have duly pointed to the complex relation between knowledge and design: knowledge can take various forms; can be produced by scientists and local communities alike; its interpretation, filtering and operationalization for decision making stem from various interests and are subject to power differences (Bardzell, 2010; Irani et. al., 2010); it is, in turn, involved in asserting and gaining power through establishing legitimacy (Arnold & Stillman, 2009); and its construction is intimately tied to the methods and conventions of its creation (Latour, 1986). Process-wise, knowledge production and design decisions are majorly intertwined and iterative (Sein et. al, 2011).

This article condenses these distributed observations about the role of knowledge in informing design with communities, and relates them to other critical factors that influence this transition: the stakeholders who produce and interpret knowledge and take design decisions, and the conceptual and methodological frames that shape the wider setting where stakeholders operate and negotiate various understandings and decisions.

STUDY METHODS

To address the aim of examining the transition from exploration to designing action, a methodological approach was adopted that combines inquiry, retroactive observation on practice, and critical reflection. This approach draws on a cyclical pattern of inquiry, action, observation and reflection that can be found in the work of John Dewey (e.g. 1938, 1991), in Schön's work on reflective practice (1991), and in most forms of AR and Participatory Action Research - PAR (e.g. Reason and Bradbury, 2001). The fundamental assumption underpinning these approaches, and implicitly our own study, is that observation and reflection on action contribute to generating knowledge and devising novel perspectives and understandings that can be employed to improve further practice. These outcomes are particularly fruitful when reflection is undertaken in collaborative settings involving active inquiry and sharing of ideas. In our study, observation and reflection were conducted on our accomplished or on-going research projects to generate new perspectives and to think critically through processes and outcomes. Three projects conducted in Syria, Brazil and Mozambique were selected as case studies to give concreteness to this reflective exercise and to facilitate cross-analysis at later stages. The cases share a strong orientation towards participatory and qualitative approaches. Yet, they also illustrate diversity in terms of location, socio-cultural context, research goals, methodology, and project structure.

Through cycles of analysis and reflection on the three case studies, the scope of our investigation, and the initial research question were gradually refined. We concentrated on "formulating design goals" as a key focus for our analysis, and we focused on CI interventions that use rich data to inform design. The two research questions guiding the investigation were:

1. How are design goals formulated in CI interventions that rely on data-intensive exploratory methodologies?
2. What factors and dynamics shape them?

Three analytical categories emerged as common and important across the three cases -*knowledge pathways*, *stakeholder involvement,* and *conceptual and methodological framing*(see Halabi et al., 2014). In a second stage, cross-analysis was undertaken to understand how similar issues played out and were solved differently in the cases selected. This gave rise to the concept of "*aligning design intentions*" which we used as a unifying theme for our findings. The emergence, evolution and alignment of design intentions in each case was examined by means of the first three analytical categories and then contrasted across cases. This process of iterative comparison, hypothesizing, and then back to verification with qualitative data resonates with inductive analysis in sociology (e.g. Becker, 1953; 1990). In the next section, we introduce the three analytical categories, along with the concept of "aligning design intentions". By this we sketch a conceptual framework for reflecting on the transition towards design.

ALIGNING DESIGN INTENTIONS: A CONCEPTUAL FRAMEWORK

Although the three analytical categories emerged empirically through our iterative analysis, they resonate with similar concepts treated in CI, design, HCI and PAR literatures. These are further outlined below.

Knowledge pathways refers to the trajectories taken by knowledge, from knowledge production episodes (e.g. informal conversations, storytelling, and interviews) to insights that inform design, and beyond, making their way into the community ecology with varied impacts. By using this notion, the study calls attention to the variety of knowledge instances that inform design, coming from different sources, and featuring different degrees of interpretation. Knowledge sources can be formal and researcher-sanctioned, if they follow rigorous procedures for data collection and analysis, or can be informal (e.g. local group conversations). The term "knowledge" has been preferred over the one of "information". This recognizes that it incorporates both explicit and tacit dimensions (Christie, 2004; Nonaka et al., 2000), which are dynamic and reconfigured during the process of research and design. While the data generated through formalized procedures are instances of representational knowledge (i.e. information, see Christie, 2004), these can be used to trigger and inform new reflections and knowledge instances.

A sizable number of studies engage with the interplay between knowledge and power in CI research (Arnold & Stillman, 2009). Realizing that including certain types of knowledge while discarding others is entangled with the exercise of power, researchers have been concerned with the validation of various types of knowledge (tacit and explicit; common and scientific). This is a critical point in making community-based research and design initiatives inclusive, while observing academically sanctioned measures of validity. These views are exemplified in feminist and postcolonial studies (Harding, 2003; Briggs & Sharp, 2004), in their appropriation in design studies (Bardzell 2010; Irani, 2010; Winschiers-Goagoses et al. 2012), in community-based research (Green, 2001), and in participatory approaches to research and development (Dearden & Rizivi, 2008).

Stakeholder involvement refers to the degree of stakeholder participation in decision-making along different stages of an initiative. It is also concerned with the various interests and agendas brought by the stakeholders. For this study, involvement in exploratory and design stages is particularly relevant. Involvement can be quantified in terms of participation in actions ranging from data generation, interpretation, and informal knowledge production episodes, to decision-making in design activities.

Attention to various stakeholders, their interests and roles has been emphasized through the notion of "participation" in design, development, and research, which stems from ethical and practical preoccupations to collaborate with people and communities within the scope of the initiative. Some of the knotty issues echoed by researchers include: the identification of rightful stakeholders in community-based projects (Heeks, 1999; Vines et. al., 2013), tensions and conflicts associated with different local agendas held by different stakeholder groups (Sabiescu et al., 2014; Vines et. al., 2013), knowledge differentials and challenges posed by informed participation in design (Bidwell and Hardy, 2009; Mutenda et. al., 2011), and the types of stakeholder involvement and participation

afforded by a project along a project timeline and in relation to the importance of decisions taken (Heeks 1999; Mutenda et. al., 2011).

Conceptual and methodological framing captures the process by which the space of possibility for research and design decisions is defined and limited through conceptual and practical choices that can be advanced equally by researchers and community members. In this sense, choosing a particular theory and methodological framework, and the way to structure project activities, are all framing actions, because they limit the space of possibility for design processes and outcomes. Framing approaches are analysed in this study in terms of structure (highly structured vs. free-flow), and with reference to landmark framing judgements. In design, "framing judgment" refers to deliberation acts that define and limit "the space of potential design outcomes" (Nelson & Stolterman, 2012: 199). They are intentional acts that set boundaries for the design process conceptually, creatively, and practically, deciding what is kept and what is left outside (Ibid.).

Framing is less explicit as a concern in approaches popular in CI. However, it is recognized that the mental and theoretical frameworks we adopt, as well as the material means available, have a significant role in shaping further learning and future action (including the design of technology). This has been well highlighted in the social sciences (e.g. Becker, 1990), and in research on the social construction of knowledge in science and technology (Latour, 1986).

During cross-analysis, we identified a common pattern in the findings that prevailed along all three analytical categories. This pattern showed a movement that occurred during the moments of transition towards design (formulating design goals), which implied a shift in design intentions. Simply described, the transition towards design required aligning the intentions and agencies of various knowledge sources, stakeholders, and framings to formulate common design goals and generate momentum towards common action.

Arnold & Stillman noted a similar issue under the label of "Translations of Interest", which "refers to an alignment of participants such that their resources, agencies, authority, brute force and so on, are articulated rather than in opposition or tangential to one another" (2009). While the authors were concerned with how CI initiatives deal with the translation of interests to reach community "empowerment" as an umbrella goal, we observe a relevant pattern on an empirical level, involving the CI initiative, and during the moments of formulating design goals. Thus, when interpreted in light of Arnold & Stillman's exposition, *aligning design intentions* is a movement to gather momentum (or power) for formulating common design goals and committing to them, where the intentions of diverse actors (including the researchers) need to be distilled and aligned.

This resonates with discourses that stress the need to consolidate various visions in community-based research and design. For example, PAR (as a research framework and orientation) has been adopted to build a "common vision" between that of the researchers and the community (Sabiescu, 2010). Similar participatory approaches have been also adopted to build a "common vision" to contribute to social capital and the capacity to act (Calabrese 2006), and to "align perspectives" and reach "common goals", "common understanding", and "common interest" in CBR partnerships (Green, 2001). Various PD approaches aspire to accommodate diverse visions by creating inclusive spaces and tools to facilitate the interaction between designers and stakeholders (e.g. Muller, 2002; Sabiescu et al., 2014). Building a common vision is therefore a primary concern when there is a multiplicity of stakeholders involved in collaboration. This concern combines various aspects related to aligning different sources of knowledge and multiple interests. By coining the term "aligning design intentions", we frame design as being both intentional (driven by subjective agency) and diverse in origin (several people, institutions, and forces are involved). Thus, we highlight *intention* as the critical element that needs to be aligned for common action to take place. Knowledge, interests of various stakeholders, and the pressures brought by conceptual and material framings all become dimensions of a process underpinning the alignment of design intentions.

We summarize the features and the implications of the concept of "aligning design intentions" in the following points. First, and as the label suggests, it views the transition towards designing action as

a collective product of interests and intentional acts. Second, it views intentions involved as diverse and shifting. Thus, it highlights heterogeneity and tension within and between community groups and in contact with the CI project. Third, it highlights action as political, power-laden, and as an issue of confrontation and struggle facing material and social reality. It also implies that enough momentum of intentions pointing in the same direction is required for action to take place. Finally, it does not pre-assume a clear division between the "community" and the "researcher" or the "CI project" since the utility of such distinction depends on the particular case under examination. It looks at them as being on the same level of analysis, where everybody is an actor with intention and capacity oriented towards a certain direction, although those capacities are often disproportionate and need to be discussed.

The conceptual framework we introduced, combining the concept of "aligning design intentions" with the three analytical categories, is useful to describe how decision-making and planning in CI interventions occurs. It is also useful as a tool to reflect on progress, or to analyse failure. We concretely show this in the analysis and the discussion in the remainder of this article.

CASES AND ANALYSIS

This section introduces three community-based research projects conducted in Syria, Brazil and Mozambique. The cases have been selected to illustrate diversity in terms of location, socio-cultural context, research goals, methodology, and project structure. We present each case using the three analytical categories underpinning the process of aligning design intentions: *knowledge pathways, stakeholder involvement*, and *conceptual and methodological framing*. A summary overview of the three cases is provided in Table 1.

Case 1: OH.DIY and the Search for Better Management

The first case is concerned with the "Open Hardware and Do it Yourself" (OH.DIY) group, which brought together volunteers and Arab speakers interested in learning and sharing information around hardware making and electronic design. The case of OH.DIY (a part of a wider collaborative community) was observed within a project that involved a two year participation and online ethnography that started in December 2011. The study examined how communities and voluntary groups used online social tools to collaborate and what problems they faced (Halabi, Zimmermann, & Courant 2013).

The overarching concern of moderators in OH.DIY has been to devise an effective approach to govern the group, encourage members to participate, and enrich the movement of Open Hardware in the Arab-speaking sphere. This concern crystallized in different concrete goals derived from members' interests and from their learning through activities and interactions in the group. The case of OH.DIY shows how group moderators deliberated on designing and tweaking their online space.

Knowledge pathways
Initially, Yamen[i] (a founder and a moderator) created a Facebook group for OH.DIY and invited new members. Members started sharing news on open hardware and brainstorming ideas for Arduino projects and workshops. Members also discussed various topics ranging from recent blog posts on printing robot bodies using 3D printers, through posting questions about the correct way to use a certain transistor, to posting invitations for translating relevant articles. Subsequently, Yamen suggested creating a space dedicated for organization. He suggested that when the group grew in size, it needed a place to brainstorm, plan, and focus on organizing hardware-making workshops to go beyond sharing information. This insight was driven by his aspiration and observation that the main group was not a suitable place for organizational discussion, and it resonated with the interests and observations of the two other moderators (including the researcher), who joined in the effort. After experimenting with different tools (email, a message group) they decided to use a Facebook group for management as well. In the process, they frequently exchanged their reflections on difficulties and best management practices learned through trial and error (with the researcher often basing his reflections on his field notes). This helped aligning a common understanding on how to

deal with management and adapt this practice from other groups in the community which were pleased with the results. The Moderators then created a meta Facebook group for planning and organization, named "OH.DIY Organization".

Stakeholder Involvement

Members' involvement in the design of their digital space reflected the structure of the community itself. During the beginnings of OH.DIY as a group on Facebook, Yamen invited close colleagues and friends, including the researcher, to discuss future activities and how they would promote the group. At that early phase, the group was small (10 to 20 members), and members generally took decisions together. As the group grew, members needed an independent space to discuss group management. After communicating over email and text chat, that decision was taken by Yamen, the researcher, and Sara (another moderator). After experimenting with Google groups and Teamlab, they created a new Facebook group titled "OH.DIY Management". Shortly after, they invited two new members who were highly active in Open Hardware and in discussions on the main group. Since then, the moderators have used the new organizational group for discussions around management and activity planning. This flow shows who was involved in the design activities and when: from having a small OH.DIY group (where decisions and design activity were open to all founding members) to creating a dedicated space (where most active members are the ones who mainly deliberate on design before sharing their proposals with the rest of the community).

Conceptual and Methodological Framing

The researcher, in addition to being personally interested in the group, was involved in studying the practices of its members and their use of online tools. At that time, the researcher was not bound to inducing a certain change or outcome. He started as a participant observant, but as the study progressed, he became actively and equally involved with other members (inspired by Collins' notion of "Participant Comprehension", 1984). This was possible as community members used online social tools and were continuously reflecting and re-configuring their digital environment (Halabi, Courant, & Zimmermann, 2013). Data was gathered by capturing screenshots and field notes of online activity and discussions. This allowed the researcher to integrate with the interests of other members, and to adopt local conceptual categories both in collaborating with them and in analysing data (such as the understanding of "community", "collaboration", "management", and "participation"). In the same spirit, when Yamen brought up the issue of configuring management, the researcher participated with him and Sara in discussing and creating the management group. Their decision to adapt Facebook for management as well came from their collective experience, time commitment, the existence of the OH.DIY group on Facebook, and their conviction that Facebook is a popular platform in the Arab world. The moderators discussed continuously over email and chat, and thus co-constructed viewpoints and co-debated how to interpret the links between causes and effects. Therefore, the researcher's conceptions were not qualitatively distinct from those of group members, but since he systematically gathered and analysed data which contributed to a "longer memory" of the group, this allowed him to become a facilitator for reflecting on members' activities and practices (Carroll & Rosson, 2006).

Case 2: ABC Is Not Easy As 123, The Case of Keyboards in the Favelas of Brazil

The second case presents a study about the use of ICTs by Favela (urban slums) residents in community technology centres (CTCs). Favelas are mostly inhabited by people from marginalised social classes and referred as "subnormal agglomerations" and zones of social abandonment (Nemer & Reed, 2013). Favela residents get poor services for their basic needs, such as health and education, as well as low access to technology and the Internet. Based on fieldwork from May to October 2013 in the Favelas of Vitória, Brazil, this study highlights the motivations, engagements, and adoption of ICTs by marginalized people in CTCs, such as telecentres and LAN houses. It attempts to understand the experience of the marginalised in CTCs, and how their experience informs the ways we should think about what constitutes empowerment vis-à-vis ICTs.

For this paper, we focus on the experience of Favela residents with the computer keyboard. We lay out the users' struggle and bring to light their design suggestions for the QWERTY keyboard, which was an alphabetical keyboard (AK). AK has been claimed to be inefficient by several scholars (see Granata et al., 2010), yet, such studies were conducted in countries where the participants were already used to the QWERTY keyboard. In the Favelas, where the people were not raised around western artefacts, people perceived that an AK would improve their experience with the technology. Even though designing an AK may not be the most suitable layout in the end, it would certainly be a first step towards a keyboard that could better fit the locals' needs and expectations (Nemer et al., 2013).

Knowledge Pathways

Computers have emerged as symbols of modernity in both the developed and the developing world, and currently are seen as bridges to promote social and digital equalities. Because computers have been imported from the centre - United States and Western Europe - to nations on the periphery, they are often perceived as sites of resistance and struggle. One of the struggles that Favela residents had was with the standard QWERTY keyboard, which they found frustrating and upsetting:

> "I'm trying to learn how to use this thing [computer] but it doesn't make sense, I waste so much time to write [type] something because I can't find the right letters [keys]. It gets in the way of learning this thing [computer], I feel angry and unmotivated. But that's OK because when I find the damn letter [key] I don't push it, I punch it!" (Rosana, 47, Itararé).

This barrier caused anger in the persistent, but even worse it caused avoidance:

> "I don't have the patience, if I have to write [type] something I ask my son Jadson to do so. He comes here and gets everything done quicker than me. I know that this way I won't learn anything, but we have so many problems already." (Alice, 39, Itararé).

The letter keys were not the only issue in the CTC. The arrangement of the numerical keys was often contested by the users:

> "As you can see, I'm always on the phone and I'm used to these numbers [keys]. It starts up here with the number 1, and then goes down to 9 and then 0. Every time I have to write [type] my cellular [phone] on Face [Facebook], I have to do it two or three times because these numbers on the keyboard are upside-down" (Pedro, 16, São Benedito).

The community was discouraged to make improvements not because of lack of will, but lack of technological expertise and of the rhetoric behind the "untouchable perfect western" technology, which did not allow them to deconstruct the "black box" - keyboard. To deeply understand their complaints and ideas, the researcher organized a focus group at the CTC. When asked about how they would improve the keyboard, answers reflected this sense of powerlessness and voicelessness: "We can't change this keyboard", "it came like this, there's nothing we can do", "we are not capable or have the power to change this". After the researcher explained the possibilities of a potential change, they proposed a keyboard in alphabetical order and numbers following the telephone dial pad.

Stakeholder Involvement

Although the researcher performed an active role in approaching Favelas residents, organizing focus groups, and asking questions about their technology use, the findings shown here attempt to represent their genuine experiences. The researcher did not polish participants' voices in order to make them fit into a pre-defined theoretical framework. Hence, the study's findings shed light on the perspectives of Favela residents in order to bring the experience of those who are usually found at the "bottom of the pyramid."[ii]

The research involved 56 participants all of whom resided in the Favelas. 14 in-depth and semi-structured interviews were conducted in each CTC (with an average of 35-60 minutes per interview). The selected users visited the CTCs at least twice a week, 30 were female and 26 male and they fit into two age groups: 15-24 and 24-45. The focus group involved seven participants: four female and three male users of the CTC who volunteered to take part in the meeting.

Conceptual and Methodological Framing

In order to conduct the study, the researcher used methods drawn from critical ethnography, such as participant observation, interviews and focus groups (Nemer, 2015). Critical ethnography is a logical way to access cultural understandings about the values that surround technology use. This methodology provides the researcher with a powerful tool to resist domestication and encourages the researcher to not ask only "what is" questions but also "what could be" (Denzin, 2001). Following this line of thought, the researcher examined the design implications emerging from the community's opinion about, and struggles with the technology in four CTCs. Although design goals were not stipulated before engaging with the field, the researcher wanted to understand the experiences of Favela dwellers with technology, which were western artefacts, and analyse the potential consequences of such technology in non-western contexts. Hence, interviews were shaped to address the nuances of participants' experiences with the artefacts.

Case 3: The Community Multimedia Centre of Ilha de Moçambique

The last case is based on a project, called RE-ACT, which focused on Mozambican Community Multimedia Centres (CMCs), venues including a telecentre and a community radio (UNESCO, 2004). The project aimed to investigate the social meanings that different stakeholders attribute to CMCs and to design and implement actions to improve their performance.

RE-ACT included a research-intensive phase and an action-oriented phase. Data gathered in the first phase was meant to inform the second, which involved the design and implementation of customized small budget 18-months long improvement actions for the CMCs considered.

Knowledge Pathways

RE-ACT employed a structured approach for both its research-intensive and action-oriented phases. Yet, attention was paid to adequately involving local stakeholders through semi-structured interviews and questionnaires with different CMCs stakeholders, photo-elicitation, and observations. Finally, the researchers, CMC directors and local communities moved from learning to design by holding collaborative co-design sessions.

First, a hands-on co-design workshop was held in Maputo, involving RE-ACT researchers, initiating agencies and CMC directors. It consisted of three main sessions, aimed to (i) present from the exploratory phase and give "food for thought" on CMCs weaknesses and strengths; (ii) reflect on outcomes and key design elements (beneficiaries in the communities, their specific needs, the possibilities of the CMCs to help); and (iii) choose one improvement action per CMC and adapt it to each centre's context and infrastructure.

Second, two co-design workshops were organized at each CMC location to discuss final design details, one involving representatives of the communities and CMCs staff members, and one involving staff of the CMC only.

Upon analysis, the selection and initial design of the actions for improvement were not determined by data outcomes only, but also by the previous knowledge of CMCs' directors. The case of the CMC of Ilha de Moçambique is illustrative in this regard. The action involved creating a website to promote sustainable tourism on the island. Due to its rich history and significant natural and cultural value, in 1996 Ilha de Moçambique was declared by UNESCO a World Heritage Site. The island has therefore started to arrange infrastructures to host incoming tourists. The local community has shown interest in the preservation of the island and in making tourists attentive to local values, the environment and community development. The director's decision to implement a promotional

website for Ilha de Moçambique managed by the CMC was aligned with the main insights coming from the data, e.g. the need to improve the telecentre part of the CMCs more than the community radio part, and the need to localize and personalize telecentre services according to the specific local reality. Yet it also relied heavily on the director's knowledge of the context: the island is a World Heritage Site, visited by many tourists, it features an active association of little entrepreneurs in tourism, and it has a scarce online presence. This design choice aimed to benefit both the CMC and the local community, by (i) empowering the CMC to provide a novel service for the community, which would both generate new income and create a stronger link between the CMC and the community; and by (ii) promoting the social, cultural, and touristic value of the site, thus potentially attracting new sources of income for the community at large, as well as ensuring its conservation.

Stakeholder Involvement
Although RE-ACT had clear "top-down" design and implementation goals that determined its knowledge-gathering and design activities, its framing continuously dipped into local knowledge and aimed to encourage local stakeholders to get involved in decision-making processes. The role of local stakeholders became more prominent as the project progressed.

Researchers were involved in all phases of the project:

1. They designed and implemented the data gathering activities;
2. They pre-analysed the data;
3. They organised workshops and focus groups with local stakeholders;
4. They facilitated the selection of one improvement action per CMC process;
5. They acted as consultants in the consolidation and implementation processes of improvement actions.

Community members and the directors of the CMCs were involved in three ways:

1. They were interviewed and observed in order to learn and open up perspectives that could only emerge through local input;
2. They participated in a first workshop to brainstorm and decide the actions for improvement to be designed;
3. They were involved in co-design workshops to refine the design of the selected actions.

Conceptual and Methodological Framing
The project's conceptual and methodological framework resided in the belief that a "design-reality gap" (Heeks, 2002) is often at the basis of the failure of Information and Communication Technologies for Development (ICT4D) interventions, and that the specificities of different local contexts are frequently neglected in "top-down" project designs (Heeks, 2008; Unwin, 2009). Consequently, RE-ACT framed its methodology in the theory of social representations (Moscovici, 1961) to give voice to local perspectives without neglecting the expectations of funders and initiating agencies (Vannini, 2014).

The same way, the strategy of co-design (Sanders and Stappers, 2008; Ramachandran et al., 2008) was chosen to mark the transition from exploration to design, by dipping into local knowledge to foster community ownership and create enduring links between the CMCs and their communities (David et al., 2013).

Table 1. Summary overview of the cases showing the movement of aligning design intentions along the three analytical categories used

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Case 1: OH.DIY and the search for better management

Location: Syria (researcher based in Switzerland)

Research goals: (i) To contribute to local community development; and (ii) to design social internet tools to support local communities.

Knowledge pathways: Community members learned to establish distinct groupings to organize and manage their activities. This was implicit in the way members managed their groups, and explicit when reflecting on it. Moderators (including the researcher) frequently exchanged their reflections on difficulties, aspirations, and best management practices learned through trial and error. This helped aligning a common understanding on how to deal with management.

Stakeholder involvement: Little distinction in roles between researcher and community members. The researcher participated in discussions on improving group management and assisted in implementing the decided actions. The researcher thus participated within the existing community structure. Group moderators were the most active in group activities, and had higher influence on its life course. They followed an increasingly outward process in organizing activities, starting with focused discussion with core moderators and moving outward if the initiative gained agreement and momentum.

Conceptual and methodological framing: Ethnography, participant comprehension, and participatory design. This helped the researcher to adopt the concepts and categories used by community members to describe the community. It also allowed collaborating on pressing matters (that members agreed on) in the same settings members used for their activities.

Design goals: A Facebook group dedicated to discussing management-related issues.

Case 2: The case of Keyboards in the Favelas of Brazil

Location: Brazil (researcher based in the USA)

Research goals: (i) To understand the experience of marginalised people in CTCs; (ii) to inform common ways of thinking about "empowerment" and "disempowerment" vis-à-vis technology; and (iii) to produce knowledge usable for policy, which can also enable the design of CTCs and technologies suitable for the marginalised.

Knowledge pathways: Throughout the project, knowledge was retrieved through the mediation of the researcher, through ethnographic techniques. This lead to insights about the QWERTY keyboard layout in the context of the Favelas. Closer to the identification of design implications, knowledge production episodes were favoured that encouraged participants to reflect on their experiences and share their insights.

Stakeholder involvement: The researcher identified the issue and decided to go deeper by getting the users' perspectives. The researcher directed the interviews and focus group; the issue and solution were allowed to emerge from the users' experience.

Conceptual and methodological framing: Critical ethnography and assessing qualitative aspects of technology use, such as the non-instrumental ones.

Design goals: Favela dwellers urged for a keyboard that would be a better fit for their reality in the CTCs; one of the proposed designs was an alphabetical ordered keyboard.

Case 3: The Community Multimedia Centres of Ilha de Moçambique

Location: Mozambique (researchers based in Switzerland and Mozambique)

Research goals: (i) *To investigate the social meanings* attributed to technology solutions; (ii) *to design and implement actions to improve* the performances of the venues involved. Researchers' "top-down" goals remained unchanged throughout the project; local stakeholders were involved in formulating specific design goals and developing activities to achieve them.

Knowledge pathways: The knowledge elicited from the exploratory phase (interviews, questionnaires, observations) covered local perceptions of each CMC. Findings were presented during the first co-design workshop, where CMC directors brainstormed and decided upon improvement actions for their own CMCs. Community representatives intervened in refining the design of the selected actions.

Stakeholder involvement: (i) *Data gathering*: designed and implemented by project researchers; (ii) *Data Analysis of interviews:* mainly project researchers. Local directors helped in interpreting parts of the data; (iii) *Organization of workshops and focus groups:* project researchers; (iv) *Ideation and selection of improvement actions:* local CMC directors with the help of project researchers; (v) *Consolidation and adaptation of the actions*: local staff, project researchers, local community members; and (vi) *Implementation*: local staff, remote support of researchers.

Conceptual and methodological framing: Social Representations Theory to delve into local understandings; Co-Design as a means for local participation.

Design goals: One improvement action for each CMC involved.

DISCUSSION: ALIGNING DESIGN INTENTIONS

In this section we use the three analytical categories introduced (knowledge pathways, stakeholder involvement, and conceptual and methodological framing) to elaborate on how the transition between exploration and design introduces a set of tensions and challenges tied to the need to align the design intentions involved. This illustrates the use of the framework as analytical tool to juxtapose the cases and bring to surface a richer understanding of the transition towards design.

Knowledge Pathways: Aligning Intentions Involves Filtering and Reshaping Knowledge

The transition from an *exploratory* phase, concerned with data generation, interpretation and reflection upon findings, to *selection* and *decision-making* for formulating design goals (and back), is one of the core concerns of this paper. One of the most revealing aspects of this transition is related to the pathways taken to produce, analyse, interpret knowledge and allow it to inform the formulation of design goals. The three cases presented highlight key aspects and landmarks in this process, and illustrate different takes and approaches.

RE-ACT generated a large data corpus and a substantial set of findings. The aim of the first co-design workshop was to enable CMC directors to use these findings to inform the design of improvement actions. But did CMC directors really formulate their ideas drawing only on the data they were presented or engaged with? As one of the RE-ACT researchers noticed upon reflection on the data, some of the ideas for improvement actions formulated were hardly related to the insights and data collected in the exploratory phase. CMC directors formulated ideas in a setting where they had been listening to distilled information about communities' perceptions of CMCs, and after engaging with interpretation of visual materials generated by local people. Still, the knowledge and impressions of the CMCs and local communities appeared to determine their decisions just as much as, and in some cases even more than, the information that they had been exposed to throughout the co-design workshop. While they could engage with the data in fostered speculation, in some cases it served mostly as a trigger for reflection, allowing them to delve into their own pool of knowledge and experience with their communities and CMCs.

In the OH.DIY case in Syria, the researcher also noticed that a small part of the data collected was used in discussions with community members, and that the formulation of design goals was often based on general impressions and anecdotes of events remembered and practices that seemed to work. These cases indicate as well that only a fraction of the information gathered during the exploratory phase of the research, mainly driven by the researcher's intention, may have direct links with the formulation of design goals. We notice here that the formulation of design goals is necessarily related with aligning or solving tensions between the knowledge(s) of various stakeholders, including researchers/designers and community members. This process often involves filtering and reshaping knowledge that is commonly understood and valued, but may also display a quality of "contagion", by which knowledge produced through formalised and informal events mutually influence each other. Due to this, despite the concern for rigor and precision in formulating "scientific knowledge", the knowledge that informs design with communities is often much less comprehensive from a scientific point of view (especially in qualitative research where data tends to be abundant and heterogeneous). This echoes the challenges that researchers find when they attempt to account for and explain the role played by comprehensive field studies in their design decisions (Grudin & Grinter, 1994; Nardi, 1996: 92). When reflecting on the role of knowledge(s) in formulating design goals in the cases described, what appears to happen in effect is a movement close to the spirit of PAR, where the interests, memories, and experiences of community members are given a central role in formulating design goals and deciding strategic movements towards action (Sabiescu, 2010; Montero, 2000). This does not undermine the role of data-intensive qualitative field studies and their "thick descriptions" (Geertz, 1973) in opening the space for formulating design goals (for a critique on the role of ethnography in design, see Dourish 2006). Yet, their contribution appears to be less concerned with directly informing design, and more

concerned with creating a space for reflection in which community knowledge(s) are encouraged to surface. Therefore, data-intensive research methodologies of this type appear to be most promising not as direct sources for informing design, but rather as triggers for engaging with, surfacing and contributing back to communities with knowledge that is already theirs in tacit form. This also highlights the need to deal with the anxiety caused by the difficulty of linking all the details of those thick descriptions with the formulated design goals.

Stakeholder Involvement: Following Existing Community Structures

As with many community-based design and research projects, the three cases presented could only involve a limited number of community members, with some members participating in certain phases and some in others. At the same time, each project aspired to represent a collective voice of community members, and further instil it in the formulation of design goals. This section examines patterns of stakeholder involvement in relation to two aspects: firstly, related to the role of participating stakeholders in community structures; and secondly related to role of stakeholders in the project itself, particularly their participation in knowledge production, interpretation and decision-making.

Emulating Research and Design Strategies on Existing Community Structures
In each of the three cases, patterns of stakeholder involvement in the processes leading to the formulation of design goals followed pre-existing patterns in the community with respect to roles, responsibilities, hierarchies and power structures. The three projects aimed to access and improve the already existing local realities by respecting and emulating the local hierarchies and contexts. The focus group held in the Favelas of Vitoria involved frequent users of the CTC, who were the most interested in technology and the different ways to appropriate it, despite their limited knowledge on deconstructing the artefacts. In the OH.DIY case, group moderators were the most involved in deciding design goals, followed by active members, which was the same for almost all community activities, not only during design. RE-ACT had a more complex structure, involving three social groups at three different stages: CMC directors, CMCs staff members, and representatives from the beneficiary communities.

Emulating community structures naturally privileges members with positions of responsibility, or opinion leaders. We suggest that this is not far from the way we choose to follow the structures and rules of communities we are involved in as researchers and practitioners. Following these structures and practices is a way to align various intentions and ensure acceptance, collaboration and effectiveness. This can be considered necessary for projects to be accepted and appropriated by the communities, especially when researchers are involved in contexts that are different from theirs (Puri et al., 2004).

This can be contrasted with works that assume a strong social-activist stance, where researchers choose to position their work in opposition to existing social structures for dismantling them and encouraging change (e.g. see the works of DiSalvo, 2012 on adversarial design and Hirsch, 2008 on contestational design). These works render explicit the friction of going against the interests and intentions of those having a stake in the opposed system, but they also demonstrate the necessity of social mobilization for achieving social change. In other words, instead of solely leaning on existing social structures, "social re-structuring" becomes necessary within the scope of designing action for social change.

Roles of Sakeholders: How much leverage should researchers bring to design?
Different patterns of community involvement in the process of knowledge production and decision-making can be highlighted in the three cases. Yet, by looking closely at how knowledge made its way into design, the role of the community appears strategically relevant in the three projects. In the Favelas, the researcher was immersed in the context, and observed possible issues related to technology design and use. This process required validation by community feedback to align his interpretation of the issues related to the keyboard layout with the opinions and experience of the participants. Although the researcher intentionally sought not to become a main part in formulating

design implications, he actively used his skills to resist domestication by encouraging the participants to think critically about the western artefact (the keyboard) and to propose improvements. In RE-ACT, the research team was responsible for data generation and analysis, for the presentation of the main research outcomes, and for structuring the different levels of involvement and participation of local stakeholders into the design process. The position of CMC directors and the communities gained prominence in formulating concepts and design goals for improvement actions. CMC directors formulated ideas on actions during the workshop in Maputo. In later community-based workshops, the role of CMC directors, staff, and local communities superseded that of the RE-ACT researchers in taking design decisions and transitioning to action.

Taking a comparative perspective, the researcher in the OH.DIY case adopted the practices of community members and took the role of a peer assistant for formulating design goals. This minimized the friction for aligning design intentions that would have been more starkly present if new tools and practices to produce and interpret knowledge for design were introduced. Indeed, this friction was more felt in RE-ACT and the Favela, where researchers appear to have been in privileged positions for data interpretation and decision-making. However, this enabled bringing in expertise and resources to facilitate wide forms of designed action.

Framing: Between Free-flow and Strong Structure

The three cases present us with interesting insights about framing. Ethnographic approaches have been embraced by two of the projects. In the cases of OH.DIY and the Favelas, there was a deliberate goal for researchers to lower profile, interfere as little as possible and allow a natural course for knowledge production through active observation and engagement with community members. The OH.DIY case, for example, started as unbounded observation taking note of any aspects of community interaction that could potentially be of interest. Similarly, the researcher in the Favelas made sure to let the participants express their opinions clearly without jumping into early and misleading conclusions. The main goal was to allow participants to formulate or surface their own goals in accordance with their values, and therefore contribute to the expansion of agency (Sen, 1999). However, later in the project course, when some leads from the analysis became solid and where the design intentions of various stakeholders needed to be focused and aligned, both the OH.DIY and the Favela cases moved towards a more structured approach.

Differently, the RE-ACT case adopted a structured approach and a well-defined theory that guided and fixed landmarks in its methodology for data generation. Even if listening to the different local voices was a goal of the project, the theory of social representations and co-design were the lenses that defined what was to be included. The first co-design workshop had well-outlined spaces for presentation of information, discussion, creative engagement, brainstorming and decision-making. Co-design was adopted as a method to include local voices and afford another level of community participation. Despite the readiness to associate fixed framing and structured approaches with a limitation of design possibilities, it seems that freedom and plentiful choice are not necessarily the hard-line prerequisite for insightful and relevant action. As one of the researchers remarked in his reflections on OH.DIY:

> "When we have a more open way of participating and the researcher keeps a lower profile (i.e. ethnography), we benefit more from the fact that people can express freely and act for themselves. But equally, we cannot tease out things that people would otherwise express if the discussion was structured and targeted."

It becomes clear then that in all three projects, transitioning to design involved a shift in activities, tools, resources, and methods in order to focus and align design intentions. Structure, creative patterns of engagement, tools and even the limits set can act as triggers to generate ideas or surface needs and goals that were not brought to conscious attention beforehand (for examples on framing design environments with community members see Horan & Wells, 2005; DiSalvo et al., 2011; and Björgvinsson et al., 2010).

CONCLUSION

This paper engaged with understanding some of the dynamics of the transition from exploration to design in CI interventions, with a particular interest in how this transition unfolds in participatory projects, or those employing data-intensive exploratory methodologies. We conclude that the central issue faced by community-based projects in their transition from exploration to design is related to aligning various design intentions to derive shared design goals reflecting a common vision towards design. We proposed three analytical categories for examining the transition from exploration to design and the processes underpinning the alignment of design intentions: *knowledge pathways*, *stakeholder involvement,* and *conceptual and methodological framing.* These categories have been used to analyse the knowledge-to-design continuum in three case studies, all of which employed data-intensive qualitative methodologies and had a concern with accommodating local voices in design. The methodological implications resulting from the analysis can be summarised as critical points to consider and reflect upon:

First, the difficulty of accommodating the variety of opinions and voices present in a community appears to find a response in the way patterns of stakeholder involvement follow community structures. For instance, emulating community structures implies that leading roles in a new initiative are assigned to people that tend to play leading roles in the community organisation.

Second, the notion of "knowledge pathways" allowed a close examination and a critical reflection on the role and contribution of researcher-sanctioned, "scientific" knowledge in informing design intentions, in relation to the fluid, dynamic knowledge produced in community interactions. The analysis indicates that this knowledge base, even if dwelling on a large data corpus, is less a direct source for informing design goals, and more an occasion for triggering reflection and stimulating new knowledge production episodes where issues pertinent to the formulation of design goals are revealed. While this observation does not undermine the role of "thick descriptions" in informing community-based design, we note that for the purpose of formulating design goals, the role of large piles of data and information may be on the same level of importance as knowledge emerging from informal events in communities. Yet, the *process* of knowledge production itself appears to be important for aligning design intentions, as it enables the creation of a shared space of interaction and knowledge exchange in which a process of "contagion" occurs. This process of contagion affects the quality of the knowledge produced through both formalised and informal production episodes, and is a crucial step in aligning design intentions and formulating a shared vision.

Third, the examination of framing approaches and framing judgements revealed that the degree of structure adopted in a certain methodological approach appears to affect the formulation of design goals, by gradually limiting the space of possibilities for taking decisions along the design continuum. This process is a counterpoint to the one of knowledge production. We argue that, while the knowledge that makes its way in design is rarely directly sourced from scientific, researcher-sanctioned methods, the degree of structure imposed upon a project affects significantly the space of possible design solutions that can be envisaged based on this knowledge.

Therefore, data-intensive research methodologies of this type appear to be most promising not as direct sources for informing design, but rather as triggers for engaging with, surfacing and contributing back to communities the knowledge that is already theirs in tacit form.

ENDNOTES

ⁱ All personal names of community members have been replaced by aliases.
ⁱⁱ Bottom of the pyramid: the three billion people who live on less than US$2 per day (Heeks, 2008).

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