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The Tree and The Room: Co-Designing DIY WiFi Networks with Emergent Local Metaphors

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Abstract | The use of metaphor for communicating conceptual models of interactive systems has a well-documented history in Interaction Design. Although metaphors can primarily be understood as linguistic devices, designers incorporate them into the design process in order to make abstract ideas more concrete and tractable. In this paper we present two case studies where resident researchers worked with Greek village communities to explore potential uses of a “do-it-yourself” WiFi networking technology platform. Built using simple, low-cost Raspberry Pi computer hardware and specially developed, open-source software, this toolkit has the potential to enable hyper-local applications and services to be developed and maintained within a host community. During the co-design process, locally specific, spatial metaphors emerged - the tree and the room - that proved useful for collective sense-making. In this paper, we argue for the importance of foregrounding and supporting emergent design metaphors that are contextually meaningful within the local situation.

KEYWORDS | PARTICIPATORY DESIGN, CO-DESIGN, METAPHOR, WIFI NETWORKING

1. Introduction

This paper describes a pair of related design case studies that were undertaken during residential Test Labs situated in two villages in different areas of northern Greece; Kokkinopilos on Mount Olympus to the east, and Tsepelovo in the Zagori national park region, further to the west. These case studies are presented as examples where emergent, contextually specific and spatially oriented metaphors were influential in the progress and development of the installations. The paper begins with a description of the broader research programme and the motivations behind the case studies, and then presents a review of the literature addressing the use of metaphor in design. The two case studies are described, and the paper concludes with reflection and discussion of the ways that metaphors were influential in each case study process. This discussion then concludes with a summary of “implications for design”, specifically some recommendations for approaching “in-the-wild”, co-design projects with an awareness of the potential of metaphor as a design resource.

2. DIY WiFi networks “in the wild”

The two case studies presented in this paper were carried out as part of a larger research project called MAZI that was investigating the creation of grassroots WiFi communication networks, including the software applications and local services that can be built around them. Central to the aims of the project is the dissemination of low-cost, easily accessible “Do-It-Yourself” (DIY) networking technologies that enable participatory experimentation and co-design within local communities. The vision is that these technologies could support collective action and creativity, enhancing the possibilities for social life.

This approach to Do-It-Yourself community networking technology combines low-cost hardware with open source software applications. Within the research project, wireless networks were built using Raspberry Pi computers incorporating suites of specially adapted applications available to the user via a browser on their own laptop, mobile device or smartphone (figure 1).



Figure 1: an early version of the WiFi network zone in an outdoor location, including the Raspberry Pi computer and battery.

The toolkit itself is designed to be expandable in the future in order to incorporate a range of open source applications to meet demand, and there are online collaborative resources, including a presence on the GitHub software development platform, to support this ongoing development. At the time of writing, the toolkit includes applications for collaborative note taking and editing, photo and file sharing, website building, and creating polls and surveys.

This approach is not intended as a way to replace the more conventional and widespread Internet infrastructure, rather it is intended to be complementary. An appropriate analogy here might compare industrial scale agriculture to organic urban gardens. They each have different purposes and operate at different scales, but both can have a place within the wider ecosystem of food production. There is growing evidence of interest in developing local community networks, both in response to the perception of possible downsides of global scale networks, and also due to their potential as tools for community engagement, hyper-local knowledge sharing and supporting social cohesion (Davies & Gaved, 2017). The

research undertaken within this project is exploring how DIY WiFi network technologies can be adopted by citizens as part of a move towards the “right to the hybrid city” (Antoniadis & Apostol, 2014). This idea that “‘doing things locally” is an element of the Internet’s future, not its past’ (Antoniadis, 2018) is central to this approach. The overall aims of the research project are to make this technology better understood and more easily deployed, and to design and develop a freely available software and hardware toolkit. In this way, the toolkit can enable citizens and communities to build their own local WiFi networks for facilitating hybrid virtual and physical social interactions.

The case studies presented in this paper used early versions of the toolkit “in the wild”, exposing the working prototypes and collections of applications to people in real-world situations within communities that represent the intended end users. This approach to design research draws from the anthropologically informed methods popularized by Suchman (1987) and others, and it places importance on understanding new technology interventions within everyday life, rather than working away from the setting, within the researchers’ own usability and user experience (UX) design labs. The term “in-the-wild” here refers to “carrying out *in-situ* development and engagement, sampling experiences, and probing people in their homes and on the streets.” (Rogers & Marshall, 2017)

The insights and knowledge gained during this process were fed back to the technical developers of the toolkit, located in a research institution.

3. Metaphors in Design

In everyday language practice metaphors are widely used and their function is well understood. On the surface, the metaphor is a seemingly simple concept, although a comprehensive definition can be rather difficult to pin down. According to Lakoff and Johnson (2003), a metaphor is more than a linguistic or literary device used to express “one kind of thing in terms of another”. Linguistic metaphors work, they claim, because the way that humans actually think about abstract concepts - the cognitive process - is largely metaphorical. As Underhill (2018) claims; “metaphor is fundamental to conceptual thought”.

Metaphors are useful, possibly even essential, in order to communicate ideas between people, and this process is helpful precisely because people tend to think in a metaphorical way often without even being fully aware of this process. As stated by Lakoff and Johnson (2003), “metaphor is pervasive in everyday life, not just in language but in thought and action”.

The metaphors we use to describe the world form and shape our understanding of it. As physical beings, our primary experience of the world is phenomenological, that is to say it relates to how we experience - first hand and in a sensory way - the physical things that surround us (Merleau-Ponty, 1962). Although phenomenology as an academic discipline is concerned with the study of subjective conscious experience it is clear that, from a practical

perspective as humans, how we each experience the world is sufficiently similar that metaphors are useful and natural tactics to structure and communicate ideas and concepts. Lakoff and Johnson (2003) consider that the primary function of metaphor is understanding, building on the work of Richards (1936) who characterised metaphors as comprising of a tenor and a vehicle, where tenor is the underlying idea of principal subject and vehicle is the secondary subject which provides a figurative description of the tenor. For example, the ship (tenor) parted the waves like a plough (vehicle). The work reported in this paper has a particular focus on conversations that take place early in the design process. Typically, “design dialogues” at this stage are ill formed and fragmented as participants seek clarity both as individuals and as a group. The use of metaphor is an important conceptual tool where the tenor is intended to provide a domain specific anchor for participants, while vehicle definitions should come from sources that are commonly shared and accessible.

Bridging concepts can be useful for supporting shared understandings during the design process. They are similar to Schön’s idea of generative metaphors which he characterises as the carrying over of frames or perspectives from one domain to another (Schön, 1979). In design situations, Cross (1996) considers the role of language in forming bridges between problems and solutions, rather than leaping straight to a creative solution. To illustrate this point, during a study of a group trying to design a device for carrying a hiker’s backpack on a mountain bike, Cross (1996) reported the impact of a single phrase, in this case “tray”, and how it influenced the remainder of the design process. The concept of a tray acted as a bridge that lead to the revealing of novel solutions. This example resonates with the ideas around the role of language and its influence on the design process during the case studies that will be discussed in this paper.

The work of Frank and von Sommaruga Howard (2010) further explores the role of dialogue in design and they emphasise the importance of creating a conversation between designer and client that is both open-ended but that critically also allows for the possibility of new knowledge to be generated. While the focus of their research is primarily designer to client or designer to designer conversations, the aspirations are just as relevant to co-design practice where these roles could be represented by different stakeholders and actors, for example end-users, design researchers and organisational representatives. The dialogue that emerges from such interactions takes the form of a shared enquiry, where language and artefacts promote a way of thinking and reflection by a group, and the individuals that comprise the group. When discussing the importance of language during design meetings, Frank and von Sommaruga Howard argue that “language does not just accompany design, it is a constituent of design.” Language is a part of the “doing” (designing) and the thing “done” (the designed work) (Dong, 2007).

4 . The Test Labs and the case studies

The lead partners in the two case studies were part of a non-profit organization, unMonastery described as “a social clinic for the future”. The organization carries out place-based social innovations, aimed at addressing the interlinked needs of empty space, unemployment and depleting social services by embedding committed, skilled individuals within communities that could benefit from their presence.

In the paper we use the term “Test Labs” to refer to the residencies within each village. This is the term used by the resident researchers themselves to refer to their projects. The term “case studies” has a narrower scope and refers specifically to the design instances or examples discussed in more detail in this paper.

4.1 Interdisciplinarity “insider” researchers

For clarity, in this paper, we use the term “researchers” as an inclusive term to refer to the people who were resident in the case study Test Labs, and we also use the term to refer to members of the other organisations who were part of the wider collaborative project, some of whom visited the Test Labs and were involved in the work in a more indirect way. The resident researchers sometimes described themselves as “insider researchers”, immersing themselves into the life of the village during their residencies. This approach resonates strongly with the research “in-the-wild” approach mentioned in Section 2 earlier in this paper.

4.2 The case studies

The two related case studies presented here were carried out in villages in northern Greece, each in a distinct area of the country, Kokkinopilos and Tsepelovo in the Zagori national park region. The Kokkinopilos case study took place over three visits of around two to four weeks each, while the Tsepelovo case study, the last in the timeline, comprised of one longer residential visit of nearly three months. In addition, researchers carried out various scoping and preparatory visits before the Test Labs were established and the design case studies took place.

4.3 Background and preparatory work

The Test Lab in Kokkinopilos was the first to be established and was selected after initial scoping visits revealed particular issues regarding the lack of internet access. Later visits identified a suitable vacant building in the village to house the Test Lab. This location became the primary focus for the lab in these early stages. However, a secondary location was also considered in the west side of the Greek mainland, centring around the town of Ioannina.

5. Case study 1: Kokkinopilos village

Kokkinopilos is a small mountain village, part of the Elassona municipality in the mainland of Greece, sited high on the slopes of the Olympus mountain range (figure 2a). Although this mountain region is popular with summer tourists, particularly the coastal side, Kokkinopilos is situated on the inland slopes of the mountain range, is less well known and can be difficult to access. The population is in the low hundreds, but the numbers fluctuate widely according to the seasons, with a very reduced population of mainly older people in residence during the winter months.



Figures 2 (a) Kokkinopilos village and (b) disused school building

In the early months of the Test Lab in 2016, a small, but constantly changing team made several visits to the village of Kokkinopilos engaging in relationship building and collaborative planning activities, often taking place in the social environment of one of the local tavernas. The primary aim at this stage was to build a trusting relationship which could become the ground for mutually beneficial collaboration. The unMonastery researchers expressed a wish to use the disused village school building (figure 2b) as an experimental co-living, co-working Test Lab. In exchange for the use of the building, an offer was made to do something for the village. This way of presenting the group not as *problem-solvers*, but as *a group with a need* was important to set the tone of the negotiations.

These taverna conversations revealed some desires among the villagers around the development of tourism within the area, without losing the particular atmosphere and serenity of the place. Specifically, mapping of the cultural sites was discussed, including the archaeology, the churches and water springs, and also to collect stories. These requirements came from expressions of the need to; increase the economic sustainability of the area, to enable the village to evolve for the future, and to capture existing knowledge. These perceived needs were a response to the concerns about the impact of the younger generations moving away to urban areas and the seasonal variations in agricultural life. Very

specifically and concretely, the villagers asked for a website for the village, both in Greek and English.

5.1 The emergence of the Room metaphor: from digital to analogue

One of the concepts that was chosen to be developed was an archive of local knowledge to be kept in the village and accessed by visitors via the local WiFi network. This would be hosted on a MAZI zone built on Raspberry Pi computers supplied by the researchers.

Some of the resident researchers were particularly inspired by the approach of prototyping; the stage that sits between abstract ideas and “proper prototypes” (Savoia, 2011). The prototyping approach has the aim of informing *what* to build rather than focusing on *how* to build it. It focuses on testing ideas by building simple versions or mockups to test their acceptance by the intended user group. Prototypes are intended to be even simpler, and used earlier in the design process, than the more familiar low-fidelity prototypes, and rather than being used to explore functionality or features, they have the single aim of investigating whether the concept should be built at all. The prototyping approach was appealing in the highly exploratory context of the village Test Lab, and it informed the discussion between researchers.

This enabled the researchers and villagers to continue to collect material and have conversations about what to make available on the internet and what to keep on the local network. One of the classrooms in the schoolhouse was transformed into a walk-in analogue “network zone”. This became a place for people to contribute and to collate thoughts and knowledge; a physical archive in the form of a room.

The creation of a physical, tangible space helped the team to see their progress, and also helped the villagers to grasp what exactly they were working on. The whole collection of collated content was easily visible when entering and walking through the room, and items could be touched and handled, added to and annotated.

Each aspect of the content categories intended to be incorporated into the networked WiFi zone hosted on the Raspberry Pis was translated into an analogue version – a hand-made map (figures 3 a & b) was made to mark points of interest that were shared with the researchers. Notes and lists were made and filed under the appropriate heading on the wall. Recipes, water sources, stories, history – everything had its place. A printer was bought (which was donated to the village at the end of the residency) and photos were printed in order to start planning the website for the village. An analogue Guestbook (figure 4) was set up – a green board with chalk and a small book with pen, for messages. Scrapbooks were made and passed around so that villagers could easily contribute.



Figures 3 a & b: The map of the village

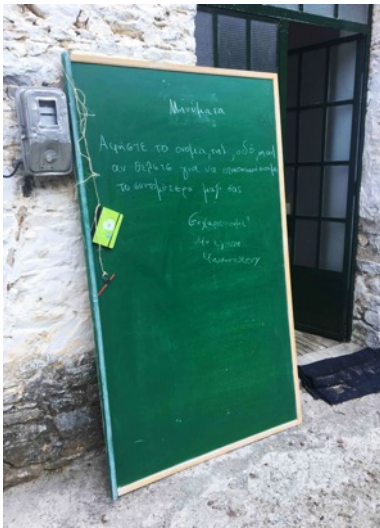
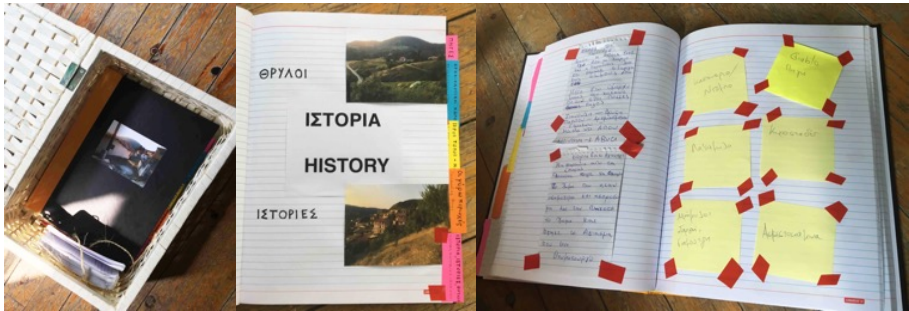


Figure 4: The analogue Guestbook

This analogue way of working continued for a couple of weeks, and it seemed to be positively received. The collections included; stories, history, water sources, recipes, artefacts (photos of), sacred locations, local idioms, Mount Olympus information, and local, medicinal plants. A local WiFi zone was created as a demonstrator through which the villagers could view the material that was proposed to include on the online website to be uploaded to the Internet.

At the end of the project, notes and photos were collated into a scrapbook and left for the villagers, along with files and photos on memory sticks (figures 5 a, b & c).



Figures 5 a, b & c: The scrapbooks

6. Case Study 2: Zagori Region and Tsepelovo village

The second Test Lab took place in Tsepelovo village, one of the Zagori region villages in the Pindus mountains of northwestern Greece. The nearest large town is Ioannina where people from the surrounding villages often migrate to, and even further to the capital, Athens. The surrounding mountainous villages are mostly populated by an older generation but in recent years there has been a noticeable desire for younger people to move to the villages mostly due to the beautiful natural surroundings they offer.

A building (figure 6a), in Tsepelovo village (figure 6b), owned by the Athens School of Fine Arts, was chosen as the residential hub of the Zagori region Test Lab. The building is mostly used in the summer months, and the Test Lab took place over a period of around two months duration late in the year (October to December) in 2017.



Figures 6: (a) The Zagori Test Lab building and (b) Tsepelovo village

6.1 Identifying needs

During the early scoping visits to the Zagori region, researchers identified a number of areas of action specifically in the mountainous regions. They discovered a desire to: build a community network; develop alternative tourism; archive local traditions and stories; create alternative forms of education; raise awareness of environmental concerns; and search for local resource sharing tools, including agricultural resources.

6.2 The Tree metaphor: the Platanos Provocation

Similar to the Kokkinopilos case study, one of the aims of the Test Lab was to develop a technological instance, installation or provocation in the village that would demonstrate the capabilities and possibilities of the DIY WiFi networking toolkit. Rather than bringing individual project examples to the village situation from outside, it was deemed important that the concept would be arrived at collaboratively with people living locally. From discussions during workshops, the idea of the “Platanos” emerged as an idea to raise awareness in the village of what was happening in the Test Lab building, and to try out the technology in-situ.

The plane tree, or platanos (figure 7a) in Greek is a permanent feature of many village squares, called the “plateia”, in mainland Greece. The squares often include the village church and a water spring, and so the shade of the platanos provides a focal point for gatherings. People say that if the platanos could speak it could tell you everything about the village. It was decided to build a network zone around this concept in the main square of Tsepelovo, based around one of the applications of the toolkit, the Guestbook application.



Figures 7 (a) The Platanos in Tsepelovo village square and (b) the gathering in the village square

Early in the Test Lab residency a major village weekend event presented a good opportunity to interact with the extended community within the platanos square. This was the

commemoration of the Greek entry into the second world war and was acknowledged with a large gathering in the village square of residents and those who live elsewhere but who still consider the village to be their home (figure 7b).

The Platanos installation presented a Guestbook so that visitors could leave the Platanos tree a message during the gathering so that others could log in and see it. The installation was programmed and uploaded to the Raspberry Pi computing kit by the researchers during a process of collaborative learning about the technical aspects of the toolkit itself. Although the Guestbook was chosen to be fairly simple to understand and interact with, there were some deeper ideas influencing the overall concept, including ideas around collective decision making and decentralised democracy. Villagers could upload an image and type a short text message using their own mobile devices (figure 8). The presence of the installation network zone was promoted with posters around the village, and during the event itself the researchers were present, talking to the villagers, explaining the installation and encouraging the posting of messages to the Platanos tree. Some of the researchers were logged in as the Platanos tree's own profile, answering messages in the voice of the tree. The impression gained during the event was that people did enjoy the experience and the provocative nature of the concept opened up opportunities for discussions between the villagers and the researchers.



Figure 8: connecting to the Platanos Tree Guestbook

7 Discussion

The two case studies described in the paper illustrate the importance for the design process of identifying emergent, spatial, contextually relevant metaphors in the framing and communication of an early design concept. This was particularly important in this co-design project because of the situated, “in-the-wild” nature of the work. During a combination of collaboration, collective discourse and practical workshops in each of the Test Labs, the tangible metaphors emerged, and were further developed. These metaphors supported the identification of understandings and insights around the possibilities of the DIY WiFi networking technology. This shifted the emphasis somewhat away from early identification of concrete technological solutions, opening up wider discussions.

The visual, physical and spatial language of the two ideas, the room from Kokkinopilos and the tree from Tsepelovo, were demonstrated to be effective at communicating the affordances and conceptual models of the technology. Using the terminology of Richards (1936) as discussed in section 3, a metaphor is comprised of a tenor and vehicle pairing. In these studies, in each case the DIY WiFi network was the tenor, and the room and tree were the vehicles that described the purposes of the networks in terms that were meaningful in each local situation. Critically, these vehicles emerged from the co-design process and were grounded in the spatial context of each setting.

The room metaphor was developed as a creative response to a multi-layered situation and it provided a physical representation of the virtual DIY Network that was being developed – a hybrid network. The school room was a space that was familiar to the villagers, many of whom had been pupils there in previous years, and this encouraged a richer discussion about the nature and format of the village resources. The tree metaphor was more explicitly related to the everyday life of the village. The Platanos provides a canopy that enables the villagers to congregate and socialise. By creating a network that let villagers leave messages for the tree, and that gave a voice to the tree itself, the prototype built on the local myth that the Platanos knows all the secrets of the village.

To conclude, we propose two key lessons learnt from these case studies:

- Useful metaphors can emerge from the specific context: they should be grounded in the language of the local situation in order to enable shared meaning to occur. Designers and researchers should be alert to possibilities residing within the situation and must be sensitive about observing and listening to what the wider context could be communicating.
- The use of metaphors can support shared meaning through the framing of a need or problem, but they do not necessarily lead directly to solutions, their strength can lie in their power to provoke and to support discussion.

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