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# Space and places: when interacting with and in physical space becomes a meaningful experience

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**Abstract** Human experience of physical space and places is a complex phenomenon that includes geographical and sensorial, as well as more social and interpersonal dimensions. We investigate theoretical insights from computing research and environmental psychology on space and place to determine the different dimensions of the experience of physical space. Empirical results from a case study on creative activities for environment exploration are also presented. We indicate five dimensions that encompass the different ways of apprehending our environment, as well as the emotional relationships we develop toward it through personal and interpersonal experiences-in-place. To us, technology should be examined in terms of its potentiality for supporting rich experiences of and in physical space. We assume that the identified dimensions can serve as basis for the development of technological tools to be used in that perspective.

**Keywords** Space, Places, Outdoor activities, Experiences-in-place, Pinholes, Digital and non-digital artefacts

## 1 Introduction

For the majority of young people, as digital natives [42], cyberspace becomes an integrated part of their experience of spatiality. However, several studies underline the fracturing of physical and virtual spaces, and stress the fact that the children of today have more difficulty in getting into contact with their physical local surroundings and spaces due to the decrease of opportunities for exchanges with them [17, 46]. As pointed out by Bekker et al. [6], by spending an increasing amount of their time behind their computers, children tend to have a less active life.

According to Gauthier and Moukalou [17] the new technologies allow disembodiment of the exploration of the world: it happens through the cyberspace where corporal and spatial constraints are removed, so that no physical sensation is associated with it. In fact, Risotto and Giuliani [46] identify several environmental and social factors that contribute to a decline of children's independent and physical mobility: e.g. the urban structure that reduces the number of public spaces and favours an increase in traffic, and the related changes in lifestyle and in parental models, such as the intensive use of cars and the reduction of children's independent mobility. In any case, the decrease of active physical mobility in space impairs the acquisition of sensory-motor informations or any other that allows people to apprehend their environment with respect to its spatial qualities, but also to its social and cultural aspects [19, 46].

In this case, there is also a reduction of opportunities for face-to-face interactions [27]. In relation to this issue, using computers, surfing on the Internet or playing games may simply lead the users to spend more time alone and to neglect interactions with physically close relatives. For instance, the study of Kraut et al. [27] showed that a greater use of the Internet was associated with reduced family communication. In fact, current trends in research and development underline the importance of preserving face-to-face interactions, and have thus moved to studying the potentiality of technology for enhancing direct interactions, and are seeking to design technologies that support rich interactions between co-present users [9, 14, 21, 31, 54].

Our assumption is that experiencing the physical (as opposed to virtual) space through physical movement and through interaction with elements that compose it, will allow the association of specific settings to experiences that will condition the apprehension, the knowledge and ultimately the emotional relationship with these settings.

With this assumption in mind, our aim is to identify and qualify the different experiences we have of and in physical

space, with a particular focus on outdoor settings, as well as how face-to-face interactions intervene in the occurrence of these experiences. Finally, we address the potentiality of technology for supporting these experiences.

In order to highlight the different kind of experiences we live in outdoor settings, we investigate the notions of space, place and sense of place through the prism of distinct disciplines: we rely on computing research, but also on environmental psychology, which has extensively explored human's relationships with places [3, 26, 32–34, 53]. We complement these theoretical insights with an analysis of an explorative case study on creative activities where a non-digital artefact, the “pinhole”, mediates the exploration of outdoor environments. Adopting an instrumental perspective [43, 44], we investigate which experiences of physical space are favoured through its use, and what properties of the pinhole support these experiences.

Based on this literature review and the empirical results from our case study, we propose five dimensions that represent the different kind of experiences we have of and in physical space, these are: geometrical and geographical, sensorial, cultural, personal, and relational. The proposed dimensions will hopefully act as a guide for analysing and subsequently designing technologies that support rich interactions with and in the physical environment, by considering the complexity of our relationships towards physical space.

## **2 Physical space and place in computing research**

### **2.1 Place versus space**

The seminal works of Harrison and Dourish [19] and of Dourish [15] endow the conception of spatiality with immaterial and social aspects, which leads them to distinguish space from place. “Space refers to the structural and geometrical qualities of a physical environment, while place includes dimensions of lived experience, interaction and use of space”. These authors in fact build on a phenomenological perspective [20, 45, 51] in order to highlight the meaning that spaces acquire through active and engaged participation in them, turning these spaces into socially meaningful places. Thus physical space can be considered as a place because it affords particular activities, and is invested with cultural expectations and sociocultural meanings, as also stressed by Nova [38].

### **2.2 Sense of place**

In parallel to the concept of place, the notion of “sense of place” has developed. Harrison and Dourish [19] define it as a “communally held sense of appropriate behaviour, and a context for engaging in and interpreting action” (p7). Sense of place is conceived as the result of the appropriation of culturally defined norms and expectations that frame behaviours. Hence, for Harrison and Dourish, behavioural framing is not linked to “spatial features” of a setting but rather to social cues that are acquired by socialization. Within that perspective, sense of place thus refers to the fact of knowing and understanding the properties of places, i.e. their spatial characteristics but also their social meanings [38]. Sense of place is what makes a space specific [1], and generally relates to the physical characteristics of the environment, the affect and meanings (including memories and associations), and the activities afforded by the place including the social interactions associated with the place [52].

Therefore, in terms of people's experience, sense of place refers to the fact that people apprehend physical space not only through the perception of its spatial characteristics, but also through the awareness of the social cues related to it. Those social cues act as constraints or at least frame the kinds of behaviours or activities expected and afforded in particular settings.

### **2.3 Place, sense of place and social interactions**

The distinction between space and place has influenced the way that collaborative and interactive technological systems or augmented environments are envisaged and designed [15, 47]. It implies considering the cultural meanings conveyed by a system or an environment, besides its spatial features. For instance, recent developments in the domain of interactive installations have investigated how the spatial structure of a system and of the context in which tangible interaction takes place, reflect social cues that facilitate or inhibit social interactions. Hornecker [24] shows how a system explicitly and implicitly encourages interactions through its structural properties. For example, she observes a “clavier path” (when walking along the path, it activates colour spotlights and emits different sounds) that triggers collaborative behaviours. She considers that this installation encouraged people to cooperate because of its size that requires the activity of several people in order to create complex “soundscapes”, since one person could only reach and then produce limited lights and sounds. Fatah Schiek et al. [16] have also developed an interesting interactive installation as an illuminating digital surface that can be embedded into the urban environment. Comparing its use by pedestrians walking in different areas, the above-mentioned authors observed different types of behaviour and the occurrence of shared social encounters in relation to the spatial properties and affordances of the physical surroundings.

## **2.4 Experience of the physical space and sense of place**

### **2.4.1 Reaffirming the centrality of physicality and of the body**

“Interfaces are embedded in space, they take up real space, they are situated in places, and users need to move in real space to interact with them” [22]. Considering the materiality of tangible interactions, some authors, such as Hornecker [22–24], assert our status of spatial beings, living, interacting with and in physical space, as we encounter objects and people in space. She considers the body as “central reference point for perception”. Furthermore, the most recent studies on interactive systems using body movement and physical interactions highlight the implicit knowledge acquired through body movements and the benefits of applying structural isomorphic relations between action and response to interactive systems. Antle et al. [2] show that interaction with a system is all the more efficient since the body movements required to trigger a response from the system are congruent with users’ spatial experience and everyday movements. These insights underlining the centrality of the body are in accordance with a pedagogical viewpoint according to which gesture is supposed to support thinking and learning [18]. More generally, it is considered that children (and also adults) learn from interacting with objects [40], and body movements. Pellegrini and Smith [41] show that physically active play benefits children’s development in significant ways: “physical activities abound in our children’s world and are crucial to their development because they are taking pleasure in testing their budding abilities, learning how well they work, and practicing their various uses”.

### **2.4.2 Outdoor experiences and sense of place**

Seitinger [49] explores how digital technologies (animated playground props) enhance children’s open-ended and physically active play in outdoor settings. Children are encouraged to move around and develop their motor skills, since active play in outdoor playgrounds involves full-body engagement: running, jumping, swinging, sliding and every other form of physical activity. She highlights the acquisition of spatial competences through the “playful” use of space: children learn to read its spatial qualities; they can estimate distances, materials, and ultimately more abstract qualities of space. From these observations, we infer that physical engagement and movement in space, particularly in outdoor settings, enable children to apprehend space in its material and immaterial aspects. Indeed, through active physical mobility in their environment, children develop spatial abilities and environmental competences that are necessary for positioning themselves, respectively, in the physical and social spaces [46]— i.e. to acquire a sense of place:

- Know important marks and find your way.
- Know the geographical location of the places and how to reach them.
- Be able to communicate this knowledge to others.
- Know the rules and usages linked to particular places.
- Know who lives or hangs on there, what places should be avoided, what are the behaviours related to a place, etc.

Studies on wearable, mobile technologies also build on previous conceptions of sense of place to create engaging play or learning outdoor experiences. In their project “A new sense of place”, Williams et al. [56] involve children as active users of technology in order to create soundscapes in relation to specific outdoor environments. The authors investigate the potentiality of mobile and wireless technology to have impact on what they term the “spatial practices” of children: mobility, outdoor play and educational potentials in urban settings. Williams et al. [56] actually build on children’s sense of place to trigger the creation and use of sounds in relation to specific familiar spaces. These authors define this as “that feeling of knowing a place, of being at home there, which is derived from accumulated experiences and memories” (p. 2). The way children’s sense of place is evaluated in their study reflects a lack of theoretical grounding that would support this definition. Moreover, the experiences that are supposed to produce sense of place are neither described nor theoretically grounded.

Nevertheless, if we reformulate this definition in our own terms, it is worth mentioning that: (1) by considering feelings (e.g. being at home there), this involves affective aspects of our experience of space and place, and (2) it envisions the fact that experiencing the physical space allows creating a link with it. We develop these two points in the following sections of this article.

## **3 Physical space and place in environmental psychology**

### **3.1 Sense of place in environmental psychology**

It is interesting to underline that the psychological study of place shares the same roots in phenomenological perspective as Harrison and Dourish’s work on space and place [19]. The works of Heidegger, Husserl, Tuan or Relph, among others, constitute a common basis that gave birth to different conceptions and research interests:

psychological research—mainly in environmental psychology—focuses on the emotional ties or bonds with physical locations [45] and considers that the steady accretion of sentiments related to experiences lived in context participate in the development of meaning [51].

We must note that the term of “place” is indifferently used to designate physical locations or settings as diverse as a home, a bathroom, public spaces (a pub, the neighbourhood), as well as urban or natural settings such as a forest. In environmental psychology research, space and place are not firmly and systematically distinguished at a conceptual level. As in Harrison and Dourish’s conception of place [19], the normative aspects related to cultural framing of behaviours are considered. A few authors address the impact of social and cultural dimensions on how places are used and viewed [3, 32, 33]. However, the focus is mainly on the relationships that people develop with the places as physical locations.

Sense of place is thus a concept for capturing people’s relationships with the physical environment in which they act [3, 26, 34]. According to Manzo [33, 34], this notion actually evokes our emotional relationships with places: the feelings we develop toward places (either positive, negative or ambivalent) and the meanings we thereby assign to them. Therefore, this position enlarges the conception of space and place by addressing and specifying the nature of our interactions with and in physical space.

### 3.2 Experiences-in-place and emotional relationship with physical space

As shown by Manzo [34] in her exciting study on place meaning, the image, the representations, the importance and signification that we assign to places, depend on the experiences we live in those places: the “experiences-in-place” [34]. Actually, it is through the experiences that we consider relevant and important to us that we form a significant relationships to places. Hence, the places themselves are not important. The experiences that are lived in the places make them important [34]. Some researches on the relations of children and teenagers with their environments also highlight this phenomenon: “(...) outward exploration was particularly important for some children regardless of the natural elements present in the place. (p. 111) [13]”; “For an environment to become favoured it must afford the adolescents activities that are important to them (p. 180)” [8].

Significant “experiences-in-place”, constitutive of our emotional relationship to places, are of different kinds. They can be either positive or negative and affect the valency of our feelings toward a place. When asked about important places, people evoke mainly places where they have lived [34]:

- **Experiences of “evolving identity” and personal growth.** Places become significant because they afford opportunities for privacy, introspection and self-reflection, or because significant life events occurred in these places (for example the beginning or ending of a love relationship).
- **Memories.** A place may allow the emergence of significant events or people’s memory, or conversely, these are the memories of people and events that enable places to emerge as significant.
- **Feelings of safety, threat and belonging.** Particularly for socially marginalised groups (minority ethnic groups, gays, women in Manzo’s study) feeling accepted, free to be themselves, and feeling that they are part of a community, are salient characteristics of significant places.

Actually, Manzo [33, 34] insists on the idea that people are active users and shapers of their environments. We sometimes search for specific places and use them creatively depending on our needs. Studies on children’s and teenagers’ uses of places show that they engage and invest, physically and emotionally, particular places that allow specific learning and that satisfy their developmental needs. Derr [13], for instance, shows that children use some spaces as “exploration places” that allow experiencing feelings of freedom, of control and of efficacy. Some others are “special places” that provide opportunities for stimulating creativity, imagination, for getting away from others and for centring oneself. Children can also experience their environments through a relation to other persons. For teenagers, the house, the school, the neighbourhood and the city centre are diverse spaces for exploration of the others and of themselves, since those places meet the adolescents’ needs for interactions and belonging, but also isolation [8, 29, 30].

### 3.3 Role of social interactions

From these insights on experiences-in-place, we can infer the major role that interacting with other people in a face-to-face way plays in the evolution of our relationships with places and in the development of place meaning. Personal and relational experiences are interrelated, as interactions with others intervene in the experience of significant life moments. “(...) A place can become meaningful for the social opportunities one finds there, or because it represents a turning point in a relationship”. Moreover “other people help to create space—literally and metaphorically—in people’s lives. Relationships open doors to new places on both physical and emotional levels.

In this way, we can see how interpersonal relationships impact place meaning as well as personal development” (p. 77) [34].

Furthermore, places can be associated with a particular person, or a group of persons, and this influences the feelings towards the place [12, 13, 34] and contributes to the shaping of individual and social identities [53]. Mannarini et al. [32] show, for instance, that a positive image of one’s neighbourhood is linked to a positive self-image and a stronger sense of community. Oldenburg [39] also underlined the importance of informal public gathering places, as third-places—great good places between home and work—for the development of a sense of place and community engagement. Studies with children also illustrate how relations to places may define identity: “The ways children learn about and experience place matters because these more intimate, ongoing, everyday kinds of experiences that combine family and community with place are those that children hold onto and are more likely to integrate into their own identity” [12].

## **4 An extended vision of our experiences of and in the physical space**

### **4.1 Reconciling the two perspectives**

From the combination of the different conceptions of the notions of place and sense of place, we assume that exploring physical space through physical movement and through interaction with elements that compose it, allows associating specific settings to particular experiences that will condition our apprehension, knowledge, and ultimately our affective relationship with these settings. To paraphrase Relph [45], if “place” is to be considered as a phenomenon of direct experience, we must examine the entire range of experiences through which we all know and make places. From the literature review proposed in the previous sections, we can envisage what kind of experiences we make of and in physical space. Experiencing physical space allow apprehending its spatial properties but also sensing what makes it “a place”, as Harrison and Dourish [19] intend, i.e. the cultural and social meanings and expectations. Extrapolating from environmental psychology studies, we can add that what makes a place significant is also the emotional experiences we associate to that place, of which social interactions are a major vehicle—“People develop connections to places through the social experiences and connections to others in those places (p. 79)” [34].

### **4.2 Non-digital artefacts for experiencing the physical space: a case study on pinhole**

A recently conducted explorative case study highlights the different experiences of physical space that can be had through outdoor activities [10, 11].

This case study concerns creative workshops organised for 2 years in our city, which involved more than 400 participants. Exploring together the notions of identity and territory participants (including children, teenagers, migrants, displaced populations, local citizens) constructed and shared multifaceted artistic interpretations of common locations.

We studied outdoor creative activities that reunite participants from different generations and socio-cultural backgrounds. Children, teenagers, adults and elders are invited to individually and collectively discover and tell stories about their area, neighbourhood, habits, living space, and cultural differences by producing pinhole images and narratives.

#### **4.2.1 Description of the case**

In the form of hands-on laboratories, these workshops let participants build their own artefacts, pinholes, from inexpensive and readily available materials.

Pinholes are rudimentary cameras following the principle of a camera obscura: small boxes pierced by a very little hole that allows light to come inside. They capture the reality just like the eyes do. On the surface that is opposite to the hole, an inverted image of the subject is formed and captured by a photo-sensitive paper (such as photographic paper).

During the workshops participants were invited to build their own cameras, observe their environments, explore their ideas, take pictures, develop the photographs and to create narratives on the issue of Territory. These activities were characterised by important sharing moments at all steps and led to the production of artistic creations: the photos and narratives, which were shown in a public exhibition and edited in several books. Figure 1 shows several key steps of the workshops.

The workshops allow appreciating the familiar environment differently as participants—individually and collectively— rediscover their neighbourhoods. Indeed, participants have to move in and pay attention to the environment in order to choose the subjects of their pictures:

“We scan the environment, searching for something we really like before taking a picture, so we must pay careful attention to what is around us”. Then, a new way of seeing a familiar environment can arise: “We rediscover places that can be interesting though we see them everyday without considering them (...) it is as if we have new eyeglasses”. As the activities are partly carried out collectively and imply encountering and sharing an experience with other people, the question of social interaction, which emerges through these outdoor activities, is therefore central.

#### 4.2.2 Boundaries of the case study and participants

The case study involved an analysis of four of these workshops, each lasting 3 to 4 days, with a total of 52 participants aged from 6 to 65. The first studied workshop involved 13 children aged from 9 to 12; the second assembled 15 participants among whose ages varied between 6 and 65; the third workshop involved 12 teenagers from 12 to 15 years old; in the fourth observed workshop, the ages of the 12 participants ranged from 24 to 54 years.

Within an instrumental perspective [40, 41] we specifically investigated the potential of the pinhole, as a nondigital artefact, for mediating the exploration and experience of the outdoor environments: what kind of space experiences are lived by the participants through their use of the pinhole, and what are the pinhole’s instrumental properties with respect to the identified space experiences.

#### 4.2.3 Data collection and method of analysis

Data collection firstly relied on participant observations [5]. Observation accounts describe the context (date, place, participants) and the progression of the workshops, the activities, the animators and participants’ actions, free expression and comments. Some sequences of the workshops were video recorded, and we regularly took photos of the ongoing activities. We also conducted 19 in-depth interviews with participants and animators using the Kvale methodology [28], and carried out two sessions of evaluation collectively with the participants as focus groups [35].

These two techniques aimed at exploring participants’ experiences in and with outdoor space, and their appreciation of the pinhole’s role in the occurrence of these experiences. The interviews and focus groups were audio-recorded and transcribed. Within this qualitative approach, multiple sources of evidence were identified [57], including archival documentation and participants’ tangible productions (pinholes, pinholes photos, narratives, and edited books).

We analysed transcriptions of the interviews using a content analysis approach [4]. The data was re-organised and condensed into thematic categories in order to extract emerging dimensions of the participants’ experience of space. In addition, an activity analysis [36, 55] was performed on the basis of observation accounts and video recordings. We identified the different actions of which the photo activity was composed, the way the pinhole was used by participants, and determined the properties of the pinhole as an artefact, with respect to experience of space. We thus finally combined insights from both analysis (to highlight more particularly the experiences that were lived by the participants through the photo activity), and the pinhole’s properties that enabled this non-digital device to mediate people’s experiences with and in space.

#### 4.2.4 Results

**Geographical experience.** The pinhole implies physically moving in space, as participants search for something to take as a picture. Participants then explore, and for some discover, the different places composing their direct environments (buildings, public spaces, green area) and create a new mental map of their surroundings. It is not just that the pinhole is a mobile tool, but also, the aim of its use gives the pinhole-artefact a facilitating role in geographical discovery of the environment.

**Sensorial experience.** The pinhole leads to appreciating sensorial properties of the environment: “To take a good picture, you must pay attention to light, texture, colours, movement”. Because it implies taking into account the physical properties of the photographed subject, the pinhole mediates the sensorial relation to the environment and “reveals” its physical properties.

**Relational experience** The pinhole camera is an “open” artefact [25]: participants interacting with the pinhole camera are aware of, and physically involved in the different steps of the process leading from the camera to the photography. Consequently, it favours opportunities to interact with others. During the interviews, the participants were asked: “Which moment(s) of the process has(have) particularly elicited interactions between you and other participants?” The participants mainly pointed out the following steps: the outdoor moments of environment exploration, the development of the photographs in the laboratory, the moments when the photos are shared, discussed and commented (participants also congratulate each other). The pinhole camera is indeed an “externalisable” tool in the sense that Bruner [7] intended, i.e. producing an external result that can be shared and

discussed amongst the participants; the moments of sharing of the pictures (external result) are opportunities for fruitful interactions.

**Personal experience** The quality of the pinhole camera as an open artefact also fosters a sense of autonomy and pride. Present at every step of the process, the participants are made responsible for the result. Each step, to be successfully completed, requires that the participants involve themselves in the activity, and implies a reflection before acting: “Each time you take picture, you have to question yourself permanently, because many factors change (the light for instance). So, you must carefully think (about how to take the picture, about what angle to choose, about the exposure time)”. The first results are not necessarily satisfying. Participants must often try several times to have pictures that they like. When the results are pleasant, participants feel proud: “I’m proud because I see an evolution in the results”; and many of them have expressed many times the enchantment they experienced in having managed to do something by themselves: “We did something by ourselves. And it works!” As participants control and are involved in the different steps of the production process, they experience a sense of responsibility and pride that follows from their successful involvement in the activity of photo production.

What makes the pinhole so rewarding is also that it is *simple, versatile and pleasurable* [37]. Made of plastic and cardboard, it is simple to build, and low cost. As we could observe in the workshops, it was easy for all participants, even the youngest children, to build their pinhole camera, though certain steps of the construction require finer abilities (use of cutters, for instance). It is versatile in the sense that it encourages novel and creative interactions or uses.

Depending on motivations or goals pursued by the participants, the pinhole camera was used differently and creatively. Some discovered the possibility of superimposing images; one participant chose to use his pinhole while moving, others experimented different forms of camera, etc. Easy to use, with enjoyable and valuable results, the pinhole is pleasurable. Reflections of participants from the different workshops, such as: “I’m proud!” or “I’m able to do beautiful things”, also stress the satisfaction they had experienced when confronted to results of the pinhole camera’s use, i.e. their photographs.



Fig. 1 A pinhole camera; participants (re) discovering a green area close to their neighbourhood; a teenage participant taking her photo in a train station; participants develop their photo and share the results with each other

### 4.3 Five dimensions of the experience of physical space

The results from our case study partially corroborate theoretical insights from both computing research and environmental psychology, by highlighting different experiences that people have with and in their environment. Thus, on the basis of our synthesis of theoretical approaches and empirical results, we propose five interrelated dimensions that constitute the experience of physical space. The three-first dimensions relate to apprehension, knowledge of the physical space in its spatial characteristics but also in its socially meaningful aspects. These three dimensions reflect the notions of space and place as defined principally by Harrison and Dourish [19] (cf. point 2):

- 1. Geometrical and Geographical** experience is the apprehension of the spatial qualities of the environment, i.e. estimation of distance, structure, shape of the setting, and the spatial disposition of the different elements composing the setting.
- 2. Sensorial experience** stands for the apprehension of the sensorial qualities of the environment: the colours, the smells, the material, and the textures.
- 3. Cultural experience** represents the apprehension of the behavioural appropriateness, of the cultural expectations and understandings of behaviours, and corollary of the activities that are expected (and accepted) to occur in a particular setting.

The two latter dimensions relate to apprehension of physical space in a more emotional way, as mainly underlined by environmental psychology (cf. point 3). These dimensions refer to the “experiences-in-place” that make the places in which they occur meaningful to people. We divide them into two categories:

- 4. Personal experience** figures the meaningful experiences-in-place that are mainly experienced at an individual level. These are the opportunities that places offer for reflection, introspection, self-understanding and personal growth;



**5. Relational experience** represents the opportunities for interpersonal relationships and interactions that happen in places, contributing to our development as individuals and as members of a community.

## 5 Towards technologies that support rich experience of the physical space

Now that strong social interactions are rarely limited by distance, they should not contribute to dissipating the importance of our interactions with the environment and in particular with the meanings that we give individually or collectively to the places where we live. In fact, the engagement in physical space is closely linked to social and interpersonal aspects, which shape the emotional relationships we develop toward it.

From a combination of theoretical and empirical insights from computing research, environmental psychology and our own researches, we have illustrated the complexity of human experience of physical space. We divide it into five main dimensions that are interrelated: geographical, sensorial, cultural, personal and relational.

We envisage that technologies, instead of moving us away from our environment, can support these meaningful interactions with and in physical space. Therefore, the objective of design could be to conceive devices that enable and favour the different dimensions of the experience of physical space. Thus, the five identified dimensions may initially serve as a framework for analysing the potential of technological devices to support the different experiences of physical space; for instance, do they:

- Offer a chance for physically exploring the environment
- Represent opportunities for exercising abilities related to spatial skills (knowing important marks, knowing the geographical location of the places, etc.)
- Create opportunities for developing environmental competences (know the rules and usages linked to particular places)
- Foster sensorial discovery of the environment
- Allow users to feel responsible and valuable
- Elicit face-to-face interactions and favour rich collective experiences between users.

Whilst being preliminary, the typology that we propose will be subsequently refined by conceptualising the interrelationships between the five dimensions. This will contribute to developing a broader view and understanding of how we relate to our physical space.

In our research, we explored these different dimensions of the experience of physical space within a particular kind of situation that brings people to share a creative activity in a face-to-face way. Though it does not support more specifically some of the identified dimensions, our study shows how a device can mediate several aspects of people's experiences of and in places: the pinhole sustains face-to-face social interactions, personal development and leads to better knowledge of space and places, thanks to its properties as an artefact (being simple, open, externalisable, mobile, etc.).

A few current research projects explore the potentiality of the Internet and mobile technologies to support the discovery of local environments and to geo-reference sensations and emotions related to specific places, so that people can produce and share multiple personal and communal experiences of their environment [48, 50]. It seems to us to be an interesting research direction to envisage the properties of more technological tools to be used or conceived for outdoor activities that aim to foster rich experiences of and in space. We expect that the study of technological devices' potentiality with respect to these issues, will inform the design of technological tools for rich experiences-in-place that take into consideration the complexity of our relationship to physical space.

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