Rethinking the Accessibility of Digital Content with Perceptual Supplementation System through the Lens of an Ethics of Care

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Abstract. In this paper, we discuss the tension between the ethical perspectives of Justice and Care for technology design research. We first introduce the ideal project of universal accessibility bared upon standards and rules that leave broadly open the complexity of their application in practices. By contrast, we present the ethics of Care as a critic as well as a complementary perspective needed for the realization and negotiation of shared values. We ground the debate in the case of the accessibility of digital spaces for the visually impaired and blind persons. Through our research work on the design of perceptual supplementation systems, we propose to account for two possible places of dialog between Care and Design, on one hand the product of design, and on the other hand the design approach itself.

Keywords: design, care, ethics, accessibility, perceptual supplementation, visual impairment.

1   Introduction

Any technique changes the very possibilities of acting in the world at the individual and the social level. On this premise, the designer cannot escape from the ethical questions raised by her work when designing and introducing new artefacts and devices. As digital technologies pervade in more and more societal spheres (e.g. healthcare, work, entertainment or interpersonal relationships), the important development of technical innovation these last twenty years has seen a raising concern from design and HCI research for ethical questions [1, 2].

   Among the most important approaches on this subject matter, Participatory design with its commitment of opening the design of technology to end-users and all relevant stakeholders of a social world has at its roots a strong ethical reflection for democratic participation [3, 4] and participants emancipation. In a different vein, Value Sensitive Design [5] provides a framework and methods aimed at addressing end-users values in design products, for instance privacy [6] or universal access [7]. One core difficulty

of this endeavor being the tension between designing for a universal value and addressing its implementation to local settings [8].

Ethics of Justice is often opposed to an ethics of Care. Ethical questions are either seen from a rule application perspective that is issued from Kant's categorical imperative. Or, the ethical questions are understood in relation with the concrete and mundane character of each situation. Both cases allow to define technical conditions that orient human activity and its associated norms. For the ethics of Justice, these conditions are first the written marks as laws, rules and contracts. These are also the different implementations of constraints over action like for instance mandatory fields and checkboxes on a digital form or speed regulation device in cars. In the opposite way, the technical conditions of an ethics of care are interaction systems that enable us to give our attention to someone else, to recognize this attention in its singularity and to provide mediation that give a feeling of presence and responsibility. These technical conditions are also the way participation and engagement are thought in the use of technology.

In this paper, we propose to discuss the tension between the ethical perspectives of Justice and Care for technology design research. The discussion between design and an ethics of Care is a current and vivid research debate where care proves fruitful to shed light on design project participants situated ethics [9] and the relation between the materiality of design with participants values [10]. However few work in design research approach the reflection by considering that our agency is supplemented or augmented by technology [11]. Such a perspective enables to draw interesting links with design research concepts that are the product of design and the design approach.

As a generative instance, we propose to ground the debate in the case of the accessibility of digital spaces for the visually impaired and blind persons. At this level we focus here on sensory supplementation system as they provide a clear case of augmented agency.

We first introduce the ideal project of a universal accessibility bared upon standards and rules that leave broadly open the complexity of their application in practices. By contrast, we present the ethics of Care as a critic as well as a complementary perspective needed for the realization and negotiation of shared values. After presenting our research work on the design of perceptual supplementation systems, we propose to account for two possible places of dialog between Care and Design: the designed artefact and the design approach. These two reflective analysis of our research work through an ethics of care lens are a contribution to the wider project of associating an ethics of care to the practices and artefacts of design. We conclude by discussing the stakes and limits of this approach.

2   Ethics of Justice: the Case of Accessibility Norms

The accessibility for all to public information and services is an ethical principle inscribed by law in most modern countries. However the partial and difficult application of these accessibility principles shows the limits of an ethics of Justice alone for the accomplishment of universal access through norms, rules and related enforcement mechanisms. For instance in France, the law for the equality on rights,

opportunities, participation and citizenship in favor of disabled persons has been adopted in February 2005 [12]. Its application for all public organizations and buildings has been delayed for more than 10 years later while its ambitions have been revised down [13]. This is an instance of the complexity of enforcing such ethical principles for which writings alone offer a limited support.

This tension between high level ethical principles and implementation is also found in the case of digital content accessibility on the Internet. The W3C Web Accessibility Initiative (WAI) [14] promotes and develops guidelines and resources for the project of making the Internet accessible for people with specific needs. Among the WAI projects, the Web Content Accessibility Guidelines (WCAG) has become, since their first publication in 1999, a *de facto* standard. The WCAG provide a set of recommendations (12 directives gathered in 4 principles: perceivable, operable, understandable, robust) and satisfaction criteria to make a digital content accessible for all. For instance, apart from documented exception, we can find the following guidelines in the WCAG reference document [15]: "1.1.1 Non-text Content : All non-text content that is presented to the user has a text alternative that serves the equivalent purpose", or, "1.4.3 Contrast (Minimum) : The visual presentation of text and images of text has a contrast ratio of at least 4.5:1." (that is contrast ratio between the brightest and the darkest color should be at least of 4.5 over 1).

The guidelines and the numerous examples of good and wrong practices gathered by the WCAG constitute an important work that is a reference in the domain of accessibility [16], nonetheless the systematic application, even automated [17], of these criteria show their limits to achieve accessibility in practices. Power *et al.* [18] highlight in a study with visually impaired and blind persons that WCAG account only for half of the usability problems encountered in the use of websites content. These limits are to our sense less related with an issue of completeness than from an approach that aimed at defining universal principles that could work for all and address any situation. Aware of the issue, the WAI develops and dispenses supplementary training material more nuanced and pragmatic with the WAI's Education and Outreach Working Group (EOWG) to accompany the WCAG standard document.

Another research on the limits of a normative approach of accessibility offers an interesting alternative. In the case of web content accessibility, Mankoff et al. [19] have conducted a comparative study of four accessibility evaluation methods. The user study has been based on several websites offering to perform mundane tasks: looking for a public transport direction, registering to an online class, finding a contact in a directory and finding the best price for a product in an online catalog. The different evaluation methods considered are: an automated accessibility issues analysis tool, an expert review based on WCAG (version 1.0) conducted by web developers with and without a screen reading software, an assessment by blind persons[1] with their own technical environment (personal computer and screen reading software). The results of the four modes of evaluation have been compared according to the number and types of encountered problems (in part based on WCAG) with a baseline in lab study conducted with blind persons on the same tasks.

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[1] The involved blind persons were subscribers on a mailing-list group that offer voluntary service of web accessibility evaluation.

The comparison shows that the expert analysis by web developers using a screen reading software, that is being in nearly the same access to content conditions than a blind person, is the most successful evaluation method in terms of number and richness of accessibility problems raised. This last approach reveals even more fruitful than the evaluation by the blind persons themselves. We can hypothesize that the better knowledge of web development from the experts was key at this level.

At the end, we observed that even in such a simplified context with well-defined tasks, the application of accessibility norms, viewed as an instance of an ethics of Justice, is limited. This ethical perspective is supplemented with relevance by another view on the accessibility to digital content. By performing the tasks with a screen reading software, as would do a blind person, for their accessibility evaluation, the expert web developers appeared to give a better attention to the intended users and to have a better understanding of their needs. An attention and engagement that brings a needed supplement to the limit of the normative perspective and that can be better accounted for through the lens of an ethics of Care. Anticipating the perspective of Tronto's care activity model [20], that way the experts develop a deeper sympathy and care more about the end-users' experience which provides them a ground for giving a better care.

3   An Ethics of Care and a Model of Care Activity

The development of an ethics of Care is historically associated with Carol Gilligan research work in Psychology [21] on the critics of the time dominant model of moral development, the Kohlberg's six stages of moral development scale [22]. This scale assesses the responses of young subjects invited through an interview to express themselves about prototypical moral dilemmas, for instance, should a character steal, or not, a drug that he cannot afford in order to save a relative from illness. Gilligan's critic starts from the observation that certain subjects systematically scored less to the scale, especially female subjects. In her analysis, she highlights that the dilemmas that grounds Kohlberg's theory and the categorization of the expected subjects answers brought a bias by assuming a specific conception of justice that value objectivity and logic but appear detached from human relationships and context [21]. By interpreting the less ranked subjects' answers through the lens of other criteria, Gilligan's highlights the existence of another moral rationality as rich and complex. This work has opened an important field of research and analysis on Ethics (see for instance [23, 24]) which gathered around the idea of an ethics of Care and building the foundation for a situated moral reflection. In this perspective, the interpersonal relationship, their history and future, as well as the practical constraints on possible actions are key dimension of analysis [25].

In her work of analyzing the notion of care [20, 26], Joan Tronto proposes a model of the care activity aimed at characterizing the specificity of this activity by contrast to other as for instance production or creation. Tronto identifies four different phases in the care activity:

- **Caring about:** This first phase concerns the understanding and recognition of a need of care. The care activity implies an attention for what a person needs in terms of care and a sympathy for her situation. This includes also the necessity to think about existing and possible responses for the person in need of care.

- **Taking care of:** Identifying the need for care is only a beginning. Care as an activity involves for the care taker an engagement, requires to take a responsibility regarding the person or situation that needs to be repaired.

- **Care giving:** This phase consists in the practical achievement of care. The question of competency is important here because the practical provision of care requires knowledge and a skillful action.

- **Care receiving:** This last part is focused on the evaluation of the response to the care provided. This phase is essential to know if the provided care has fulfilled the care need. This can lead to reconsider the previous phases as the provided care can miss (for instance when the need has been misidentified) or only partially fulfill the need.

Of course, there exist overlays between the four phases of care which can be in fact less separated than in the former presentation. However, this model is interesting to address the implication of care in practice. Existing research reports on its use in order to reflect the impact of an ethics of Care on nursing work practices [27]. In a similar approach, we use this model to think how an ethics of Care can influence design and innovation research.

4 The Designed Artefact and the Design Activity as Places of Dialog with an Ethics of Care

Joan Tronto in her work [20, 26] proposes to define the notion of Care as: "a specie of activity that includes everything we do to maintain, contain, and repair our 'world' so that we can live in it as well as possible. That world includes our bodies, ourselves, and our environment.".

Regarding our aim to develop relations between care and technology design, this definition echoes the purpose Rittel and Weber [28] gives to the design activity: "the aim is not find the truth, but to improve some characteristics of the world where people live." Beyond the pragmatic orientation shared by these perspectives, we propose to consider to what extent a technology design activity can be conceived in line with an ethics of Care.

We identify two reflection pathways on this matter, here termed as place of dialog. By place of dialog we mean a concept from a domain, here design, that enables fruitful reflections with another domain, here ethics of Care. We ground our reflection on two cases taken from previous research for the development of perceptual supplementation systems: on one hand, how a product of a design activity, an artefact,

can on its own implement an ethics of care? (4.1); on the other hand, in what way the design activity itself can be thought as a care activity (4.2).

4.1 The Designed Artefact and the Qualities of Mediation for the Care

The four phases of Tronto's care activity model can be thought about the artefact produced by design, the technical mediation itself. Indeed, care activities are actual encounters between persons. These activities have to live in bodies that are able to express a vulnerability, to feel a sense of responsibility, to give and to receive. As all human activities, care can be mediated by technical and cultural support. In this way, our design research consists in building interaction devices that enable these encounters where an attention to the other is made possible. Our stake is there to understand the technical conditions that make such encounters possible at a distance as well as to understand what is at play in human encounters, through the variation of these technical mediations.

This open several research questions: how can a tool enables attention to the other and her needs of care? how engagement and responsibility can be stirred up from each part of the relationship through a technical mediation, especially the digital ones? How can care be skilfully provided through a technical mediation? How the evaluation of the care and the often invisible care receiving work can be achieved in this context?

As a follow up of our research on perceptual crossings (ie, catching someone's eye, mutual touch; see [29]), we have designed an interaction device based on the sense of touch that can be used by visually impaired persons and aim to be accessible for all. This research can be considered as an example of our approach. We briefly present this application in order to draw conceptual implications.

Touch Through [30] is a mobile app that connect two users through their smartphones in order to enable them to make the experience of touch (ie, a tactile contact) at a distance. This research continues and pushes further a previous work that dealt with "augmented love" [31] and the possibility of an "intercontinental caress" [32]. Touch Through has been developed for research purposes but its potential applications for communication are broad. By contrast with our other senses as sight or hearing, the analysis of the specificities of touch as a perceptual modality [33] highlights that our daily experience of touch requires the coincidence between the action and sensation points. In other words, I have to touch and to be touched (and conversely). We observe this constraint doesn't hold for sight or hearing where I can hear without being heard, or seen and be hidden from others view for instance. Another specific constraint of tactile perception is its active dimension because we need to act (i.e., to move my finger) in order to sustain the feeling of touch.

By interacting through Touch Through, the users touch the screen of their smartphones with one finger in order to manifest their presence (figure 1).

Fig. 1. Two users of Touch Through are looking for each other in their screen space (visual coincidental condition).

In the interaction frame settled by Touch Through to enable a kind of touch at a distance, the users have the indication of the presence of one other (by a vibration or a visual feedback) only if their fingers (their action points) are situated at the same place in their respective screens (figure 2). By recreating the constraint of touch, Touch Through thus enables a tactile mode of perception and interaction even when the feedback is visual.

Fig. 2. Two users of Touch Through met and experienced a touch at a distance (visual coincidental condition).

The analysis of the dyadic interactions with this device are of particular interest and allows us to draw a generic principle for technical mediation aimed to support care. Indeed, Touch Through can be configured according to two modes: "coincidental" and "distal" mode that respectively enforce or not the coincidence of action point and sensation point constraint of touch. In the "distal" mode, each user can see the position of the contact point of its partner in the space of her screen. Joining and following the partner to trigger the vibration of the smartphones is very easy. In the "coincidental" mode, the users cannot see each other positions in the screen space. They have to first randomly explore their screen to have the opportunity to encounter their partner and feel the vibration of their smartphone. Then the users have to pay a close attention to each other perceptual activity in order to be able to follow each other and succeed in performing a coordinated move.

We have setup an experiment with Touch Through where the participants are asked to discriminate between being in interaction with another self, or being in interaction with a bot (i.e., a recording of the finger movement of a previous interacting subject). The results of this kind of perceptual Turing test has been that the participants

perform much better in the "coincidental" condition [30]. Once the contact is established between the partners, a brittle dynamic is initiated by them in order to sustain the sensation of each other such as when one move her finger, the other has to move to keep the contact. Far from staying static, a playful interaction dynamic is developed between the users that consists in slow coordinated moves so they can sustain the contact sensation in deploying a more or less complex path in their respective screen space. Facing recorded movement, this kind of game is no more possible as there is no reciprocal perceptual attention with the bot.

In the "visual distal" condition it remains possible to follow a pseudo interaction with the bot as the visual information allows to foresee the movements and the user to move faster. However in this condition, the participants have more difficulties to identify whether they are interacting with an other self or a bot and obtain poor results. The presence of visual information appear thus to be a drawback in recognizing a potential partner presence.

At the opposite, the "coincidental" condition, by the inherent difficulty of sustaining contact, bear instantaneously a feeling of the partner presence. Put another way, I feel the attention of the other to my own attention.

If Touch Through has not for the moment found a clear application in terms of care activity, it displays an interesting quality regarding the notion of care. Indeed the "coincidental" interaction mode invites and constrains by some extent its users to be especially attentive to each other to be able to sustain interaction.

We can propose a generic principle from this particular case: the design of technical support for a care activity should not be focused on transmitting the most complete information to its users. Instead, what is necessary is a technology that enables the users to perceive the orientation of the perceptual activity of their partner in interaction, and conversely. The paradox that consist in formulating a generic principle for care technologies (when an ethics of Care is precisely to refuse any ethics of high level principles in favour of the singularity of every human situation) can be resolved when we recognize that any encounters with the other must be achieved through bodies and objects. Indeed, the description of the other's face by Emmanuel Levinas in *Totality and Infinity* [34] is to show that the other manifests itself as a "counter-phenomenon": always already a mark of what resists to be phenomenalized. The face of the other has also to be a fact in objectivity, even when it is to mark a break with objectivity. Levinas thus describes the encounter with or the experience of another person as questioning the spontaneous intentionality; that we can understand from a perceptual viewpoint as a perception disorder: the other as what resists being phenomenalized through her phenomenality. In the same vein, Sartre in *Being and Nothingness* [35] allows us to understand the other through her intentionality as something that resists being spatially determined, as what we encounter, not what we constitute as an objectively determined entity. Thus, in the dynamic of the perceptual crossing that arises between Touch Through users, each other cannot determine precisely the position and the movements of her partner, yet the partner keep being present one for the other. This presence means the partner's attention to my self [36, 29].

4.2   The Design Approach - Design as a Form of Care Activity?

Stéphane Vial [37] proposes the notion of "effect of design" to question the duality between the produced artefact and the design process and activity at large. For instance [38], a complex design object as a urban public bicycle system (for instance, the Velib' in Paris) cannot be reduced to the material design of the bikes or docking stations regarding the aim of developing alternative and sustainable modes of transportation to citizens in urban areas. The realization of such a sociotechnical system encompasses numerous issues that can be part of the design activity: the negotiations with local authorities, communication of a desirable future with prospective users, policy making, thought about maintenance and quality of service. When it comes to produce a design effect, the material product of the design activity, the artefact, appears at the end as much important as the creative process and the design approach that achieves it. If we envision a design activity aimed at producing an effect for the care, the design activity, through its orientation towards understanding and rethinking practices as well as towards developing relationships with a public, becomes also a place of dialog with an ethics of Care [9].

We propose here to address how understanding a design activity through the lens of an ethics of Care can change the aims and success criteria of such projects. We ground our reflection on the case of the ITOIP (Tactile Interaction for Orientation, Information and Presence) [39] research project that aimed at improving the accessibility of digital and urban spaces for the visually impaired and blind persons by the use of a perceptual supplementation system.
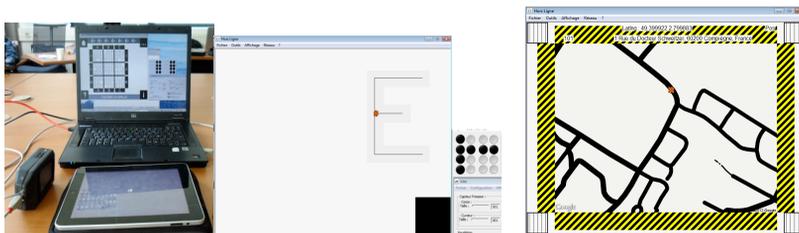
Fig. 3. From left to right, the Tactos system with its tactile stimulation module and the tactile screen of a tablet as effector; a tutorial application about recognizing the shapes of capital letters; a screenshot of Tactos Map.

The ITOIP project has developed several tactile and interactive applications concerned with the three main themes of the research project: information, orientation and presence. The design of these applications has been conducted through a participatory approach with four blind persons thank to the support of a local association, the APICADEV (located in the North of France), that advocates for accessibility for the visually impaired and blind persons. The project has mainly used the perceptual supplementation system called Tactos (figure 3) [40, 41] that enables its user to develop a perception of spatial content like shapes and layout. Through a minimalist tactile stimulation (ie, a pair of electronic Braille cells) and the user awareness of her own gesture on an effector (ie, a tactile screen or a pen tablet), the user can develop an ability to recognize shapes, from lines to more complex

geometrical shapes, without symbolic translation to the difference of screen reader software that offers a linear and symbolic access to digital content.

The ITOIP project with the participation of blind persons has especially developed an accessible urban audio tactile map that enables users familiar with Tactos to rediscover their daily path in the city and to plan new path to explore. Applications designed to explore complex shapes with sound augmentation (ie, plane, boat or train in line drawing style) as well as games have been also developed inspired by our discussions with the participant users.

Going forward with the designed system and application would be out of scope of this paper and we propose here a reading of the ITOIP project proceedings through the lens of the care activity model we have introduced earlier (section 3). As the ITOIP project addresses the accessibility of digital and urban spaces, the project is an effort to contribute to the improvement of visually impaired and blind persons situation. The focus is thus less on the applications or the designed artefacts than on the conduct of the design research and the relationships with participants.

On the basis of the four phases of the care activity model proposed by Tronto, we analyze the responses that we had proposed through the ITOIP project. This alternative reading from a care perspective highlights aspects that have been in line with an ethics of care as well as other aspects that have missed it or didn't succeed to provide a response.

- **Caring about:** Through the project participatory design approach with the APICADEV we have been sensitized to the daily problems encountered by our participants. Especially during the first six months where we have run a co-design workshop gathering two to three blind persons each week. The organization of these workshop sessions has involved to set up the conditions for welcoming the participants, particularly at our lab (to accompany the participants and take them back home, finding with them the easiest and safest public transport itinerary for the university, arrange the room for the workshop). The organization of our meetings have been opportunities for us to better understand the challenge of navigating a city without sight and the numerous accessibility issues encountered daily. This experience has oriented the project response in terms of choice of digital content interesting to make accessible and explain our decision to work on bus line and city maps. Our regular exchanges with them lead us to discuss about other needs out of the scope of the project or exceed what we thought possible to offer as a response in our context, as for instance the access to job market, the uncertainties of urban road work or the bad attitude of "sighted persons" to spontaneously freeze and mute themselves when they have to pass each other with a blind person. Our important fieldwork with blind persons has supported us in getting a richer understanding of our participants needs in order to define with them several propositions to design accessible content with Tactos in the scope of the ITOIP project: the development of an accessible city map and itinerary, and enabling the access to the spatial dimension of content and layout of document over the Internet.

- **Taking care of:** From the needs jointly negotiated with the participants, the ITOIP project has open to nearly two years of co-design work in order to develop prototypes and then a working system that has been finally deployed at the APICADEV office. Our engagement and responsibility has been for the association and the blind persons who have been involved with us. However, after two years of joint work, this engagement has been difficult to continue given the end of the project and the limited human and financial resources. Of course, a system as Tactos is the cumulative achievement of several research project. Nonetheless the question of how to sustain the engagement with the participants along the succession of research project remains open and appears as essential from an ethics of care perspective. The work of sustaining the relationship built with the participants along a research project appears as a neglected dimension that would benefit from a better consideration through the assignment of dedicated resources inside project plan in this perspective.

- **Care giving:** The participatory workshop sessions have enabled the joint development of accessible application with Tactos. The researchers have brought their knowledge of tactile interfaces and perceptual supplementation on the conceptual as well as technical level. The participant blind persons have brought their experience and constructive evaluation of the different versions of the applications throughout their production. The aim of deploying our system outside the lab has also oriented our work towards the development of Tactos training content in order to ease the discovery and appropriation of this perceptual supplementation system by visually impaired and blind persons outside the project. About one year and a half after the beginning of the project, a complete Tactos workstation has been installed at the APICADEV office. This milestone is a first step in the direction of making the project outcomes available to more visually impaired and blind persons. However, in the wider perspective of improving the accessibility of digital content, the availability of the system for blind persons is difficult apart from coming to our lab or at the APICADEV office. This invite us to consider the conditions and modes of diffusion as an important aspect from a care activity perspective so that the developed response could benefit to the largest number possible. To this end, a more important number of tactile interaction modules could be produced and distributed with associated software, however the consequences in terms of support service and maintenance costs appear not sustainable regarding the limited resources available for the ITOIP project and its partners (a research team and a local association). This imposes limits to the competency of the project partners for the diffusion of its outcomes.

- **Care receiving:** We have benefited from very positive feedback from the project participants and from blind persons outside the project on the occasion of presentations and demos. This is a strong motivation to continue the work on Tactos. Nevertheless, the improvement in terms of accessibility

to digital content achieved during the project stay limited regarding the daily accessibility issues encountered by the visually and blind persons.

The analogy between the design activity and the care activity we have presented has of course limits. In her work Joan Tronto explains she has proposed a model of the care activity in particular to tell the difference between care and other forms of human activity as well as to characterize its specificities. However this reflection allowed us to question the values and aims of technology design work, especially in a current context where the social expectations towards research and technology are strong. Planning project resources to sustain the relationships developed through a design research or providing way to allow a wide deployment of the developed solution appear as important dimensions from a care activity perspective. At this level, the development of Fablabs [42] and Hackerspace [10] these last years open interesting pathways in order to support the development of care relations between persons on the basis of creation and technology.

5 Discussion

Our analysis was aimed at exploring two possible pathways to think a dialog between design and an ethics of Care in the context of perceptual supplementation technology research. The presented cases show that the model of the care activity proposed by Tronto allows a new understanding of the stakes of a design work oriented towards care depending on whether we focus on the designed artefact or on the design approach:

- As a reflection about the quality to search for in tools and interfaces for interaction; in the case of Touch Through we highlight that other qualities than usability or efficiency might be of interest for a tool in a perspective of care.
- As a framework to analyze a design project approach by analogy with a care activity; the case of the ITOIP project emphasizes events and aspects of a design project that can be consistent with a "care oriented approach" or that would need further work regarding the limited response of the current design approach, as for instance the issue of deployment and diffusion out of the lab or the issue of sustaining relationships with participants after the project's end.

A lot of questions remain open for each of these place of dialog between design and an ethics of Care.

We share with participatory design research the observation [43, 44] that the format of design research project can be an issue when it comes to deal with the stakes of engagement and responsibility over time from a care perspective. Up to which point in time goes the project stakeholders responsibility: prototyping? deployment? support and maintenance? Such defined steps contrast with the more opened horizon of more typical care activities as parenting or the care for chronic conditions by health professionals [25]. Further work is needed to inspire design work at this level about how care relationships break, evolve and ends.

For research projects, the knowledge development and methodological stakes are rarely reducible to the success of their applications. However the expectations for improving the conditions of the end users are often strong. Our reflection also questions the values behind design, research and engineering [45]. Analyzing a project from a care activity perspective questions its values. For instance, the aims of an engineering project could be different from performance or function and could favor the development of the relationships among participants or the design of object that needs to be cared for.

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