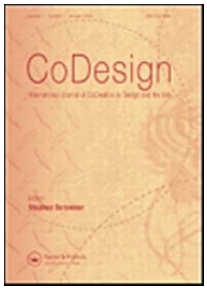

Challenging Industry Conceptions with Provotypes

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Laurens Boer (corresponding author)

Mads Clausen Institute, University of Southern Denmark, Sønderborg, Denmark

Alsion 2, 6400, Sønderborg, Denmark.

laurens@mci.sdu.dk

+45 6550 1276

Jared Donovan

Queensland University of Technology, Brisbane, Australia

j.donovan@qut.edu.au

+61 7 3138 3135

Jacob Buur

Mads Clausen Institute, University of Southern Denmark, Sønderborg, Denmark

buur@mci.sdu.dk

+45 6550 1661

Challenging Industry Conceptions with Provotypes

Design researchers have an important role to play when engaged with user-driven design projects in industry. Design researchers can craft ethnographic material to facilitate transfers of user-knowledge to industry, and demonstrate how this material can be used in the design of new products and services. However, ethnographic findings can reveal issues that are at tension with conceptions of the project members from industry. Other than brushing these tensions aside, we propose *provotyping* (provocative prototyping) as an approach to constructively build on them as a resource for change. Provotypes are ethnographically rooted, technically working, robust artefacts that deliberately challenge stakeholder conceptions by reifying and exposing tensions that surround a field of organizational interest. The daily and local experience of provotypes aim to stir dialectical processes of reflection on how conceptions currently are, and fuel the front end of a development process by speculating how conceptions could be different. In this article we start by making explicit the relation between provotypes, practices of critical design and organizational sense-making. We then illustrate through a multi-stakeholder project that concerned the field of indoor climate how provotypes facilitate transfers of user knowledge to industry, and how they contribute to the development of new products and services. We end by framing the role of the design researcher and discuss the politics that are inherent to design provocations.

Keywords: provotyping; participatory innovation; critical design; organizational sense-making

1. Introduction

User-driven development projects in industry involve different stakeholders, such as managers, engineers, designers, and ‘users’. Design researchers have an important role in these types of projects. Not only can they support project members from industry in creating empathy with the people and context of their interest by crafting and transferring ethnographic findings; they can also demonstrate *how* these findings can be used in the development of new products or services. However, these activities are not at all straightforward, as ethnographic findings can reveal issues that are at tension with

dominant conceptions in industry. As a constructive way forward, we rekindle '*provotyping'* (provocative prototyping) from the 1990's system design community as a way to appreciate tensions in the fuzzy front end of a new product development project that involves multiple stakeholders. This is motivated by provotypings' relevance for contemporary design research topics, notably the field of critical design and the need for a new kind of design research that is '*oriented directly toward the influence of design on organizational life'* (Buchanan 2008, p.3).

In this article we position the approach to organizational development and the instrumental ways of working with critical design.. We propose provotypes as ethnographically rooted technically working and robust artefacts that deliberately challenge common stakeholder conceptions. We draw experiences from a project concerning indoor climate that brought together stakeholders from several companies, and in which provotypes were employed. We demonstrate how provotypes support the transfer of user-knowledge, and how they guide the fuzzy-front end of a design process. We reflect on the differences and overlap between critical design, organizational sense-making and provotyping and suggest distinctions based on the findings from our research. We end with a discussion on the role of the design researcher, and the politics of provocation.

2. Provotypes

Provotypes were introduced to the systems design community in the beginning of the 1990's (Mogensen 1991). They were developed for computer system developers, to find out how to move from an analysis of current workplace practices to the design of new workplace practices. Provotypes centred the dilemma of *tradition* and *transcendence* (Ehn 1988), which is concerned with the balance between current competences of professional practitioners, and the competences that are needed to operate new systems.

Hence the central questions of the approach at its introduction: '*How do we on the one hand, devize qualitatively new systems, and on the other hand, ensure their usability in a given practice?*'(Mogensen 1991, p.31). As a reply, discrepancies in current practice were regarded as a resource for change, other than something that should be brushed aside. This idea was drawn from Activity Theory (Engeström 1987). Activity Theory posits that activities are mediated by instruments, which become 'invisible' or taken-for-granted when they are 'in use' (Ehn 1988). The taken-for-grantedness of practice was provoked by elaborating on the inherent contradictions of the activity, where the dialectical demystification of contradictions was regarded as a driver for development. These notions of Activity Theory provided an understanding of how individuals are engaged in practices, but it is foremost a psychological and sociological theory. Prototyping was introduced to make the notion of 'contradictions as a resource for change' useful for systems development. Prototyping is directed towards the construction of the future; implies the need for iteration; and encourages concrete experience. As such, provotypes provoke the taken-for-grantedness of everyday practice, by exposing discrepancies in the practice through prototyping.

Provotypes for participatory innovation (Boer and Donovan 2012, Donovan and Gunn 2012) is a reconsideration of the systems design approach to provotyping. Participatory Innovation combines Participatory Design and Design Anthropology with a management concept of organizational roles and identities to develop new business opportunities (Buur and Matthews 2008, Gunn and Donovan 2012). In participatory innovation, ideas and opportunities develop in the crossing of understandings, where it is a challenge to reconcile the different voices (Buur and Larsen 2010). Participants in participatory innovation include not only the practitioner and the system designer, but a wider design team, a broader conception of the 'user', and stakeholders across a variety

of organizations. To support the reconciliation of voices, provotypes for participatory innovation call forth some of the inherent taken-for-granted understandings of stakeholders and question their values, beliefs, and assumptions, by deliberately creating perceptions that are at odds with current conceptions. By calling forth taken-for-granted understandings, provotypes aim to overcome barriers of understanding that are usually difficult to express. Further, the initial focus of provotypes on usability issues of a practice shifts towards playing out tensions relating to organizational interests. To identify and provoke these tensions requires the design researcher to understand the patterns at play in the field and in the organizations, which can be gathered through ethnographic investigations and workshops with organizations.

Provotypes for participatory innovation can be employed for different purposes. Provotypes can be a means of generative design research by employing them with 'users' in their daily context (Boer and Donovan 2012). Provotypes can also engage members of a development team, to stir sense-making of the ethnographic tensions that are addressed by them. However, introducing provotypes in the organizational context poses research challenges not yet explored. Although practices of design and organizational change are increasingly moving towards each other (Buchanan 2008), there is still a tendency for people in industrial organizations to see design as an end point and not as a process that creates opportunities for critical self-reflection (Junginger 2008). In this article we explore the fundamental concepts at play in provotyping activities with industrial organizations. We study what properties of provotypes this presumes, and how a practice of provotyping can be explicated. We start by positioning provotyping in relation to the instrumental use of critical design, organizational sense-making and collaboration after which we illustrate how we worked with provotypes in a Participatory Innovation case study.

Critical design

Artefacts that challenge the status quo are central to the 'showroom approach' in constructive design research (Koskinen *et al.* 2011). The 'showroom approach' describes design research as a means to stir debate, where it's purpose '*…is not to present the dreams of industry [but to] stimulate discussion and debate amongst designers, industry and the public'* (Dunne and Raby 2001, p.58); and as a way of problem finding rather than problem solving (Mazé and Redström 2007). Such critiques can expose mainstream conventions in design, and exhibit that *'[a]t its worst product design simply reinforces global capitalist values… [and risks being] viewed simply as an agent of capitalism*' (Dunne and Raby 2001, p.59). Such critiques also mobilize techniques that are central to design practice but utilize them to articulate systemic conditions outside of design itself, for example by stirring debate about sustainability (Mazé and Redström 2008). Critical design artefacts are typically shown in galleries and exhibitions, hence the term showroom approach. These venues enable designers to create an experimental, fictional space of imagination open to a wider public audience. The artefacts stir reflection on the locally experienced material surroundings of the 'showroom', giving room to speculate about the artefacts' underlying values and beliefs.

The critical social theorist Calhoun suggests that critical reflection on the way things are, with their underlying, often hidden factors, enables exploration of other possibilities, and can allow an improvement in the way things are (Calhoun 1995). How these critical practices may improve the way things are is not an easy subject. On the one hand, enabling, affording, and evoking critical reflection, discussion, debate, and speculation is typically considered an improvement in itself. On the other hand, to make critique meaningful, it must be directed at those who contribute to the culture that is

being critiqued (Koskinen et al. 2011). This would, however, necessitate a movement out of the gallery, and the perception of critical design as intellectual debates 'by designers for designers'. It would also shift the role of debate from an end to a means. This instrumental use of critical design has been explored in design research. Sengers suggests that critical reflection 'on unconscious values embedded in computing and the practices that it supports can and should be a core principle of technology design´ (Sengers 2005, p.49), and Bowen shows how reflection evoked through critical artefacts can improve practices of Participatory Design (Bowen 2009).

Organizational sense-making

Paradoxically, the instrumental use of critical design has noteworthy similarities with the commercial development of new products and services. Already in the 1980's, Morgan suggested that organizations can benefit from '*fostering a kind of critical thinking that encourages us to understand and grasp the multiple meanings of situations and to confront and manage contradiction and paradox, rather than to pretend that they do not exist*' (Morgan 1986, p.339). Revolutionary products and organizational transformations both depend on a change in fundamental, unconscious, shared values and beliefs (Rousseau 1995). Such values and beliefs are the core of an organizational culture, of which the traces gradually become visible in organizational patterns of behaviours and artefacts (Schein 1985). The *outside-in* approach to organizational change builds on these levels and suggests how designers can continuously articulate and manifest a human-centred design rationale in artefacts, to influence an organizational culture in becoming more human-centred (Junginger 2008). This approach aims to trigger dialectical processes of change within the organization, to encourage fundamental assumptions to surface, and thereby invite organizations to empathize with a human-centred perspective. The tangible expression of the artefact

enables organizational thinking to develop concretely through action and encourages new behaviours (Coughlan *et al.* 2007). Contextualized design interventions can break the patterns in which organizational culture is negotiated and reinvented (Ibid.).

The topic of organizational sense-making is concerned with managing 'disturbances' in organizations. Sense-making occurs when members of an organization confront events, issues, and actions that are somehow surprising or confusing (Maitliss 2005), where innovative organizations have a system of sense-making that allows the absorption, articulation, combination, and reframing of market and technology understandings (Dougherty *et al.* 2000). This can support the development of new product opportunities, management practices, and strategic standards. Processes of sense-making are fundamentally social, since members of an organization explain sets of cues in their environment in - mediated - interactions with others (Maitliss 2005).

Countercultural efforts that provoke and question mainstream judgment to stir organizational sense-making are thus important components to support new product development through interventions. These interventions should be contextualized and seen in the broader perspective of history, society, and culture. They must be accessible and actionable, and elaborated and questioned (Engeström 2000). The 'Innovation Matrix' developed by Philips Design (Kyffin & Gardien, 2009) is particularly interesting in respect of deliberately stirring organizational sense-making as it inspired by practices of critical design. In the matrix, three horizons of growth are employed (Baghai *et al.* 1999), where the third horizon is dedicated to creating viable options, the second horizon to developing new business, and the first horizon to extending and defending the company's core business. To identify and develop value in the third horizon, ethnographic studies and Design Probes are respectively mentioned. The Design Probes (Philips Design 2011) are targeted to rethink the status quo by

developing visionary artefacts to explore how emerging social signals could shape the distant future.

Collaboration

Interventions with designed artefacts have proven to be a driving mechanism for negotiation in processes of Participatory Innovation. Artefacts enable collaboration across stakeholders (Heinemann *et al.* 2009); and create a space of play and fiction in which conventional concepts can be questioned and reified (Buur and Ankenbrand 2012). Artefacts in cross-disciplinary activities motivate collaboration, allow participants to work across different types of boundaries (Gregory 2003), and constitute the fundamental infrastructure of activities (Nicolini *et al.* 2011). Artefacts can be regarded as a problem space into which actors bring various skills and conceptual tools to negotiate their objectives (Engeström and Miettinen 1999).

Provotypes for participatory innovation can be situated to instrumental ways of working with critical design as they stir discussion about taken-for-granted understandings that are embedded in organizational products and services. Provotypes are interventions that provoke organizational sense-making, by elaborating on ethnographically discovered tensions. The physical presence and design characteristics of provotypes support collaboration by provoking negotiation of conceptions between participants. This view on collaboration these relations embody resonates with *agonistic* approaches design that engage contestation and dissensus as fertile grounds for design *inquiry* and emphasise the political character of design *things* (DiSalvo 2012, Björgvinsson, Ehn, & Hillgren 2012). In the next section we present a multi-stakeholder project in the field of indoor climate in which we deployed provotypes within organizations, in order to elaborate on these relations.

3. The indoor climate project

The 'Indoor Climate and Quality of Life' project brought together stakeholders from five indoor climate related companies in the building industry, researchers from two universities, and five private families. The aim of the project was to generate new knowledge about people's experience and understanding of indoor climate 'comfort' in homes, offices, and institutions in order to open up new development directions for the building industry. The project ran over a 3-year period with three PhD-researchers, two postdocs and faculty from the two universities. The research method for this investigation was action research with concrete interventions in project workshops with company partners, and with participating families in their homes. Activities were generally video-recorded for later analysis.

Prior provocations

The field of indoor climate is dominated by quantitative arguments as justification for 'true' beliefs. As stated early on by a representative of our window manufacturing partner (Buur 2012, pp.31):

> *Window engineer*: This company has a very long tradition for quality and trustworthiness. Every statement from the company has to be based on sound evidence. And here I mean based on technical arguments or on numbers.

The premise of the project was thus in itself challenging: to introduce comfort concepts from the social sciences that emphasize human experiences of indoor climate into a knowledge tradition dominated by quantitative research. This was also apparent in the combination of research partners: coming from disciplines of interaction design and design anthropology, the authors collaborated with an engineering indoor climate lab unit.

Project activities were organized according to a participatory innovation process, which emphasizes ongoing collaboration between researchers, 'users', and organizations. Roughly, the project activities could be divided into 'understanding stakeholder conceptions' and 'challenging stakeholder conceptions' in order to explore design concepts (figure 1). The project began with an ethnographic field study completed at the five families across their homes, offices, and kindergartens (figure 1-1). Observations from the field study were then brought into activities of collaborative sense-making with the project partners that aimed at developing an understanding of the patterns of indoor climate related activities (figure 1-2). This enabled us as design team to not only identify conceptual tensions within the field, but also tensions between conceptions in the field and conceptions of the project partners. The process of sense-making led to the development of six 'comfort themes' that identified relations between prominent aspects of indoor climate and people's experience of comfort. As a reaction to the engineering concept of users as 'passive' recipients of 'comfort' we talked about these themes as 'comfort practices' – as things that people *do*. See (Jaffari and Matthews 2009), (Jaffari *et al.* 2011), and (Jaffari and Buur, forthcoming) for more details about these project activities.

< FIGURE 1 HERE >

In the work reported on in this paper, we elaborate on one of these six 'comfort themes', which related to tensions around the 'experienced' indoor climate and the 'measured' indoor climate – tensions that were inherent to the project set-up. This theme was entitled '*comfort is bringing feelings, observations, and understandings in tune*' and addressed ways in which indoor climate perceptions are shaped and how people try to build their understanding of indoor climate experiences through small experiments. Foremost for the development of a provotype, this theme illustrated how

indoor climate understandings were shaped through consulting 'experts', knowledgeable friends, or the Internet. We learned that these sources, on which people often relied, would frequently argue for decisions about how to adjust the indoor climate based on measurements. For example, by stating that the thermostat shouldn't be raised, because the temperature was already at 21 degrees. Thus, the number in itself – ostensibly detached from context – was taken as evidence that the temperature *should* be satisfactory. This decontextualized number is at tension with people's local experiences of indoor climate, which derive not from a single number, but from a wide array of interconnected practices. Numbers tend to come with 'inscribed' meaning, and are often used by experts to ground decisions.

The Render-Lamp provotype

The Render-Lamp provotype was developed to create perceptions that were at odds with the conception of indoor climate as numbers. It elaborated on the tension between decomposing indoor climate into measurable parameters on the one hand, versus indoor climate as a holistic experience on the other. The provotype was a lamp that monitored five dominant indoor climate parameters and played them back as a combined, dynamic light impression (figure 2). The indoor temperature was coupled to the colour of the light; CO2 was coupled to the height of the light; light intensity in the room was coupled to the intensity of the light; sound was coupled to the amount of lights that were shining along the height of the light; and humidity was coupled to the angle in which the light shone. The lamp was deployed at a family as a means of generative design research to explore how 'users' would respond when reference points to indoor climate change from something to be 'read' towards something that could be 'related to' (figure 1-3). See (Boer and Donovan 2012) for more details on provotypes as generative design research.

< FIGURE 2 HERE >

Reflections on the Render-Lamp

Following our participatory innovation approach, we brought the lamp into a project workshop with the project partners to trigger discussions about the tensions embodied in the lamp, reflect on the results of deploying the lamp in a household, and subsequently explore design opportunities (figure 1-4). The lamp provoked the project partners to express their conceptions when it comes to understanding indoor climate. The following transcript indicates the different, seemingly conflicting viewpoints of project partners:

> *Indoor climate researcher*: What if…that they have to grasp too much information on this lamp? My problem with the lamp is that I would have too much information, that I would be confused whether it is CO2 or temperature.
>
> *Social science researcher*: Maybe that is only because we are engineers and think in parameters, in order to be able to grasp it (indoor climate) in the first place. If people experience indoor climate as a holistic thing, then maybe they can just relate their experience to whatever the lamp does.
>
> *Building consultant*: When the lamp looks like that, I'm comfortable. But maybe [mechanical ventilation engineer] there, she looks at the lamp, the same lamp, and feels discomfort… That's why I think this gives so much meaning; it's not God itself that speaks, this is good and this is bad. This is how you read it, and you sense it is good or bad.

The provotype provoked the project partners to express their understandings on the concept of indoor climate, something that is normally not under scrutiny. Moreover, the lamp provided a tangible expression that *enabled* a discussion about a tension that otherwise would easily be dismissed or would be too hard to express. The lamp appeared to make experiences 'accountable', where usually only numbers were. This marked a shift in which the project team came to the agreement that the holistic

representation of indoor climate could potentially support the shaping of understandings by opening up relational ways to discuss experiences of indoor climate.

The Render-Lamp triggered speculation about potential opportunities for further development. The light was embraced as design direction, and the project team concluded that a lamp-like object can offer an abstract language that could be complemented by numbers and figures. But moreover, the partners still clung to faith that numbers can *tell* people what to do. They were convinced that it should be possible to derive concrete recommendations for improvement of the indoor climate based on the *measurements* performed by the 'lamp'. However, this idea is at odds with the ethnographic studies, which emphasized that indoor climate is much more than figures. To provide people with *contextualized* recommendations would require an understanding of activities and desires in that particular moment, but also over the preceding time.

This finding, that though discussion had highlighted some of the tensions between participants' understandings of indoor climate and what we had found from the field, showed that the stakeholders were not yet able to reconceptualise what an indoor climate product might mean in the light of these tensions. This resonates with Iversen's finding that '*[a]rriving at a stage whereby stakeholders question their values and even resulting in reconceptualising their original values during the design process is fine, but values are only grounded when stakeholders can negotiate this new-found conceptualisation successfully within their everyday practice*' (Iversen *et al.* 2012, p.97). Challenging conceptions in one-off encounters might not be enough for the new conceptions to be sustainable, which explains the design suggestions made by the project partners.

As this seemed to be a major barrier for the project to move forward, we devised a second-generation provotype loosely based on our earlier lamp provotype (figure 1-5). However, rather than situating this provotype in the homes of householder participants, we decided instead to situate it within the *project partners' firms* to serve as a platform for daily, local, accessible and actionable reorganization of conceptions. Ways of seeing and their corresponding values and beliefs are deeply rooted in an organization, and the longer these values and beliefs 'work', the deeper they will be rooted into an organization and the harder it is to change them (Kotter 1992). By deploying our second-generation provotype in the context of the project participants' firms we aimed to support processes of absorption, articulation, combination, and reframing of common understandings of indoor climate and how to improve it.

< FIGURE 3 HERE >

The Sensitive Aunt provotype

This second generation provotype (figure 3) aimed to provoke conversations about two issues: first, that indoor climate must be understood through a holistic representation; and second, that providing recommendations for indoor climate actions can't be given based on measurements alone. The provotype was named 'the Sensitive Aunt' following an analogy suggested by one of the partners. It indicates temperature and air-quality measurements in the way the light shines on its white inner surface: colour relates to temperature; a pulsating 'breathing' to air quality. The void inside the provotype reflects the idea that indoor climate is an intangible phenomenon. On the top surface of the provotype two triangular shaped buttons operate a text display. When the buttons are pressed simultaneously, the screen shows a recommendation to improve the indoor climate based on the current measurements of light intensity, air quality, and temperature. The recommendations are randomly picked from one of three groups:

compelling advice, social advice, and persuasive advice. For compelling advice, guidelines were phrased in such a way that they felt like they *must* be followed; social advices were phrased to encourage other people in the room to join problem solving; and persuasive advices were formulated as suggestions (Table 1).

< TABLE 1 HERE >

In the formulation of the advices we build on tactics employed in critical design to stir discussion with artefacts. Gaver suggests finding a detail in the topic of interest, exaggerating it, designing for it, and finding an artefact or location (Gaver 2002). Dunne suggests playing with a certain kind of *reductio ad absurdum* as a way to evoke discussions about values in everyday products and what this would mean for future values (Dunne 2012). *Reductio ad absurdum* is a method of disproving a proposition by showing that its inevitable consequences would be absurd. E.g. affirming that the way we live our lives today will lead to an absurd future situation. Further, humour is a way of creating a scene of imagination, which makes people question the reality of an object and so supports speculation (Dunne and Raby 2007). In formulating the recommendations, we worked with humour and a mild form of *reductio ad absurdum.* We deliberately included a social category in the recommendations to stir organizational sense-making. Further, we did not show the actual measurements of the temperature, air quality and light intensity, to exaggerate the idea that recommendations come with a certain 'authoritarian' thinking that does not always relate to situated experiences.

Reflections on the Sensitive Aunt

Five Sensitive Aunt provotypes were deployed at each of the industry partners during the same time for a period of one month (figure 4). As processes of organizational sense-making are fundamentally social, we carefully negotiated with the partners where the provotype would be placed inside the respective companies. In each company, the

Sensitive Aunt would move between different internal departments, such as R&D, Marketing, Sales, and Engineering; and with various numbers of people occupying the rooms, in order to stimulate a wide variety of dialogues across seemingly different viewpoints *inside* the company. At the following project meeting the partners discussed their experiences and articulated the experiences of their colleagues. Core subjects were: the holistic representation of indoor climate in light; the provision of recommendations to improve the indoor climate; and what these experiences would mean for the project direction. We identified four benefits of provotyping when they are moved *inside* the company and experienced on a day to day basis:

< FIGURE 4 HERE >

Real, or not? Things *can* change

When the Sensitive Aunt was deployed inside the companies, most of the colleagues of the project partners appeared to be alienated by its functionality at its introduction. Other members of the organizations could not identify its added value or commercial potential, and the provotype did not seem to connect to any need or problem. However, as time passed the provotype gradually got 'domesticated' in the organizational environment. The light of the Sensitive Aunt in one moment is not particularly informing, over time one learns to relate to it. In one engineering department, colleagues got even so fascinated that they wanted a look 'under the hood'.

Part of the feedback from the company partners concerned issues of usability, such as the response-time of the display, the visibility of the display, the size of the provotype, and its robustness. These usability issues indicated that the provotype was actually used. But, usability issues concern reflections on a material product level, where provotypes are foremost concerned with reflections on the underlying values and beliefs of its function, form, and interaction. However, contrasting these usability issues

with the provotypes' initial rejection shows that the provotype played with conceptions of its *realness*. As Dunne and Raby put forth: *'Too weird and it will be dismissed as art… If it is regarded as art it is easier to deal with, but if it remains as design… it suggests that the everyday as we know it could be different, that things could change*' (Dunne and Raby 2007, p.10). As emphasized, it is challenging to bring the human experience perspective into an environment where arguments have to be based on '*technical arguments or on numbers*'. By having a physical, technically working, manifestation that in a critical manner shows that taken-for-granted ways of relating to the indoor climate *can* be different, members of the organization gradually opened up to engage with the provotype.

The responsibility of articulation

Moving the Sensitive Aunt across different departments both gave the partners first-hand experience, and challenged them to express their understandings of the Sensitive Aunt to other members of the organization. This transferred the role of interventionist and sense-makers from us as design team, to the individual project partners. The partners had to take responsibility over the provotype and introduce it *in* the organization. This 'forced' them to articulate the motivations behind the provotype. This helped ground the idea of 'the experienced indoor climate', as the following transcript from the reflective session indicates:

> *Design researcher*: Who feels something for the argument that it [indoor climate] must be understood through a holistic perception?
>
> *Social science researcher*: I think the way [the window engineer] explained it is that this [the Sensitive Aunt] is actually a sensor that visualizes a three or four dimensional complex measure.

> *Mechanical ventilation engineer*: But it's not only holistic in the parameters that you sense. It is also holistic in the sense that how people perceive the environment they are in.

The mechanical ventilation engineer articulates the point the provotype emphasized, but inevitably this point was still mixed with the deeply rooted understandings of indoor climate as numbers, as the social science researcher expressed. However, the provotype did initiate an articulation and *negotiation* of engineered and experienced indoor climate practices within the project team:

> *Natural ventilation engineer*: Two persons said also that if they could get a number instead of just having this light... What the actual measurement was instead of just the light.

> *Indoor climate researcher*: Some people think that 21 is OK, so they will just go after the number, some people will go after the colour. This light is a very intuitive element.

The responsibility that the project partners had with respect to introducing the provotype within their respective companies increased the seriousness of the topics that the provotype addressed and increased the level of discussion stirred by the provotype. This responsibility allowed a negotiation of how relations to the indoor climate can be different.

Re-visioning visions

As for how people took advice from the Sensitive Aunt, the project partners observed different preferences in different departments. The following collage of quotes that were taken from the meeting illustrates how the reflections from the partners ranged from laughable (Building consultant: '*it is more a gimmick than actually getting good feedback… The advices are actually used also as some kind of entertainment'*),

inaccurate but calibratable, (Window engineer: '*in the three-person office it was three engineers and they couldn't get past that the advices were not very accurate. They would like to do something if it was calibrated*'), unneeded (Mechanical ventilation engineer: *When they just get it they press it a few times and then they get some reactions like* 'put on some sunglasses*' and* 'does your partner feel the same?*' Something like that, and they say* 'owkee…*'. They didn't get any response that they needed, or they thought they needed'*), to – in rare moments – even executable (Natural ventilation engineer: '*but when that provotype told her to open the window she asked a colleague to open a window. I think that was very intriguing*'). The Sensitive Aunt experience did enable the partners to reflect on underlying, abstract issues, such as the authority of a systems and the obedience of people. It became clear that there are many attitudes, desires, and social interactions at play in an office setting. This challenged the initial idea that straightforward recommendations can be provided:

> *Window engineer*: …at the user guide department where they sort of had a laugh about the recommendations … it adds to a conversation, but it is not something that you want to do. Whereas in the engineering department they would want advice, which is sort of concrete, this is really what we should do. It's a very different attitude. I don't think that everyone wants a dialogue.

In line with (Bell and Dourish 2007) these reflections show that the actual practice of an envisioned future is considerably messier than its envisioned homogeneity. The provotype brought to the foreground the diversity of people, who are connected to others, doing their daily practices while inhabiting an indoor climate, rather than people as mere executors. The Sensitive Aunt allowed the partners to revisit their initial visions and adapt them according to their experiences.

Enabling action upon reflection

The notion of contextualized and individual experiences is fundamental to user-driven design. However, in a collaborative setting such as this project, which was dominated by technical arguments, this notion is not something to take for granted. The Render-Lamp introduced this notion to the project members and allowed a reframing of conceptions through observation. The Sensitive Aunt grounded this notion through daily and local experience and negotiations inside the company. Importantly, the speculations that were triggered by the provotype could influence a development direction. The effectiveness and sustainability of the discussions that are provoked when challenging conceptions rely on a later grounding and acting upon them. As provotypes are positioned in the front end of a development process, they leave room to act upon newly gathered conceptions.

Towards renewed 'affirmative' design

The experiences with the Sensitive Aunt changed the ways in which 'improving' indoor climate practices was talked about within the project team. The terms used shifted from *teaching* people what to do to *supporting* individuals or groups in their practices. This shift in values transferred the development direction from a quite authoritarian system towards what was suggested by the roof window engineer as an '*information partner*'. Moreover, the team discussed situations in which a system that provides support for indoor climate understandings could actually make sense. For example, when people are focused on improving the 'healthiness' of their room; on saving money; on saving energy; on maintaining the building; or on increasing comfort - both in homes and offices. This illustrates an increased sensitivity towards the indoor climate practices at play and the diversity of contexts and peoples' needs.

The newly gathered and grounded conceptions provided the project members with handles to construct a concrete design proposal. In a series of subsequent project

meetings, a 'comfort instrument' and an interactive Smartphone application for home owners was gradually and collaboratively developed (figure 5). The instrument measures the indoor climate parameters temperature, humidity, and CO_2 concentration, and shows these in a light, similar to the Render-Lamp and Sensitive Aunt. The application combines the measurements with snapshots of what is going on at that particular moment. These snapshots and measured parameters are combined into 'diary', providing home owners with clues for the story behind the numbers. This socio-technical impression could increase home owners' understandings of indoor climate. Moreover, the application provides home owners with the possibility to conduct a test to improve their indoor climate, based on the measurements done by the 'comfort instrument' and with direct support from the company partners. Home owners can send indoor climate measurements and complementing imagery to the company partners to receive contextualized support. Although this proposal is still at a conceptual level, it illustrates how the conceptions provoked by the provotypes are visible in the rationale behind the product: to support people in their indoor climate practices through contextualized dialogue; bring home owners and the company partners closer to each other; and move away from the conception that people are passive receivers of indoor climate. This proposal also shows how the provotypes 'prototyped' design aspects, such as the use of a holistic light representation to relate to indoor climate. This design proposal could open up new ways to relate to 'users' as well as new unexplored business opportunities.

<FIGURE5 HERE>

4. Provotyping, critical design, and organizational development

We started this article by positioning provotyping in relation to the instrumental use of critical design and organizational sense-making. In this section we highlight the

differences between critical design and provotyping, and how provotyping brings forth a change in conceptions of the members of the project team, and potentially within the organization. We end by elaborating on the role of the design researcher and the politics of provocation.

Provotyping and critical design

'Design provides a script that people are assumed to follow, and they usually do. And so they become actors of industry and their silent ideologies' (Koskinen et al. 2011). Critical designs and provotypes share that they both aim at stirring discussion and 'problem finding', but whereas critical design aims to stir reflection on the affirmative behaviour of people towards the ideologies of industry, provotypes for organizations stir reflection within industry, and are directed at those who make 'ideological' cultures possible. Embedding critiques in provotypes throughout a process of new product development is a way to initiate a change in the values and beliefs that will be embodied in future products. Critical designs tend to operate at the level of societal and cultural concerns – a macro level of concern – whereas provotypes speculate about the near future in the context of a development project, and are rooted in ethnographic findings and engagements with industry – a meso level of concern. Since provotypes are deployed in the context of a development process, they deliberately try to be both embracing (eagerly accepted) and estranging (deliberately disrupting what is accepted and taken for granted). Critical designs are typically deployed in the 'showroom' and foremost try to estrange. If we want to move closer to critical design's ambition – that is, to critique and stimulate discussion about our values and beliefs that are embedded in current ways of living – why not address the people who make these cultures possible in the first place?

Provotyping and organizational development

Provotypes manifest a critique that is directed at conceptions of members of organizations who participate in a development team. Moving provotypes inside project members' companies is a powerful way to spread and sustain a human-centred argument, yet a core challenge is to be accepted within organizations. For critique to be effective, organizations must perceive design as an inquiry for change. This brings two important concepts to the foreground: provotypes should contextualize conceptual tensions and they should actively trigger dialectical processes of change.

As provotypes address meso-concerns, they are not provoking for everybody. They are directed at a specific group of people within a particular topic, and the design of the provotype is grounded as such. Contextualizing provotypes means designing interventions with careful considerations of tensions across stakeholder groups. Engagements with companies should be approached by the design researcher as a process of inquiry, which is as important as user-focussed ethnographic engagements.

Provotypes should be experienced over a period of time to support the ongoing process of organizational sense-making. They should provide ongoing stimuli to not move into the background, and these stimuli should be open enough for different interpretations. The provotype must support an articulation of these interpretations, to serve as a shared platform for negotiation. The idea of both embracement and estrangement is important here. Mainly estranging mechanisms won't create an openness in organizations that is required to support an ongoing dialogue. The Sensitive Aunt was embracing in the sense that it was based on the partners' own design suggestions, however it also estranged once it was actually in use. To actively empower dialectical processes of change and stir curiosity, we provided a set of unpredictable recommendations from the provotype. Some of these particularly triggered the

involvement of fellow members of the organization in conversations. Further, the Sensitive Aunt provided a permanent and dynamically changing representation of prominent indoor climate parameters in the form of light. As organizational sense-making is a social process, ongoing experiences with provotypes seems promising in facilitating a human-centred organizational development.

The role of the design researcher and the politics of provocation

The role of the design researcher requires different Interaction Design skills, ranging from engaging with organizations and their field of interest to identifying tensions and embodying these in working provotypes. But are provotypes a way to '*push through*' a particular viewpoint? Or are they a means to *facilitate* discussions about different viewpoints on the same concept? When we refer to politics in multi-stakeholder projects we refer to the power relations and the rationale to guide and ground decisions. Choosing a tension from a web of tensions between stakeholder groups and to provoke these *is* a political act (DiSalvo 2012). It guides a project direction as it enables the exploration of a design space that surrounds the provotype. However, the dialectical processes that provotypes stir *determine* project decisions. The provotype enables stakeholders to express themselves through, and facilitates discussions with others. *How* stakeholders make sense of provotypes is what determines design decisions. It is important to note that provotypes are positioned in the front end of a development process, where it is still possible to make fundamental decisions, but moreover to manifest a design rationale which can later be implemented. Provoking dialogues about conflicting conceptions is needed to explore how conceptions can be different, however it is instrumental in finding consensus in multi-stakeholder projects. The design researcher is not as an expert about a topic of concern or a lone provocateur, but rather a designer who can take a step back and analyze tensions in stakeholders' conceptions,

values and beliefs at play and design for these.

5. Conclusion

Our goal in this article has been to outline how provotyping is relevant for design research today, and how provotype deployments in industry can contribute to human-centred product development in projects that involve multiple stakeholders. With the Sensitive Aunt, we have demonstrated the importance of daily, local interactions with provotypes and *through* provotypes with other members of the organization. Provotypes in an industry setting can call forth taken for granted conceptions of other members of the organization, and show them that conceptions *can* be different. As provotypes are facilitated by a member from the organization who participates in the development team, they provoke this member to articulate conceptions that surround a field of interest. Because provotypes are employed in the beginning of development projects, they allow project members to reshape their initial vision in a human-centred way, while enabling them to undertake action upon this vision as the project has yet to move into more prototypical activities.

The project within which we carried out this research was complex and challenging in its initial setup, involving as it did multiple different company and research partners. This was beneficial for exploring the provotypes approach, since we dealt with a wide variety of stakeholders and conceptions and were able to get a range of perspectives on the use of the approach. However, we believe that for further explorations of provotyping, it could be worthwhile focusing in on a single organization. This could be a small technical organization with a specific product or service with little consideration of the human perspective. Or this could be a big organization with socially-oriented departments that have difficulties transferring their findings to other parts of the organization.

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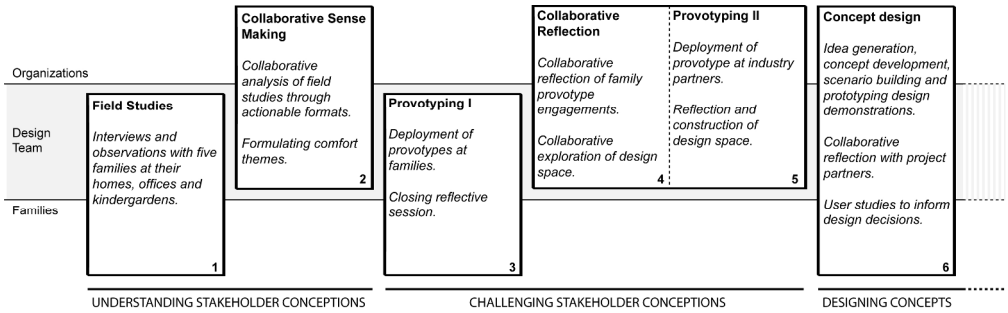

Activities across stakeholder groups in the Indoor Climate and Quality of Life project.
257x78mm (300 x 300 DPI)

The Render-Lamp provotype.
194x131mm (300 x 300 DPI)

The Sensitive Aunt provotype.
209x50mm (300 x 300 DPI)

Measured issue (type of recommendation)	Recommendation
No measured issue	*Indoor Climate is… OK!*
No measured issue	*Is there a problem?*
Too cold (compelling)	*Put on some extra clothes!*
Too cold (persuasive)	*It would be a good idea to put the thermostat up to 3*
Too warm (social)	*Ask your colleagues if it is OK to open a window*
Too warm (persuasive)	*Are there many devices switched on that are generating heat? You could turn them off.*
Too dark (persuasive)	*Could you switch on some additional lights in the room?*
Too dark (social)	*You could try to switch your desk*
Too bright (compelling)	*Turn off the artificial light in the room!*
Too bright (social)	*Ask your colleagues if they can turn off some light*
Poor air quality (persuasive)	*Could you bring in some plants in the office?*
Poor air quality (compelling)	*Get rid of dust in the air*

Examples of the Sensitive Aunts' recommendations.
110x126mm (300 x 300 DPI)

Deployments of the Sensitive Aunt.
209x50mm (300 x 300 DPI)

Design proposal of a 'comfort instrument' with interactive Smartphone application.
194x131mm (300 x 300 DPI)