Blue-Sky and Down-to-Earth: How analogous practices can support the user-centred design process

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ABSTRACT
We discuss how traditional methods for understanding design requirements are leveraged to produce innovative and fundamentally new perspectives when using analogy. We call these *analogous practice* approaches, and illustrate two cases that both use analogy to achieve exploratory design with ethnography, by gathering data from a different setting than we intend to design for. We discuss how the use of analogy is different in the cases, yet exemplify a related perspective of using analogy as a resource to support inventive design with traditional data collection methods.

Keywords
Transfer Scenarios, analogy, design methods, ethnography, Analogous Practice.

ACM Classification Keywords
H5.2. User interfaces: Theory and methods

INTRODUCTION
User centred design, including ethnographic method practitioners, has made large strides over the last several decades toward a greater understanding and respect for users' expert domain knowledge and the rich, situated nature of activity in order to improve systems' usability and utility. Design, according to this theme of work, follows understanding of the context in which the design will be used. Thus the design process and the resulting artefact are *grounded* to the use context.

Qualitative data gathering methods such as contextual inquiry, interviews and ethnography are an approach widely used in the HCI community for developing rich descriptions of use contexts and the complex, contingent environments in which activity is played out. Data from such fieldwork are abundant in detail for grounding design and improve a system's suitability. However, making use of ethnographic data within the design process can be problematic [4], particularly so for innovative design.

In this paper, we describe how to look beyond users and use analogy in ethnographic methods to gain new perspectives of a design situation. We will outline how studies of people other than target users combined with knowledge of the technology can support grounded, innovative design.

BACKGROUND
Existing work has used analogy in support of design, but not with the motivation of directly recasting findings from a qualitative method to another context.

Analogy
An analogy is an inference that if one entity (such as an object or practice) is similar to another entity in some ways, then it is probably similar in other ways as well. It is a fuzzy reasoning technique often used as a rhetorical or didactic device, for example the common – yet erroneous - analogy that an atom is like the more familiar model of the solar system [18].

Analogy and metaphor are well-known tools not only in design schools such as fashion, art, engineering and architecture, but is used by almost everyone to simplify communication in everyday life. The field of HCI has a constant stream of examples, where the most known is probably the desktop metaphor – an interaction paradigm where digital documents are treated as paper copies on a "desktop" to simplify understanding. Analogy can not only be utilised as a metaphor in design, but also has methodological possibilities [14]. "Making Tea" [17] is a design technique that illustrates how experiments in a chemistry lab were interpreted as "making tea". Here, an analogy was used to support an understanding of the "unfamiliar" activities in the chemistry practice, and to simplify the communication between the designers and the chemists.

Methods supporting innovative design
User-centred and participatory design methods have demonstrated the value in actively engaging users in design in order to leverage their expert knowledge [3]. However, an acknowledged problem is that users tend to come up with designs that are based on what they already are familiar with [19] and user centred design is not necessarily innovative [13]. Moreover, use of analogy as way of

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supporting innovative design often involves an analogy that is arbitrary or not studied in depth.

Several design techniques or methods explicitly strive for addressing an innovative design outcome, and only a few examples can be provided here. Defamiliarisation is related to our use of analogy and is a common technique in art and critical design to raise unexpected perspectives [6] and has also found applications in the design of technological artefacts [1]. Examples of de-familiarisation techniques not necessarily grounded in a practice but rather a brainstorming tool are "interaction relabeling", where two different products are combined or merged into one, such as a calculator that is interacted with like a gun, and "extreme characters" that explore a design concept for an extreme individual, such as the pope or a drug dealer [5]. IDEO, the design firm, use "Analogous Experiences", to associate the design with experiences that are analogous but different. For example, when designing a car, this could mean to reflect upon other types of travel experiences, such as horseback riding. Overall, by providing constraints for creativity, designers are supported in developing novel designs and ideas. However, this is a brainstorming technique rather than based on in depth studies of human practices and values. We will demonstrate approaches that also are analogy-based, but provides value beyond brainstorming.

ANALOGOUS PRACTICES AS A DESIGN PERSPECTIVE

Analogous context approaches are essentially concerned with using classical qualitative investigative techniques in a new way. Having found merit in its use for two quite different cases, we seek to elucidate and reflect further on using analogous data gathering approaches as a complementary design tool or philosophy. This is intended to support researchers to differentiate between this and alternative ways of using analogy in the design process.

Instead of applying the qualitative method to investigate the *actual* use context for a design, it is applied to an existing and established *analogous* use context, studying existing, established practices. Rather than attempting to integrate results from the analogous context directly into design as a form of data collection tool, the results are instead used as a creative resource to inspire and broaden design perspectives. In this manner, not only is the intended user practice and its context is seen in a new way, challenging perceptions of mundaneness, but it also has realism, grounding and depth, moderating the design process.

Selecting an appropriate analogous context depends on the nature and focus of the inquiry. For example, where the interest is physical interaction and gesture, a context analogous to controlling an industrial robot might be controlling a backhoe. Where the interest is the planning and coordination of several robots, perhaps dance choreography would be a suitable analogous context. Importantly, the analogous context should be established; it is, after all, the authentic, rich practices and experiences in which we seek to draw inspiration.

The analogous context can be studied with any number of qualitative methods, such as observational study and contextual interview. In lieu of conducting new studies, existing studies or perhaps even representations from popular culture, such as documentary film can be reviewed, with due consideration for their individual focus and agenda. Analysis of the analogous study is used to provide grounding for design work in the target context. Which elements to transfer are dependent on the design goals; for example it may be the experiential quality of use, as described in the case discussed below, or perhaps focused on the style of bodily movement, or even the use of work tools.

CASE STUDIES

We describe two case studies where we have used different approaches that exemplify analogous practice perspectives. The first case draws on analogy with a particular focus on innovative design, the second case utilises analogy for broadening the design perspective.

Designing agents an robots from reptile-owners interests

How can you design robot applications for a user group that does not yet exist? Transfer Scenarios [12] presents how we transferred the expressed interest from a specific category of pet owners into design concepts describing potential users' interest in their robots. Owners' interest in caring for pets such as lizards, spiders and snakes was taken as inspiration for how people might care for robots. We chose this category of pets because they are not especially cuddly nor can be taught advanced tricks, routines or pay attention such as a dog. Today, even a "life-like" robot such as Pleo is far more limiting to interact with compared to a dog [7]. Nevertheless we did not intend to make robot copies of the animals. We held interviews that focused on the interests people expressed in having such animals and what they did with them. We found that although reptiles often live in a special, environmentally-controlled terrarium that limits interaction, people have many reasons as to why they enjoy keeping them. For example, owners like to create living environments for their pets, to feed them and watch them eat, to admire them or even specially cross-breeding them to create interesting patterns. Some are part of a community and some enjoy the feeling of keeping a pet that others see as exotic. After the interviews we categorised different types of interest and transferred this data into describing interests in robots and agents. That is, we used the pet owners' interest as an analogy to explore potential user interests in robots and agents that also would be possible to implement.

The outcomes of the project were several design concepts exemplified with personas, built from the interviews. Two of them were implemented; Autonomous wallpaper [15], and Glowbots [11]. Autonomous wallpaper lets users decorate their walls by turning pictures into animated flowers that "live" on the wall. This was inspired by the enjoyment that people expressed of arranging the interior for the reptiles and simply watching them in the terrarium.

Glowbots were implemented as small wheel-based robots that spread their patterns. This was inspired by people's enjoyment in breeding reptiles to get new patterns, as well as emergence as an inspiring phenomenon and feasible technical property. Overall, these explorative designs show how analogy in the design process can stimulate a creative design that is grounded in real and existing interests and qualities found in a practice, rather than being purely based on idea generation. We also succeeded with technically feasible novel concepts in the field of robots and agents, a design space strongly associated to advanced science fiction products, many too technically advanced to ever become realistic as products.

From oil and gas to healthcare

At first glance, a gas refinery has little in common with a hospital. A gas refinery conjures imagery of a sprawling outdoor pipe-labyrinth of interconnected furnaces, high-pressure tanks and noisy pumps. Think of a hospital ward however, and perhaps the image of clean, sparse rooms with patients attended to by nurses dressed in white comes to mind. While the physical environment for each context is quite different, the nature of the work has many similarities. Field operators walk around the plant conducting 'rounds', taking measurements and looking for indications of damage or malfunction which automated instruments may not pick up. The operator's role is a sensorial one, in which he (or she) develops an intimate 'feeling' for the plant. Likewise, nurses perform similar tasks to an operator: observation rounds, taking measurements, making adjustments, performing small procedures. For both the nurse and the operator, their 'patients' are often wired up to instruments which log changes in measurements and raise alarms, however neither can trust automation completely – manual rounds are still an important part of their jobs. Similarities exist in the roles and relationships between nurses and doctors, operators and engineers. Doctors and engineers are experts, and prepare courses of treatment which is carried out by nurses and operators. Nurses and operators act as a mediator between the patient/plant and the doctors and engineers.

These similarities, along with others, were identified through a literature review of healthcare workplace studies [9] and our own fieldwork at oil and gas workplaces [8]. We used the analogous context of healthcare as a reflective lens on our own fieldwork. For example, we considered how a nurse uses a stethoscope to listen to a patient's heartbeat, forming a close physical connection between the two. This inspired a variety of design sketches for field operator instruments, exploring sonification of information and linkages between operator and equipment. We also considered the classical patient record, a folder stuffed with notes, test results, x-rays and so on, and how a similar metaphor might be useful as a way of aggregating and collaging data for engineers. We created concepts for a tablet-computer based system with which an engineer can draw together data from a variety of different information silos, annotate, organise and arrange interactive views of live process data.

Through the use of analogy, our perspective was broadened, helping us to think beyond what is normal and expected for the industrial context. Analogy illustrated not only alternative means of accomplishing similar tasks, but also different *qualities* of working – how would, for example, a field operator interact with a compressor with care, empathy and respect?

DISCUSSION

The two cases we outlined had different origins and design ambitions. Both exemplify how analogy can be used as a complement in a user centred process, to transfer qualitative data from one setting to another in order to ground innovative design. In one case, robot use practices are imagined based on collected data in the absence of practice. In the other case, the perspective on the existing oil and gas context is broadened and textured based on data from the analogous hospital context. The actual transfer can be accomplished with explicit steps such as exemplified by Ljungblad et al. [12], or with the designers own repertoire of design techniques. Transfer Scenarios provides very explicit steps, drawing inspiration from marginal practices. It can be appropriated, which is exemplified in [10] where experiential qualities from horseback riding are transferred into interaction design, resulting in general design implications for bodily engaging experiences. However, we believe that our notion of "analogous practices" provides a higher level and more general understanding of this specific use of analogy. Studying analogous practices can be explored in a variety of exploratory and inventive design activities, going beyond the focus on marginal practices. Both design cases builds on understanding existing human practices and values that we the designers consider being relevant for the intended setting. Thus, both approaches aims to ground innovative design in an existing, yet different practice that embodied some qualities that we want to take inspiration from. From a user-centred design perspective, this can be explained as taking an extra turn on the user requirements in the iterative circle (see Figure 1, next page). Thus, we do not avoid the users, but rely on other existing successful practices to inform and elevate the design space, beyond what the intended users can provide.

Analogous practices can only be stretched so far. While we may intuitively see the value in mapping the familiar onto the unfamiliar, care must be taken that analogy does not lead us astray. At a certain point, it becomes apparent that findings from an analogous study, no matter how compelling, simply does not map to the actual context being designed for. The jarring heterology of the two contexts serves as a valuable in-built "sanity check", hinting that findings are erroneously being used literally rather than figuratively. As with many design activities and methods for our field, design methods can be easily misunderstood or be used inappropriately [2]. In both design cases, we strive for understanding specific qualities

or appreciated practices to transfer into the intended setting. Carrying out transfers literally, such as letting oil workers use a stethoscope, or replacing "pet" with "agent" in accounts of pet-owners is a way to start grasping underlying embodied qualities that potentially could apply in the intended setting or for the intended users.

The analogous practice philosophy primarily sites ideation with designers, who are informed and inspired by the qualitative perspective from a practice that embodies some of the qualities we wish our design to aspire to. Analogy is used as a pair of glasses onto a context, providing glimpses of something fresh and unexpected which our actual user context is yet to realise or experience.

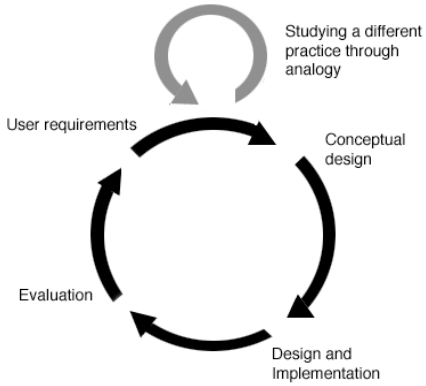

Figure 2. The iterative design cycle, with an additional twist of examining an anlogous context.

CONCLUSIONS

We discuss the notion of the analogous practice of transferring findings from a source context to a target context. This generalises and broadens the discussion from prior work. Our two instances of using analogy in ethnography and similar kinds of classical methods is not only about grounding blue-sky research [15], but also to provide some "blue-sky" or innovation opportunities for ethnographic methods. Here, the provided "blue-sky" is a rich understanding only available from actual practice and use. Traditional highly-grounded qualitative data serve as inspirational input for inventive design ideas, suggesting that such studies can raise novel or even provocative ideas. For example, by examining accounts of the sociology and work practices in healthcare, we were able to critically reflect on an industrial context and envision new tools and ways of working. By studying reptile owners' interests, we gained a new perspective of pet ownership, informing novel robot and agent designs which move beyond interactional stereotypes.

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