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Design Perspectives

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ABSTRACT

In this article we argue that a structured use of perspective descriptions can support a design process. A design perspective is a coherent set of values and aspects emphasized by the designer in a given design situation. We present a generic framework for describing 7 dimensions of perspectives concerning *user*, *artifact*, *context*, *activities, communication*, *central relations,* and *use qualities* that we argue are relevant in a design situation. Subsequently we use this metaperspective to describe four perspectives: *tool, architectural, usability,* and *media* perspective distilled from literature sources. By conducting two design workshops, we have evaluated the effects of using perspective descriptions to address the problem of idea generation in the early phases of design. Our analysis shows that the perspectives contain values that can have an important impact on the resulting artifact. By guiding the exploration of the design space, they influence both the artifact's conceptual idea and its use qualities. In our design example, a car game, the conceptual idea of the artifact varied from a goal-oriented tool to a media-based communication experience. Use qualities varied from a task-based flow of action to a format-dependent communication experience. The perspectives served as a synthesis of basic assumptions from the literature and as support to gener-

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ate conceptually different design ideas. Based on the outcome of our study, we propose an approach for working with design perspectives in design practice, and education. We also present an agenda for research on design perspectives.

1. INTRODUCTION

Design of information systems is often characterized as being a complex and open-ended process. The term "wicked problem" was originally coined in the context of societal planning (Rittel & Webber, 1984), but is now widely accepted for describing design problems in social contexts. Wicked problems are open-ended in that they cannot be objectively defined, but rather that problem solvers subjectively discover, define, and prioritize the problems in parallel with forming possible solutions. We argue that the individual perspectives of design participants are of paramount importance in this subjective process.

1.1. Perspectives

Human action and perception are often performed on the basis of one or more perspectives through which the individual sees the world. The importance of perspectives for human interpretation of the world is stressed in the literature (Bansler, 1990; Hirschheim and Klein, 1989; Molander, 1996; Nurminen, 1988; Nygaard and Sørgaard, 1987). This seeing often affects the way humans act (Kvale, 1997; Nurminen, 1987).

A definition of the term perspective was proposed by (Nurminen, 1987 p. 155): "The perspective determines to a great extent many essential characteristics of our actions, that is our praxis. It tells us the rules according to which to act, to conceive of things, to think about them etc." That definition is coherent with the definition of perspective presented by Nygaard and Sørgaard (1987). "A person's *perspective* is a part of the cognitive universe that may structure his or her cognitive processes when relating to phenomena within some domain" (emphasis in original; Nygaard & Sørgaard, 1987, p. 381).

Nygaard & Sørgaard (1987) furthermore discussed three perspectives on programming and the two perspectives of harmony and conflict in systems development. Kammersgaard (1988) discussed four design perspectives on human–computer interaction (HCI): the systems, the dialogue partner perspective, the tool perspective, and the media perspective. He argued that in design, one should take a multiperspective. In this he agrees with Nurminen (1987) who discussed three perspectives on information systems: the systems theoretical perspective, the sociotechnical perspective, and the humanistic perspective. He argues that perspectives are similar to paradigms in that they often operate unconsciously, and that they like paradigms have emerged to answer questions which previous perspectives have been unable to answer. However, perspectives regard practical, rather than scientific problems. In Soft Systems Methodology (Checkland, 1988), perspectives also have a prominent role, where a

problem situation or system is examined by explicitly applying different perspectives to view the situation and gain a multifaceted understanding.

1.2. Perspectives in Design

When the designer meets the design situation and the *artifact genre,* the designers preunderstanding forms an active design perspective. This perspective has a major influence on the actions taken in the design situation (Lawson, 1997). Arguably, genres as social contracts are another kind of conceptual space, stemming from the human cognitive system, and its capacity for creating cognitive prototypes. That means that an item may be a more or less good example of the genre, depending on how near it is to the cognitive prototype, in the conceptual space. Cognitive prototypes have central characteristics rather than necessary and sufficient conditions (Rosch, 1973, 1978). Genres are often seen as sharing aspects of form, content, and purpose with other genre products. Genre is a powerful way of framing a design, because the producer by relying on genre can be assured that the user in some sense already has experienced the product. Implicitly, designers will have with them a set of genre instances that they have experienced as designers, users, or both, constituting part of their design repertoire. Design activities are thus often related to the designer's repertoire of examples as an integrative part of design action (Schön, 1983, 1987). As Carroll (2000) discussed, having achieved design rationale and scenarios for an artifact, it may be possible to generalize the findings to the artifact genre, rather than narrowly to the specific artifact. In this way, scenarios with design rationale can be carried over to new design situations.

As a designer acts and interprets events in creating an IT-artifact, several factors influence the active design perspective that influences the way the designer explores and interprets the design space. The individual's preunderstanding forms an overall frame of reference for interpreting the world (Hirschheim & Klein, 1989), which is constituted by earlier experience, knowledge, feelings, etc. This is a personal and partly unique perspective of the world for every individual in a society.

The concept of perspectives in design highly resembles Buchanan's concept of placements in that it describes a designer's subjective, experience based on a holistic view of the design situation. "Placements are the tools by which a designer intuitively or deliberately shapes a design situation" (Buchanan, 1996, p. 16). When applying a placement to a specific design situation they give a context to and orient thinking and can be the source of new ideas and possibilities. The ability to systematically shift placement is of utmost importance for the designer's capacity to handle complex design situations (Buchanan, 1996).

Maaß and Oberquelle (1992) also argued that design perspectives can be observed in design work, in the way systems are described to users, and by the design techniques that are used. Nygaard and Sørgaard (1987) also described perspectives as being embodied by design techniques. In terms of design spaces, design techniques can guide the attention to what aspects of the design situation that are seen as important.

Design techniques frame design problems through a metaperspective by setting dimensions. For instance, the persona technique is a design technique framing design in terms of future users. The persona technique frames the design problem through a perspective, by setting dimensions for describing users, for instance by describing their life goals, experience goals, and their end goals (Cooper & Reimann, 2003, p. 64). Products may also be framed primarily from the perspective of the activities in which they are or could be relevant. That can be done through scenarios—describing a product in terms of how it is or should be used. A scenario characteristically includes a set of dimensions, for instance actors, a setting, and a goal to be attained in the activity. There is also a temporal dimension, the plot, describing aspects of use, such as events and actions. Regarding design techniques, the description embodying the dimensions can, for instance, be achieved through textual scenario descriptions, or prototypes (Carroll, 2000).

Design techniques may thus be motivated from a perspective, but do not have to involve every aspect of the perspective. An example of taking an artifact-centered perspective on design is the use of heuristics for interface evaluation. They can focus only on the interface, such as the heuristics of Nielsen and Molich (1990) and (Nielsen, 1992). In this case, the perspective taken by the designer may well affect how the heuristics are interpreted. For instance, they may affect the interpretation of who the user is, in "speaking the user's language." Heuristics may also be described from an explicit perspective. For instance, taking a genre perspective, genre-specific design guidelines for artifacts can be described, being more specific than the general guidelines of Nielsen and Molich (1990; Nielsen, 1992) but also being more restricted in their applicability (Ihlström & Lundberg, 2004). This is also true for genre specific use-qualities (Hult, 2003).

Design perspectives can also be utilized when interpreting situations of use. The role of perspectives in interpretation can be illuminated by the Neisser (1976) model of the perceptual cycle. In its simplest form, it consists of three entities: an object, a schema, and perceptual exploration. The object is in this case the use situation being observed, the design perspectives are part of the schema, and perceptual exploration is the sampling of sensory data from the use situation. In Neisser's (1976) model, the schema directs perceptual exploration, causing the schema to change. Idealized design perspectives can be used to guide perceptual exploration, by directing the analyst to the

characteristics of a situation, compared to different perspectives. In the terms of Goodwin (1994) they can be used as coding schemes. This is also applicable to interactive artifacts. Through repeated use in the profession, a coding scheme may become a part of the professional vision in the domain where the person is active, which means that people from the same profession will conduct coding in similar ways (Goodwin, 1994). In a study of colocated situations of use, perspectives were used to identify whether actions utilizing artifacts corresponded to tool, medium, system component, or the arena perspective. A shift between action characters during use was observed (Arvola, 2003). Winograd stressed the role of language in all cooperative work and summarizes earlier research in that the design perspective "determines the kind of questions that will be raised and the kinds of solutions that will be sought," and that when consciously applying a perspective as a guide to design, "It will not provide answers to all of the specific design questions, but serves to generate the questions that will demand answers" (Winograd, 1986, p. 203).

Having framed a problem, the design space can be explored, to discover different design alternatives. When a problem is framed, then, loosely, a design space is set, with dimensions and constraints. Boden (1994) described that creativity stems from exploring and transforming design spaces. For instance, explorative creativity can be exemplified by the composition of music, painting, or speech, when following the rules of composition governing these activities. These rules may or may not be known explicitly by the producer. Drawing on this kind of creativity, whatever is produced at a specific point in time could have been produced before, exploring the space of that system of rules. Boden also discussed another kind of creativity, which stems from changing the design constraints, for instance by negating or removing some rule in the generative system. Regarding design of computer technologies, this would imply that a technical development, opening new possibilities for design, opens the possibility of transforming the design space, regarding technical constraints.

One of the major challenges in conceptual design work is to generate divergent ideas. By generating different potential solutions, further possibilities can emerge through cross-fertilization. In our own professional experience as designers and teachers as well as in the literature (Lawson 1997; Löwgren & Stolterman 1998; Schön, 1983) generating diversity is an important issue. Traditionally, general creativity techniques such as brainstorming, morphological charts (Jones, 1992), deBono's six hats (de Bono, 1993), and other techniques have been used to reduce convergent thinking and thus break free from preconceptions that are brought into the design process. In metaphorical design workshops, divergent thinking is achieved by shifting metaphors. For instance, a library could be discussed in terms of a store, or a warehouse,

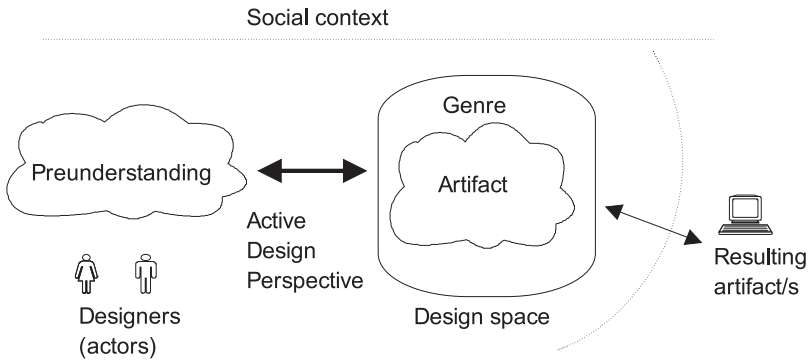
directing attention to different aspects of what a library could be (Kensing & Madsen, 1991).

Explicit design perspectives have also been used to guide design work. Bødker, Nielson, and Peterson (2000) used the same perspectives as Kammersgaard in a design workshop. They described the perspectives as character-perspective pairs, using two-page posters. For example the systems perspective was paired with the character Spock. During design, they repeatedly experienced that participants referred to how the character would have acted in the particular situation, rather than how the perspective would apply. Bødker et al. (2000), found that the character descriptions they additionally used were used in place of the perspective descriptions. Perspectives have also been used in design critique systems to organize design knowledge, support individualized critique and provide support for designing from alternative views in given design situations (Fischer, Nakakoji, Ostwald, Stahl, & Sumner, 1993).

When applied to system design and use, metaphors stand for certain perspectives (Maaß & Oberquelle, 1992). Indeed, Lakoff and Johnsson argued that the human conceptual system is built on a system of metaphors. It is based around a core of bodily experiences that have been expanded by the use of metaphor (Lakoff & Johnson, 1980). Metaphors rely on analogy, by speaking of something as it was something else, an analogy is pointed out, that there is a similarity between two different concepts.

Our view of perspectives in design is summarized in Figure 1, where key elements of the design situation are presented. Note that implicit in the following is a view of the designer as an individual even if practice often means working in design teams. The distinction of the group processes and the impact on the design perspectives are not directly addressed here.

Figure 1. **Key elements of the design situation.**



2. A GENERIC PERSPECTIVE FRAMEWORK

Because our purpose was to evaluate the structured use of perspective descriptions in design work, we first needed a generic perspective framework. In a sense, the framework can be viewed as our metaperspective of the design perspectives. In terms of conceptual spaces, the generic perspective framework sets up the dimensions of the design perspective. We needed this framework for a number of reasons. First, we wanted to be able to, in a structured way, highlight aspects of a perspective that can have important consequences in product design. Second, a design oriented metaperspective would allow us to import perspectives originating outside of the field of IT and systems design and thus use a broader frame of reference for design ideas. Third, a generic framework would allow us to better compare and contrast the different perspectives because the same design oriented dimensions are described for each perspective in the language of the framework rather than the sometimes heavily connoted terms of the different perspectives.

As our intention was to aid design of an IT-artifact, it seemed reasonable to include the *user*, the *artifact*, the *context*, and the *activities* involving use of the artifact. These components (users, artifacts, context, and activities) are related to each other in a use situation. Between these components there exists some relations. The most central relations are therefore included in a dimension in the framework. Because communication between these components is also of paramount importance in interface design and collaboration between users, it is arguably an important dimension to include in a framework. Perspectives also include norms for the characteristics of the designed artifacts that are desirable. In our design-oriented framework, these are described as specific use-qualities (Ehn, Meggerle, Steen, & Svedemar, 1997; i.e., use qualities that would be good regardless of a specific artifact and user). In a perspective, there often is an accepted terminology to describe components and relations. This terminology also has value connotations that are lost when a perspective is described with a more generic terminology. For clarity, the accepted terminology of a perspective is therefore presented under the label *described by*. However we do not regard it to be a design dimension.

As a clarification of the intended content of the framework dimensions, we created short descriptions of the aspects of the perspective that could belong to the dimension. It is, however, impossible to totally separate between the dimensions, which in some way overlap in the descriptions. The seven dimensions and the described-by category are presented next. Because a number of different perspectives should be describable in the same framework, the dimensions and their names have to be general enough to room characteristics of any design-oriented perspective. Also, designs may be framed in terms of

different *sets of values*, such as their efficiency, their ethical consequences, the discomfort users are subject to during use, or their safety. These *qualities* emerge in use, or can be seen as residing inside a product, as does the durability of a product. Defining important sets of values frames a design problem through setting the dimensions and contents of a design space.

2.1. Dimensions of the Framework

The Users: This dimension includes the actors that are seen as users of the artifacts within the perspective. The users can for example be regarded as individuals or groups of users. They can be characterized in terms of their knowledge, habits, and goals. It is also relevant to address if the perspective attends to *nonusers*. The notion of nonusers is, for instance, of importance in ethical discussions where the effects of system use greatly can affect other groups (the nonusers) not directly involved in the actions.

The Artifacts: The object of use within the perspective is some kind of artifact. This dimension focuses on what these artifacts are and also the characteristics of the artifacts. Code or formulas, for instance, can be regarded as artifacts depending on the perspective, material, virtual, or abstract artifacts.

Context: The design and use of artifacts exists within some given situation. Context refers to what is considered the use situation in which the users and artifacts interact. The context description may contain spatial, cognitive, emotional, and temporal aspects. It can, for example, include in what physical cultural and organizational environment the users and artifacts are embedded. It also includes a relation to historical and future development of this environment.

Activities: This dimension focuses on what activities are carried out within the perspective, for example, cognitive or physical, structured and predictive, or unpredictable actions and activities. Activities also include intentionality, if any, relative the use of the artifact, for example the goals or purposes, wishes, or expectations relating to the artifact use and related activities.

Central Relations: Relations can exist, for instance, between different groups of users, user and artifact, artifact and history, or surroundings. In the same way as with the perspectives, this dimension describes what can be seen as most prominent in the perspective regarding these relations. This includes what relations are focused and salient in the perspective. Depending on the perspective, the relations between the manufacturer, car, user, traffic regulations environment, and the road system can be focused.

Communication: Both design and use of artifacts creates a rich space for different kinds of communication. The use of artifacts especially includes some kind of communication, primarily between user and artifact. This dimension focuses on what is communicated and how. The term communication is used here in a broad sense, intended to include communication and interaction between active agents as well as the communicative effect artifacts can have on these agents. For example, buildings can (intended or nonintended) signal something about the designer, owner or intended use. Signs can also convey a message and a document or screen layout can inform the user of priorities or the desired work order.

Perspective-Implied Use Qualities: Within the use situation the interpretation (user) and communication between user, artifact, and context reveals some kind of use qualities relating to the artifact as a result of its use. An important aspect of design work is to identify and articulate central use qualities that are desirable given the perspective. This can, for example, include describing, according to the perspective, the desired effects resulting from the intended use of the artifact. The use of a car can, for example, be described in terms of being effective, pleasant, educative, cheap, environmental friendly, or safe.

Described By: A perspective often implies some kind of accepted terminology to describe core aspects of it. The perspective sometimes carries its own vocabulary with perspective-specific words or meanings. This category describes the accepted terminology of the perspective and what the underlying values are. For example, the term playability is highly relevant in game design but has little relevance in control room design.

3. CREATING THE PERSPECTIVES

Based on literature sources, four design perspectives were formulated: the *Tool, Architectural, Usability,* and *Media* perspectives. In our selection of what perspectives to create, our main criterion was that they in some intelligible and coherent form should exist in literature descriptions, and be interpretable from aspects of our generic perspective framework. There was no requirement that the different perspectives should be comparable in origin and purpose. In the literature, perspectives are often implicit, underlying what is being expressed, and our work has partly been to synthesize related descriptions from different sources. Moreover, where perspectives are explicitly described, the dimensions constituting the framework of description are often implicit.

One of the challenges we faced was to come to an agreement on what literature sources to base the four perspectives on. Based on one's own experience

and what literature sources are familiar, for instance regarding HCI, numerous possible different usability perspectives can be created. We have selected what we conceive to be characteristic in each perspective. To create a perspective description, we needed to refine the descriptions and thus create idealized perspectives based on what we agreed were core aspects of the chosen perspective. Apart from the fact that selections of core aspects of the perspectives can be disputable, there is the delicate and important matter of making the different perspectives equally much ideal typical (Miller, 1963), as the degree of ideal typicality will affect the design outcome. With too little idealization, the distinction between different perspectives is blurred. With too much idealization we risk ending up with caricatures of little use in design.

The level of detail and the selected vocabulary in the perspective descriptions are important. The perspectives need to be detailed enough to be understood and interpretable as whole perspectives, but the level of detail and the vocabulary must not restrict the designers thinking to the domain that the perspectives come from. In the architectural perspective, for instance, ethics is one of the central aspects, but the specific instances, such as door size allowing wheelchairs to pass, may not necessarily be transferable to IT-related areas of design. However, the underlying ethical ideas, such as equal possibilities to participate in the activities despite impairment, are transferable. This can be interpreted according to what is important in the specific IT-related genre we chose to design for.

The four perspectives were created based on the literature and our judgment about how individually differing and fruitful for design they were.

3.1. The Tool Perspective

The tool perspective deals with skilled human use of tools to shape a material into a more refined artifact. The tools act as extensions of the human body facilitating both the users or craftsmen's ability to work the material and to sense the characteristics of the material. The tool perspective in our interpretation is inspired by Kammersgaard (1988), McCullough (1998), Paulsson and Paulsson (1957), and Shneiderman (1992).

The Users: The users are seen as competent, purposeful, and rationally acting humans. Focus is generally on the single user rather than the workgroup or organization. The nonuser is not attended to because the primary user is heavily in focus.
The Artifacts: Tools act as extensions to the human body and senses. The tool compensates where the human body and senses limit the interaction with the material. The tool thus expands the number of possible actions and extends the human sensing. Tools are purposeful and adapted to human traits.

Context: A local context is considered, mostly consisting of the environment where the raw material is formed into new artifacts. For example, artifacts and knowledge can be reformed, and the tool should support and facilitate this. The tool is used in the full span between goal-oriented professional and leisure situations.
Activities: The activity aims to design and shape a material using the tool that functions in close relation with the user. The activity is goal-oriented and rational.
Communication: The communication is multimodal in both directions. The communication is ideally seen as a rich communication between user and material (the object being transformed), mediated by an artifact that is to a great extent transparent.
Central Relations: Important relations connect user, artifact, and material. Another important relation connects this triad to "purpose of use."
Perspective-implied use qualities: The artifact facilitates a smooth flow of actions involving the artifact that transparently acts as an extension to the human body and senses and leads to the fulfillment of a goal. The artifact must be safe, ergonomic, and replaceable.
Described By: Function, purposefulness, result (action-based artifact), and skill invisibility.

3.2. The Architectural Perspective

The architectural perspective originates from the culture of designing buildings and the role of buildings in sociotechnical systems and societies. Buildings are designed to facilitate construction and use and to carry aesthetic values. The building should in some respect conform to a set of functional and aesthetic characteristics that constitute a style. The architectural perspective in our interpretation is inspired by Ehn and Löwgren (1997), Jones (1992), Lawson (1997), and Lundequist (2000).

The Users: Designers and end-users can be seen as users for different purposes. The designer uses the artifact to communicate good design and create desirable norms for end-users and other designers who in their turn use the artifacts for inspiration. The end-users use the artifacts for utility and experience. They also use the artifact as a key to understand the context, for instance the presence and style of artifacts such as buildings, tools, and icons indicate their intended users and use. For the utility purposes, model users can be used in the design process. Apart from what is inherent in cultural and social norms, end-users need not have any special skills or knowledge to use the artifacts.

The Artifacts: The artifacts are parts of sociotechnical systems and are ascribed both communicative and subjective characteristics, such as aesthetics, ethics, and function. Good design is claimed to be difficult to formalize and articulate and is learnt through good examples. The artifacts should have flexibility in that they are adapted for future changes in future use. Style and social aspects influence what is viewed as good design. The artifacts should combine a creation of historical meaning with function, ethics, and aesthetics to form a whole.
Context: There is a clear connection between the context and design, where the design should be adapted to purpose, regulations, surrounding environment, and history. The context is a social setting where individuals try to attain meaningfulness, and it has important elements of culture, tradition, and style to act as a value system for artifacts.
Activities: The artifacts are used by the end-users both for utility but also to create aesthetical values and signal something to other users about the user. Artifacts create the arena for social communication and interaction with the focus on high-level goals rather than detailed actions.
Communication: The communication is multimodal (i.e., all modalities are used for communicating use and aesthetical values to users). The communication is grounded in tradition, style, and culture.
Central Relations: The most important relations connect artifacts, users, and culture. Other important relations connect designer and artifact as well as artifact and its context. There is also a relation between artistic and experiential and functional and utility aspects.
Perspective-Implied Use Qualities: The artifact should convey a positive experience and an experiential message. It should bring about an ethically and aesthetically desirable result and be ergonomically well adapted to user needs. Useful, styled with the context in mind, and beneficial for the society, including safety to use, are other perspective-implied use qualities. Furthermore, its use should be intelligible.
Described By: Aesthetics, ethics, function, design examples, and a culturally grounded artifacts with a designed message and meaning.

3.3. The Usability Perspective[1]

The usability perspective considers the adaptation of information technology and other artifacts to the cognitive abilities and previous knowledge of the

1. As mentioned earlier, this perspective is more representative of the early psychologically oriented theories within HCI than of later developments in the field. There are, of course, numerous possibilities to create perspectives different from this one within the field of HCI.

users. Artifacts should facilitate efficient and effective task completion for a set of well-defined tasks. Users interact with the artifacts through a set of accepted and meaningful operations. Through the design of the artifacts and previous experience with similar artifacts the set of meaningful operations and sequence of operations should be apparent or easily learnt and memorized by the user. The usability perspective in our interpretation is inspired by Beyer and Holzblatt (1998), Dumas and Redish (1994), Nielsen (1993), and Preece (1994).

The Users: The main focus is on the individual user. In most cases the person is from a known group of users. An organization may also be viewed as an aggregated user. The individual users are task-oriented persons with different knowledge backgrounds and with a moderate ability to adapt and learn. Focus may be on general cognitive aspects of the users.

The Artifacts: The artifacts are mainly IT-based and are viewed as tools that facilitate or make the achievement of specific well-defined goals possible. The artifacts should be well-adapted to user needs and characteristics as well as task and context. The most important qualities of artifacts are efficiency and understandability. Utility is less in focus, and there is a tendency to focus on easily measurable and specifiable characteristics of the user's interaction with the artifact.

Context: The context is described in terms of user, task, and organization. The physical context, such as illumination and noise, are regarded as important parts of the context. This is rarely the case with cultural, social, aesthetical, and historical aspects. An important exception is that the perspective well attends to the user's prior experience and knowledge. The context is most often some professional activity. The technical context such as operating system and input–output units are regarded as important parts of the context. The artifact is generally aimed at solving the whole problem and is considered to be a part of a formal and informal, rule-based and task-focused organization.

Activities: The activity is a work-oriented process of executing tasks with an overall goal. The user strives to execute a predefined task by acting or learning to act with the artifact as a tool. The major focus is the solving of tasks. The activity can vary between one-time walk up and use to expert interaction. Learning is seen as an important activity.

Communication: The system communicates the possibilities for single actions, and the user communicates single actions that together form meaningful activities. The communication is often viewed at a relatively low level (parts of a specific task; i.e., under a level where actions form meaningful activities). The system does not communicate overall purpose but rather possibilities for single actions.

Central Relations: One important relation connects a single user to the artifact and the task. Another connects user, artifact, and organization (social context).
Perspective-Implied Use Qualities: Comprehensible, efficient, controllable, learnable accepted, and task fulfilling.
Described by: Understandability; efficiency; and the triad user, artifact, and task.

3.4. The Media Perspective

The media perspective deals with the role of artifacts in mediating communication and information transfer between humans. The perspective describes a sender that wish to convey a message or an impression to a single recipient or a group of recipients. The message is adapted to the limits of the artifacts (e.g., bandwidth) and to a common ground of interpretation among the recipients, a genre. The media perspective in our interpretation is inspired by Agre (1998), Grossberg et al. (1998), Kammersgaard (1988), and McQuail (2000).

The Users: The users are individuals or groups of consumers who are seen as a part of an audience. The producers are also seen as users. The consumer (user) is one part of a dialectic system of consumer and producer. The consumer (user) is a role in the media production and is generally characterized as habitual and with a social identity but also individual characteristics. The users can be viewed as individuals, groups, stakeholders, or roles belonging to an organization. Even society can be viewed as a user. For both providers and end-users the use may be driven by the prospect of economic gain.
The Artifacts: The artifacts mediate communication actions between the different participants. The media artifact has a well-specified format to be able to be handled by the infrastructure. It must also suit the purpose of communication both with the artifact and in transferring a message. The artifacts can be understood based on collectively based expectations of a genre that is related to other products, their use, and history.
Context: The genres the media artifact belongs to, as well as similar products within the genre, are important parts of the context. Other mediating products (e.g., for viewing or transferring media) are also major parts of the context. Further examples are authorities, rules, ethics, and the spirit of the time. The complex structure of competing media, the organizational context, and users are also included in the context considered by the media perspective. To share experiences with others in society is an important part of the context.

Activities: The activities include producing, editing, filtering, distributing, seeking, interpreting, consuming, and reacting to the media artifact and its perceived content. The activities are purposeful and aimed at entertainment, information seeking, work, storytelling, and production of material. The individual user communicates and strives to understand a historically grounded present and a possible future. The stream of media products are often coupled to oppositely directed financial transactions.
Communication: The communication is either broadcast, network, or peer-to-peer. The communication can be based on either gateways or networks. It can also be synchronous or asynchronous.
Central relations: Sender–medium–receiver, relations of power, message–physical artifact, individual–media–environment, and sender–media–product–audience.
Perspective-Implied Use Qualities: Comprehensible message and a deliberate adaptation to relevant genres, purpose, media, infrastructural format, and the spirit of the time. A socially grounded and acceptable design with positive consequences for power, influence, and ethics.
Described By: Message, content, communication, ethics, culture, and genre.

4. INITIAL DESIGN WORKSHOP

Our study of how applicable the perspectives could be in a design situation was divided in two phases. The first phase was a series of design sessions to test whether the design perspectives can be used to support the generation of different design alternatives when the perspectives are well internalized. This was done by the authors after the creation of the perspectives. The second phase, presented later in the article, was a workshop with designers at Nokia in Linköping.

In the first phase we chose a car game as our design task, firstly because we and the reader have some knowledge of the conceptual idea behind car games. This experience acted as a part of our preunderstanding of the car-game genre. For the reader it can act as something to contrast our designs with (Figure 1). Second, we chose a car game as our design case to avoid giving any of the perspectives an obvious advantage. For instance, the usability perspective emerged, historically, from designers' experience with design of workplace technologies. If we thus had chosen an office workplace task, it would possibly have given the usability perspective an advantage. In contrast, we believed it might be instructive to see what happens when designing from the usability perspective and designing an artifact for a nonwork context of

use. Third, we decided to use a computer game as a model for the exemplar artifact as it implied relatively few restrictions in the design space exploration.

4.1. Method

The workshop was conducted during three 4-hr design sessions. Participants were the three authors of this article. The same design brief was used in each meeting, to create a design concept for a car game. The perspectives were used in sequence, creating one design concept using each perspective. Thus, approximately 3 hr was used for each concept. The authors have educational backgrounds in systems analysis, computer science and engineering, and cognitive science, respectively.

We used sketching techniques to support the creation of the designs. However, we did not outline a specific requirement specification for designing the artifact as we primarily focused on the use qualities of the artifacts and secondarily on the functions. While sketching, we continually looked up the perspective descriptions, comparing our sketch with the implications of the perspectives. Examples will be illustrated in the analysis section. For instance, when the context was a social setting, we included devices in the sketches to facilitate social interaction.

During the workshops, we used the descriptions of the perspectives to guide our design activity, but we also made minor corrections to the perspectives, making them more coherent and clear. The perspectives were, however, well-internalized by the authors.

4.2. Results

The descriptions of our sketched designs focus on what use qualities the games should have. They contain a sketchy description of the perspective-based use qualities of the different perspectives. There is also an influence from the artifact genre of a car game in our designs (Figure 1). This is embodied in all games focusing on driving a car in an environment for the purpose of winning. However, how to win may differ between the games. The following was our interpretation of how a car game might be designed using the perspectives.

The Tool Car Game

The tool perspective gave us a focus on flow of interaction. The interaction devices should become invisible to the driver, like an extension of the body. Thus, there is no automation of the driving task. Instead, the virtual road and car become visible through sound, vision, and force feedback. The flow of interaction through interaction devices to control the car should not be too

mentally or physically difficult, allowing the driver to finish the race without taking a break. Furthermore, the interaction devices are to be high-end standard components, enabling broken parts to be replaced. The interaction devices are close copies of the devices found in a car, making the game experience similar to driving a real car on a real road.

The user of the car game is a person with no particular handicap and, we assume, with no particular domain knowledge at the outset. To win the game, the user has to race against another player, and race faster. This requires some kind of skill that can be refined within the game.

The tool consists of the virtual car and the hardware used to navigate the virtual car. To facilitate learning, the car should act as a normal car, thus not remain on the road when a normal car would have lost its grip. The simulation is thus the material that the driver interacts with, using the steering wheel and pedals as tools.

In this perspective, the hardware is more advanced than in any of the other car games, making it economically suitable for professional training use rather than playing in the home. The realistic visual and auditory feedback is guaranteed through the use of wide-angle screen and 3D-sound. The feeling of a real car is enhanced using a physical dashboard connected to the steering wheel. See Figure 2 for a view of the interaction and Figure 3 for a screen-view in the tool car game.

Figure 2. **The interaction environment and the user in the tool car game.**

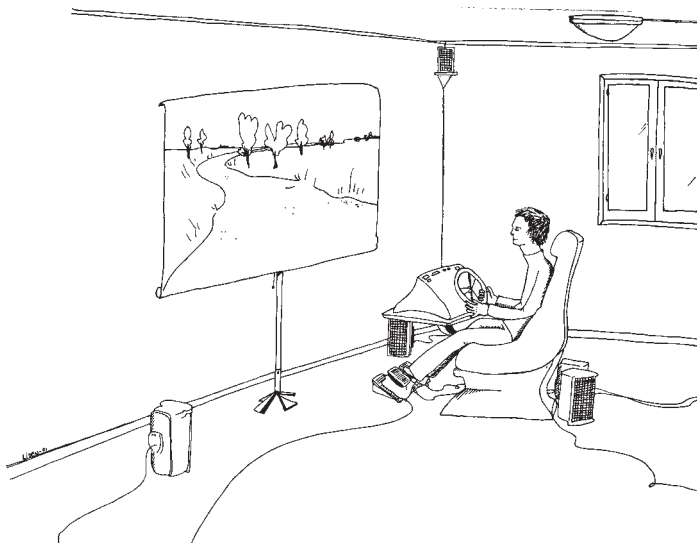
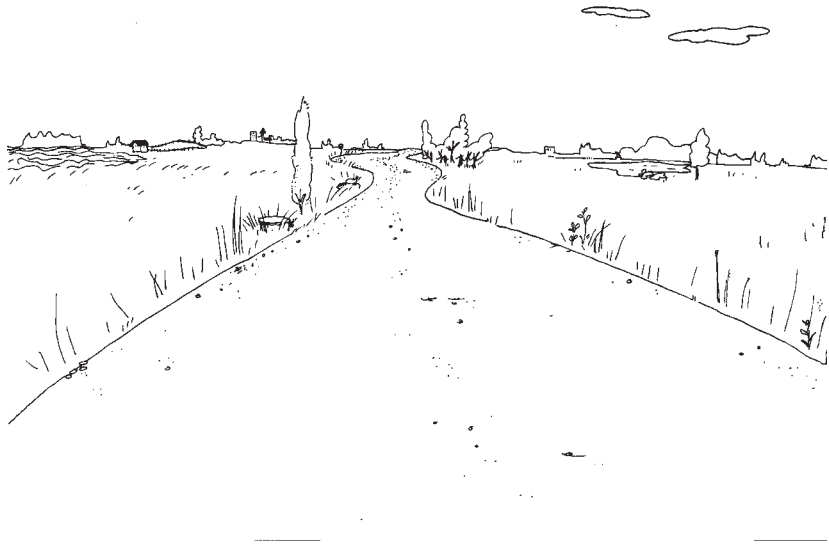


Figure 3. **A screen-view in the tool car game.**



The Architectural Car Game

From the architectural perspective, we proposed a virtual city for the players and a car interface for the players and spectators. The player is supposed to be a normal citizen who would like to experience driving and practice driving skills. The purpose of the game is not just to win but also to learn how to drive a car. It will support future generations by providing a multitude of missions in the virtual city. These missions can be anything that includes driving, and to win might, for example, be to find the safest and quickest route between two places, or to visit a sequence of locations first, without being arrested for breaking the traffic rules. It can also be played in teams, to facilitate social interaction.

The car interface should be visible to the spectators, enabling a social event surrounding each player. Using a screen and speakers allows the players to interact socially with the spectators as they play, and it allows the spectators to follow the game from the player's point of view. The game should appear inviting to the spectators and be an unobtrusive part of a home environment. Thus, the game should use aesthetically pleasing parts. The parts should be easy to move, rather than be fixed together in an arcade unit, again to fit a home environment. The parts should be standard car-interaction devices and allow the players to learn driving skills for a normal car. Society will then gain more highly skilled road users, with minimal negative consequences for the environment.

Figure 4. **The interaction environment and the users in the architectural car game.**

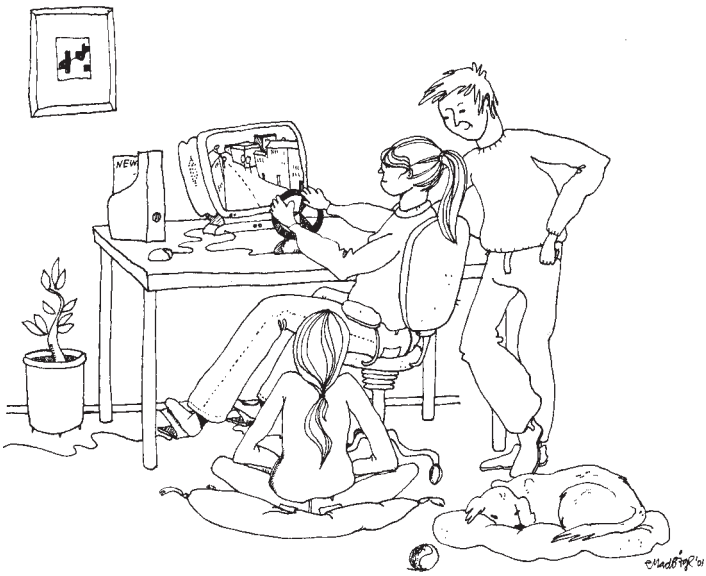


Figure 5. **A screen-view in the architectural car game.**

The virtual city will look natural and convey a sense of aesthetic values, such as beautiful scenery and buildings, with sufficient light in the virtual night to convey a sense of safety for the player and coplayers. Contributing to that sense and to the utility for society is a demand to follow traffic rules, with consequences for transgressions of the rules. Furthermore, to take a break in the game, cars must be parked, allowing the users to be in control of the game situation, in a way that looks natural to coplayers. Having parked the car, the player can use the screen to view other players if they have their virtual camera switched on. The possibility to switch the virtual camera off is an ethical consideration of privacy. Communication with coplayers while driving will be allowed for players using a headset to ensure safe driving. Safe driving will be supported with a heads-up display with a virtual map, and instrumentation. See Figure 4 for a view of the interaction and Figure 5 for a screen-view in the architectural car game.

The Usability Car Game

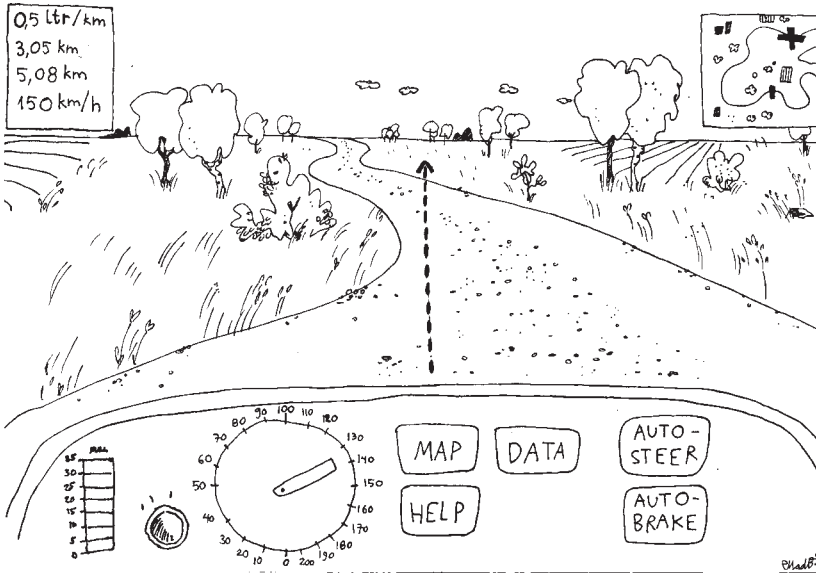
The users of the usability car game are teenagers spending a lot of time playing car games. Their technical context is a home computer, possibly connected to a network. With a network, the users can be organized in teams with real members. Without a network, the members of all the teams are virtual characters. To win, either the player comes in first or their team comes in first.

The interaction with the game should be easy to learn and should be efficient for the player. To achieve this we sketched a fully automated system, but one where the user can take control by gripping the steering wheel and release control by letting go of the wheel. The autopilot should be supported by virtual sensors, which vocally warn the user about collision hazards. A heads-up display will show the user the normal instrumentation. A map display, showing the current position and the goal, and a data window showing average fuel consumption, the distance remaining and covered, as well as the average speed may optionally be switched on. Furthermore, the user can switch on a graphic enhancement of the virtual environment. This will show the planned route in the environment, enhancing the edges of the road, and collision hazards. In addition to this, there should be a route planner to give the user increased control of the automation. Some or all of these may be indicated as buttons on the dashboard.

To facilitate the understanding of the car game, clear indications and standard interaction devices, such as game steering wheels and pedals, should be used. Should the user still not understand, an electronic voice would explain the purpose of controls and indicators pointed at by the user (using a pointing device). See Figure 6 for a view of the interaction and Figure 7 for a screen-view in the usability car game.

Figure 6. **The interaction environment and the user in the usability car game.**

Figure 7. **A screen-view in the usability car game.**



The Media Car Game

An active audience is central to the media car game. The target group is an entertainment-hungry generation, with access to a computer network infrastructure. It is a mass-communication entertainment format, with races for all users transmitted at particular times in a racing season. Due to the potential size of the audience, races will be shown in leagues, with a hierarchical structure, having the top drivers organized in racing teams. At the same time, all races will be available for public viewing, with the top races having human commentaries, and the lower series having automated commentaries.

Playing the game, everybody would start with a no-name car, playing in the lowest division, on their own, winning virtual money. Sponsors would be invited to enter as teams with their own brand cars and advertise on the game arena. More money would mean a higher degree of control over the car performance. This sponsor money could also be used as prize money in the higher divisions. Money could also be used to buy spare parts or repair broken virtual cars. Thus, virtual money is in principle interchangeable with real money in the higher divisions.

This format uses the computer network medium in two ways. First, it utilizes the possibilities for audience interactivity as any member of the audience

Figure 8. **The interaction environment and the users in the media car game.**

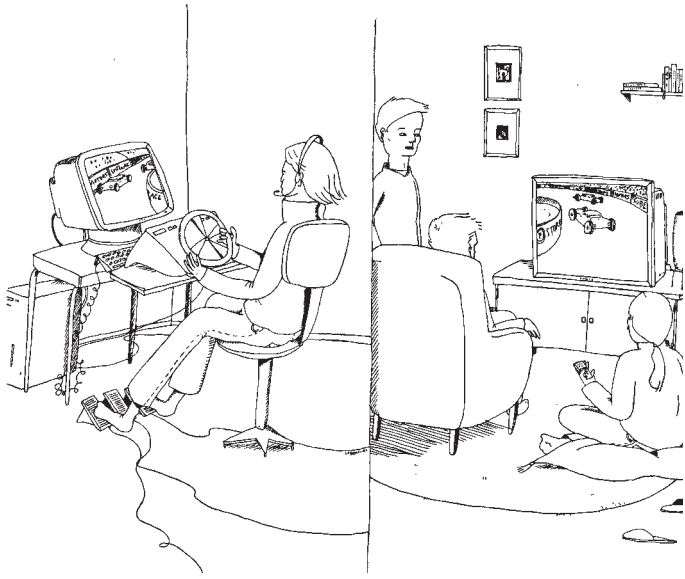
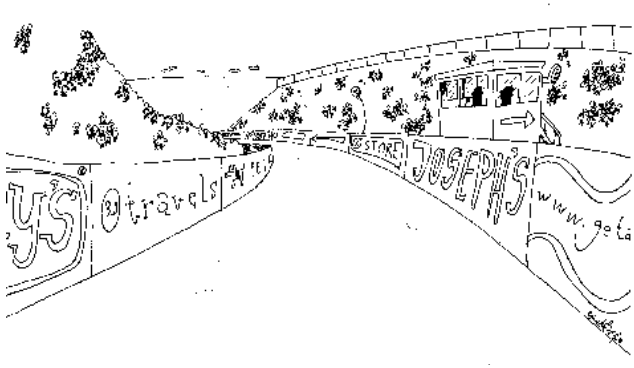


Figure 9. **A screen-view in the media car game.**



may enter the races, beginning in the lowest division. The players may use any input and output devices, but it is reasonable to believe that player in the higher divisions will use devices of good quality, such as a steering wheel, pedals and headset to communicate with team members. Second, it uses the possibility to reach every member of the audience by presenting an audience view of each race with live commentary.

Ethical questions arise from this format. As each racetrack will be broadcast for practice before the race, practice might consume a lot of time for a player who wants to win the race. When this time is taken from other social and work activities, it could cause problems for the individual and for society. Even the time of day for transmitting the race might cause problems, as the Internet allows a worldwide audience. The different time zones in the world will cause a race at noon in one location to start in the middle of the night at another location. A subculture could possibly arise around the use of the game. See Figure 8 for a view of the interaction and Figure 9 for a screen-view of the media car game.

4.3. Analysis

As mentioned earlier, our design outcome was affected by our previous general and professional preunderstanding as well as by our preconceptions of what a car game is. What differs from normal design practice is that the design outcome is also affected by our efforts to think through our idealized perspectives. We believe that our design perspectives had a divergent effect on

our design and reduced the influence from our car game genre preconceptions. Next we present some examples of how the idealized perspectives guided our design.

The Tool Car Game

The tool car game is perhaps the one that resembles ordinary car games the most. The reason may be that the perspective has its main focus on interaction characteristics. As a result, our car game genre preconceptions have a major influence on our game design, leading to a more traditional game, whereas the tool perspective has its major effect on the interaction with the game. Our idealized perspectives can thus be said to have had an overriding effect on our design in that the perspectives are focused on a subset of the use qualities of the designed artifact. For those use qualities our car game overrides preunderstanding. For instance, the game should be safe and ergonomic and lead to the goal, which lead to the game characteristic of short races, which does not tire the user too much. The use of standard, replaceable parts was also emphasized by the perspective. Also, transparency of action was emphasized by the perspective, and this was the rationale behind using high-end hardware, to make interaction as natural as possible. Nevertheless, these characteristics and the resulting game concept are rather traditional, compared to other car games, from the time. Possibly, the same characteristics could have been proposed by relying on what we see as car game genre characteristics, such as challenging and fun game play.

The Architectural Car Game

This perspective has a clear focus on aesthetical aspects, and that has affected both our selection of setting, a city with beautiful buildings and environments, and our idea that the hardware of the game should blend well into the environment in which it is used. In many existing car games, the graphics play a central role but with greater focus on presenting realistic representations of the surroundings than aesthetics and message. This perspective also implies an ethical standpoint we believe is missing in most car games. Correspondingly, the game is designed to teach and reward good judgment in realistic traffic situations. Hotheaded driving to finish a mission faster is discouraged. Our architectural car game is also designed to give the user an experience of harmony, emphasized by the perspective, rather than that of speed and excitement, which we associate with the car game genre. The users' experience of playing the game is central, but this corresponds both to our view on the car game genre and to the architectural perspective.

The Usability Car Game

In the usability car game, we focus on traditional cognitive aspects, from the perspective description, such as understandability, learnability, and efficiency in the fulfillment of the goals of the users and organization. The usability perspective does not, however, specify what kind of goals the user wants to attain, only that the tool should provide the user with an efficient and intelligible way to reach that goal. The perspective implies that a well-defined goal of the activity exists, but in the case of a car game, that kind of goal is neither obvious for the user nor for the designer. If we select the goal "to win," there is an inherent goal conflict between different users or teams in that some have to fail in their attempts to win for others to succeed. In our game, we have supported the users with cognitive aids such as collision warning systems and a heads-up display to provide information without stealing too much attention from the car-control task. These design characteristics were inspired by the context dimension of the perspective, stating that the artifact should support the "whole" task, thus making the game easier. They were also motivated by the artifact dimension, encouraging adaptation to the task. These characteristics seem to clash with what we see as good characteristics from the game genre, such as joyful interaction with friends and a feeling of mastery. This conflict may in turn make the game less acceptable, which was a desired quality from the perspective. Thus, this game concept as a whole does not seem to conform to what we view as desirable car game genre characteristics, but it does not seem to fully conform to the perspective implied characteristics either.

The Media Car Game

For the media car game, the focus is on communication rather than the interaction between user and car. The media-perspective focus on both network and broadcast aspects inspired us to design a game scheduled and transmitted via Web television to a wide passive audience as well as supporting game interaction between teams of active players and race season interaction between players, sponsors, and race organization. The game has been designed to consider economic motives for joining the race circus in that the virtual money won in the series is interchangeable with real money provided by sponsors. Sponsors can thus use the race circus for commercial advertising as a way both to create attention and to "buy" virtual race equipment to guarantee success in the race series. By playing well, individual players can earn virtual money that can later be converted to real money payouts or to get game advantages. That conforms to the perspective characteristics of the user as a consumer, and the economic motives that are seen as driving forces of consumers and producers. As with the present televised Formula One and Cart

series, sponsors can form their own teams and advertise through this medium. Ethical considerations, emphasized by the perspective-implied use qualities, such as the possibility for a large group of people to participate in the series on equal terms, are made. More advanced computers will thus not result in major race advantage.

5. DESIGN WORKSHOP AT NOKIA

The second phase of our evaluation was a study in a design setting with professional designers at Nokia, to assess the usefulness of the framework in a more realistic design situation. The participants had not internalized the perspectives but were instructed to use the written perspective descriptions.

5.1. Method

Four respondents with 2 to 5 years of experience in designing software and interaction for the Nokia multimedia terminals were enrolled. Three of the respondents have an educational background in cognitive science and one in computer science and engineering. They were asked to participate in a workshop with the purpose of evaluating a perspective-based framework for design. At the day of the workshop one of the respondents with a background in cognitive science did not attend. Accordingly, the workshop was held with three respondents plus the three authors as observers and workshop leaders in a meeting room at Nokia in Linköping.

To reduce the time needed for the workshop the number of perspectives was reduced to three as compared with the four perspectives used in our initial design workshop. We decided to remove the usability perspective, because it resulted in the least interesting design solution in our initial design workshop. In the design workshop at Nokia, we thus used the architectural, the tool, and the media perspectives. The workshop consisted of three parts: a short introduction, three design sessions, and a semistructured closing interview.

All workshop materials, including writing paper, pencils and Post-it™ notes, were provided by the researchers and brought back as data material. Before the workshop we decided to focus our observations on three aspects or categories: perspective *understanding*, perspective *support,* and perspective *hindrance*. Perspective understanding included an assessment of their understanding of the three perspectives as well as to what extent they generally could apply their understanding of the perspectives in the design. In perspective support we focused on specific instances where it was obvious or could be inferred that the design process or design decisions were guided by our presentations of the perspectives, the written perspective description handouts or

their understanding thereof. In perspective hindrance, similarly to perspective support we focused on where the perspective presentation and descriptions affected specific design acting and decisions, but here we focused on signs that our perspective interfered with or disturbed their design process. The design sessions and the concluding interview were videotaped.

The workshop was scheduled from 9:00 a.m. to 4:00 p.m., with a 1-hr lunch break at noon. Beginning with a round of presentation and a detailed schedule of the day, the first 45 min were otherwise mainly devoted to giving a background to our work regarding the role of perspectives in design and presenting the perspective framework described earlier in this article. Furthermore we distributed handouts giving a two-page summary of each perspective and confirmed the terms for the workshop, stressing the voluntary nature of participation and describing our roles as observers.

During the next 45 min we gave a brief introduction to the three perspectives—the tools, the architectural, and the media perspective—to be used in the workshop. The participants had the opportunity to ask questions if the descriptions were unclear. After that, the 3-hr long design sessions were held and the workshop was concluded with a 1-hr semistructured interview with the respondents.

The respondents were given the task of designing one car game per design session grounded in each of the perspectives. Thus, the design brief was made short, to allow the design perspectives to set the design space, allowing an exploration of that space which was also restricted by the genre, but not explicitly by other constraints. The selection of a car game as design task had two reasons: We wanted to make the results of the design sessions comparable with our initial design workshop and, similarly, we wanted to select an artifact with a wide design space and where the perspectives were equally applicable. The three 1-hr design sessions followed the same procedure, with a design phase ending with a short presentation of the final design given by one of the participants. The tools perspective was the first perspective to be used, followed by the architectural and media perspectives.

The notes taken during the design sessions and the group interview were later compared and structured into four categories. Perspective understanding, perspective support, and perspective hindrance were retained from our initial workshop focus. Based on our notes from the workshop we also added the category *preunderstanding and genre*, because respondents in discussions during the workshop often referred to earlier experience from the computer game genre, and earlier design experience clearly influenced what design techniques were used during the workshop. The workshops were consequently analyzed using four categories: *understanding*, *support*, *hindrance*, and *preunderstanding and genre*.

5.2. Results

The resulting game idea from *the tools perspective* was a single-user game for driver's license students, to be played at home to learn theory. It can be played on a normal home gaming machine using standard input devices. It is a realistic game, which may be played in scenario mode to practice something in particular, or in arcade mode, with continuous scenarios. It should be possible to leave and reenter the game whenever desired, and to switch the maps used to make it possible to use a well-known environment. Feedback should be provided, both positive and negative, from other normal cars or police cars, and from force feedback in the input devices. The standard car instrumentation should be visible on screen, perhaps with some restrictions to avoid clutter.

The game resulting from *the architecture perspective* design session takes place partly in real life, and partly in the game world. The idea is that traveling in the real world allows the game to be created by carrying a GPS registering the position of the car. Furthermore the players should be allowed to place hot spots (a position mark, used to navigate in the game world) in the real world. It should be possible to give others the opportunity to see movies and pictures from places visited, and to view what others have created.

The final game idea from *the media perspective* was a consumer information game, for presumed buyers looking for a car. The game can be upgraded with new parameters, for example by subscription from a car review television program site. It should be possible both for the players to present their own parameters and comments, based on their experience of driving the real car, and for the car manufacturer to present their parameters. These should be available to other players, who should be able to select parameters from their source of choice. They should also be able to check, for example, luggage capacity and not just driving. The proposed hardware for this game was a personal computer, with steering wheel and pedals.

5.3. Analysis of the Design Activity

Following is a presentation of the results from the empirical study at Nokia for each of the categories: *understanding*, *support*, *hindrance*, and *preunderstanding and genre*.

Understanding

The participants were observed to study the perspectives during the workshops, and they also wrote down keywords from the perspective on the whiteboard. Several expressions of understanding the perspectives were

manifested during the design sessions. During the tools perspective design session, the participants expressed an understanding of the importance of purpose-driven action, manifest as the purpose of the game, which was to learn the theory of handling car-driving situations. The driver, for example, was to be presented with situations to deal with, like in a driving school lesson, where theory dictates how to act correctly. This knowledge was seen as the material that the tool should shape. Furthermore, the notion of realism was expressed, and the participants expressed that an ergonomic design is important, with an adjustable steering wheel, and that standard parts should be used. That includes a steering wheel and pedals, but not gears, which would have been desirable, because feedback should be provided through these devices. Finally, they decided early that this should be a single-user game, in accordance with the perspective.

During the architecture perspective design session, understanding was first expressed as a desire to focus on function, ethics, and aesthetics. For example, the idea of a quiz rally was questioned from an aesthetic standpoint. Ideas based on driver's logs were questioned based on ethical considerations. Moreover, a desire to support community building in the game was presented.

After reviewing the media perspective description, the respondents observed that it matched the previous game idea well. An early suggestion was a game with increased communication between the players. The respondents observed that humans should be seen as information seeking and as trying to understand the world. This was elaborated as a need for information-based messages, and that the player should be given opportunities to tell stories. Finally they expressed the view that the game should be entertaining.

Support

The most salient expression of the tool perspective supporting the design activity was the decision to include purpose-driven action. This was the rationale for the design decision to have a driving school metaphor. Furthermore, the focus on a single user and the decision to provide feedback through steering wheel and pedals were design decisions supported by the perspective.

The community building idea contributed to the architecture game design as a community page, with a presentation of the player and of places visited. This would allow people who cannot travel to experience distant places, something that was said to be good for society. This idea was further elaborated as having the players create the game through their play, which was related to the perspective ideas of a personal impression and status. The respondents were observed to use the perspectives as a checklist. An idea thus emerged to give the player more status, so that exploration of the game would give credits to get a better car in the game.

The media game should support a consumer community, where the players may contribute with information (e.g., their own reviews of the cars). This was a clear example of a design idea based on the perspective. Furthermore, skins, being able to download a new "car" onto a generic car, was a communicative function supported by the perspective. The media perspective also supports the idea that each manufacturer should be able to produce their own game, supporting different lifestyles and environments

Hindrance

Several observations were made regarding situations where the use of the perspective was a hindrance to the design work. First, the respondents were either restricted by the perspectives or seemed to disregard them completely. This was seen as periods of focused reading and periods of relying on their preunderstanding of genre and design. Second, they did not seem to be supported in making detailed design decisions. For example, we observed that no drawings were made during the design session. Third, they did not seem to use the use qualities of the perspectives. The respondents remarked that the perspectives were sizeable and difficult, but despite this they asked no questions about them.

Preunderstanding and Genre

Design suggestions during the car game design session were often based on preunderstanding, often of the car game genre. There were several references to other games and to ideas in other games (e.g., providing several viewing positions in the game). Furthermore, games were seen as different from simulations. There was also a concern that the game had to be fun. Moreover, there was a decision to include an arcade mode in the game, and to use standard car game accessories such as steering wheel and pedals with force feedback. The driving lesson idea was based on preunderstanding in general, whereas their function orientation was most likely based on their preunderstanding of artifacts consisting of functions.

During the architecture perspective design session, there were several references to other games while the respondents were searching for the game idea. Ideas that were seen to be in conflict with the perspective were not adopted. The respondents also had the preunderstanding that one goal of making the game was to make money, and they expressed concern about the profitability of the game idea, as well as abandoning game ideas that were considered boring.

During the media perspective design session, public media were frequently used as a genre. For example taking the idea of seeing oneself

driving the car in an advertisement movie was used as a sales support. Another example is that the game was seen as an extension of car review television programs or newspaper car review sections. However, it should be noted that genres are a part of the context in the media perspective, and that this perspective thus encourages taking genres into account. The idea of skins may also be seen as emerging from the participants' preunderstanding, because it seemed that they had been in contact with that solution before.

5.4. Analysis of the Interview Session

The results of the interview session were categorized into understanding, support, hindrance, and preunderstanding and genre.

The participants found the perspective descriptions somewhat extensive, and there was an initial problem in using and *understanding* them. After using them for a while during the workshop they were however perceived easier to use. The use qualities in the perspectives were to a large extent not used. It is unclear whether this was a result of a difficulty in understanding and applying the concept of use qualities or something else. The participants found that the first two perspectives differed more from each other, whereas the media perspective was seen as fuzzy and hard to grasp.

The respondents considered the perspectives to *support* the design activity of idea creation. The frameworks were seen as expanding their design space to support the creation of alternative designs. They expressed a belief that the ideas would have been more conventional without the perspectives. Ideas were emerging with a basis in the perspectives, first as a design frame, and then they were formed to fit the perspective and the game idea. All game ideas were seen as interesting, and the perspectives were thought to be useful in their own organization, after modification.

Regarding *hindrance*, the design work was tied to the perspective manuscripts in the beginning, and the respondents experienced that it was difficult to change quickly between the perspectives. To postpone ideas until later, because they did not fit the perspectives, was seen as problematic. Moreover, the respondents concluded that the perspectives were most useful during conceptual design and less so during later design stages. Finally, the media perspective was seen as difficult to comprehend.

With respect to *preunderstanding and genre*, the participants thought that different solutions might be found depending on the experiences of the participants. The respondents had the overall impression that the car game genre had a major influence, and that the result would have been different if the goal had been for example a simulation instead of a game.

6. DISCUSSION

It is natural to conclude that the perspective framework was affected by our professional vision, in that the selection of the seven framework dimensions was highly influenced by our professional experience. They are most likely biased by our view on IT-design and quality-in-use. However, the most important consideration might be to have aspects that make sense to the designers who will use the framework, and that capture what they consider important design aspects (i.e., that the framework and subsequent perspective description make sense in a design situation). There might be no framework that all will universally agree on. This means that important improvements can be made to adapt both framework and perspective descriptions to the actual design activities. Some of the criteria may be of no relevance in a certain design situation; in others they may have to be complemented. As we observed in the workshop at Nokia, the participants asked for an opportunity to adjust the perspectives to their design situation. This would probably also be requested in other cases, and the perspectives could then be adjusted taking the artifact domain and design phase into account. The designers could, for instance, review and revise the perspective descriptions before or during the design activity. Moreover, in addition to the perspective framework used here, for instance, the dimensions of a specific scenario based design technique, or the dimensions of describing personas, could be used as perspective framework. That could, as an example, result in a characterization of tool-use scenarios, or a characterization of a tool-user, applying the tool perspective to the scenario or persona frameworks. In our framework, those two aspects correspond to the activity and user dimensions, respectively. In this way, they can be used to explore empirical data, or the resulting scenarios and personas, similar to the analysis of characters of action (Arvola, 2003). In theory, such an analysis could reveal for instance an overrepresentation of tool-use scenarios. That would indicate that design work would be improved by using multiple perspectives, unless tool use was really the only use character that could be relevant in the use situation. In a nondivergent situation, empirical data could be reevaluated in the light of the perspectives, or a perspective driven design workshop could be used to generate scenarios incorporating other perspectives. This study indicates that such work would give positive results.

6.1. Creation and Selection of Perspectives

The perspective descriptions should be specific enough to make the perspective understandable, but general enough to be meaningful outside the original contexts. It may not be necessary that designers make the same inter-

pretations of the perspective as the perspective creator or other members of the same design team just as long as designers are stimulated to think outside their ordinary patterns of design.

The level of "ideal typicality" for the perspectives is also likely to affect the designed artifact. The relative differences between the "ideal typicality" of each of the perspectives is hard to judge, but there is reason to believe that if the level of idealization changes, the resulting artifact will change to. We cannot, however, say how this affected the designs from the workshops. Finally, we observed a possible problem in the practical use of the design perspectives, as the possibility to understand them and their relation to IT-design can vary between different competencies involved in design work. The question is what kind of knowledge and how much preunderstanding is necessary to be able to use the perspectives in a constructive way. Furthermore, it is to some extent, inevitable that the four different perspectives are unequally well described since the framework in itself acts as a perspective.

6.2. Workshops

Although idealized, the perspectives formed a basis for action in the practical design situation. The analysis especially put forward certain relations between the perspective and the sketched artifact, whereas others were more implicit. The preunderstanding brought into the design situation by the different participants probably had an important effect on the specific results in the sketched artifacts, but the design perspective based dependencies remain as support for exploration.[2]

The design brief used in both the initial workshops and the workshop at Nokia was rather short and only specified the genre of the artifact to create. This stands in contrast to an industrial situation where the design work is often restricted by predefined requirements. This is both a simplifying factor and, as we see it, a strength. The design work was, for example, conducted without the demands from a buyer or an external customer. In the perspective workshops, the lack of design restrictions was mainly a means for make the influence of perspectives on design action more visible. As in most creative processes, there is no guarantee that novel perspectives and solutions result in improvements. This could be avoided by an explicit use of design rationale

2. One important aspect of action-based design work, which we have not directly discussed here, is the impact of *tacit knowledge* (see, e.g., Polanyi, 1958). This is a part of the individual's preunderstanding (see Figure 1) and rooted in the designer's earlier experience. As a part of the designer's basis for action, this aspect could have been included here. However, in trying to articulate perspectives for design action, we chose not to include this aspect.

that would guide the design process toward the more desirable solutions. This can be illustrated by the car game concept from our initial workshop, where an explicit use of design rationale could have been of use to clarify the relation between the conflicting criteria, and the design elements. We however also believe that design work can benefit from alternating between generating ideas more freely, and evaluation of the design ideas in the light of real constraints. Possibly, benefits from a design solution that is outside the scope of design constraints, could in some cases motivate a change of the constraints, or a change of the constraints in a future version of a product. This is of particular importance regarding technical constraints, as new developments alter the constraints of what is possible. We recommend that the design team decide in advance how freely they wish to explore the design situation, depending on their needs. The current results regard a process of free exploration, regarding other aspects than the perspectives. Also, design concepts may be used as input for further discussions with a customer, where restrictions can be applied after the initial design suggestions. In that case, it may not be advantageous to have too extensive design constraints during concept generation. Perspectives may also influence any design brief, implicitly guiding design in a nondivergent way. Potentially, product designers and creators of design briefs could use the perspective descriptions to increase their awareness of what (if any) design perspectives are implied by the design brief.

In these workshops, design perspectives and artifact genre were observed as guiding and restricting the design process. However, we observed a difference between our initial design workshop and the workshop at Nokia in what impact the perspectives and preunderstanding had on the design outcome. Our design suggestions were more guided by the perspectives, whereas the Nokia designers were more oriented toward the genre. There seems to be a balance here where *some* influence from the perspective is good to break free from preconceptions but too much influence may make the design diverge too much from the genre norm. The designers at Nokia seemed to be guided in their exploration of the design space by the perspectives. However, they used the genre and their preconception of design as something that should result in a profitable product, as norms for evaluating design ideas, and guiding what direction to take. Ideas that clashed either with the perspective or violated the genre norms too much were abandoned. In contrast, in our initial workshops, we did not make that consideration. The usability car game from our initial workshops is an example of where perspective focus on ease of use is in direct conflict with the typical game quality of challenging the user. These different qualities-in-use are hard to align in a coherent design as they are partly contradictory. At the same time, this conflict illustrates well that the perspectives really were influencing design work. The resulting game made it obvious that our usability perspective was not a natural standpoint for designing a car game.

We noted that the designers at Nokia did not actually use the quality-in-use dimension explicitly to explore the design space. Whether this was because the qualities were hard to understand or the concept was new, we do not know at this point, because we have not analyzed the influence of the participants' earlier experience on design work. However, when adopting a perspective, arguably, qualities would be an implicit part of the preconceptions of the designers. In our initial design workshop, we experienced some difficulties in applying some of our perspective descriptions to the car game genre. For instance concerning the tools perspective, it is not self-evident what in a car game that would constitute the material and the tool. However, we argue that the design perspectives can be used to create divergence in design, but could be improved by being adapted to specific design settings. For instance, characters of actions achieved from observations of use situations could be fed into a design workshop, to explore the design options further.

During the design workshop at Nokia we observed that the participants did not use sketches extensively as a support for the developing design ideas, as we had expected. This was in our interpretation a consequence of the limited time offered in the workshop. The participants instead designed through discussions and note taking. They also described the workshop task as different from their normal work situation. They rarely design something on a conceptual level, as in the case with the car game, and the work setting often includes organizational and project-based design restrictions. However, the design team found the perspectives supportive in generating design ideas for early conceptual design activities. The alternatives generated had, in our view, interesting variations in the approach to handling the game, conceptual design, and incentive for wanting to come back and play again.

6.3. Implications for Design

Our work shows a differentiated view of assumptions behind design action. We believe that the perspectives can be a contribution to articulating some of these aspects. One observation in our study was the conceptual difference between the artifacts that were created from the perspectives. This supports the hypothesis of previous research that multiple perspectives can be advantageous in design (Kammersgaard, 1988; Nurminen, 1987). Our experience from IT-design practice and education is that design alternatives that are conceptually radically different are often hard to generate. Often one early design idea has major influence of the direction on the final design solution. This is in our experience an indication of the difficulty for the designer to divert from their preconceptions and early ideas. In working with the sketched designs it was clear that the perspectives helped distance the design group from earlier preunderstanding, and helped expand and focus parts of the de-

sign space. This possibility to support a design process by consciously applying a perspective is also supported by earlier work (Winograd, 1986). The interpretation and synthesis of the literature helped in doing this, and we believe that the perspectives can serve as a way to conceptualize and articulate design assumptions and help create early design alternatives. It is also possible to use the perspectives in combination as they stress different aspects of a solution. Moreover, in our studies we did not encounter the problem experienced by Bødker et.al (2000), and therefore we recommend that perspective descriptions should be used without character descriptions.

It is evident that there will be tensions between designers preunderstanding of the genre and the use-qualities of the perspective. These clashes reveal some of the otherwise tacit assumptions about what constitutes a car-game, whether it is made explicit or not. They also reveal the power of making perspectives explicit, allowing the design process to follow a perspective different from each design team member's subjective car game perspective.

Enhancing Creativity in Conceptual Design

Based on the results from the workshops, we propose the following approach for using design perspectives to generate divergent design solutions.

Suggested Approach. Get acquainted to the perspective framework: Regardless of whether the designer uses our framework, a modified or an entirely different one, it is desirable that the dimensions (i.e., user, context, and task) and their meaning are well-internalized.

Establish perspectives: Use the four perspectives presented or use the framework to create more developed or new perspectives related to a practical context. In the latter case the sources of perspectives may, as in this article, be compilations of literature sources. Other sources of perspective descriptions are interviews with representatives of different professions regarding their actual views in a previous project. We argue that it is desirable that the resulting perspective descriptions are focused on the most salient characteristics to make the descriptions more ideal typical.

Get acquainted to the perspective descriptions: Well-internalized perspective descriptions will likely have a stronger effect on the design activities. This is in line with the stronger influence experienced in our initial workshop as compared to the Nokia workshop.

Establish a generous scope of design: Constraints and limited resources are a natural part of most design processes and are claimed to "force one to think in more creative and less conventional ways" (Finke, Ward, & Smith, 1992). Participants should nevertheless be instructed to assume a generous scope of design and allow ideas that are somewhat outside the constraints.

Explore the actual design problem and situation from the different perspective views. The design team can then work together (as done here) with one perspective at a time to explore and understand the design problem and situation. A team-based design is desirable if participants are less well-acquainted to the perspective framework and descriptions. Otherwise short individual design sessions may precede the group-based design.

Design Education

In education the perspective framework can be used for structuring the presentation and contrasting of different directions in design. The perspectives can be used for supporting divergent idea generation. The following perspectives have been tested in university usability and interaction design education as presented next.

Suggested Approach for a 2-hr Class.

- Make a short presentation of perspective and their influence on design work.
- Divide the class into groups of three to five students and distribute the written descriptions of the perspectives and the perspective framework.
- Let the groups select from a list of design tasks and assign a perspective for each group to base their design on.
- Be available to answer questions during the design activity.
- Let each group briefly present their resulting design for the rest of the class.
- Discussion in class their views of how they were affected by the assigned perspectives.

This approach has been tested with 4th year systems-design university students. Their views have generally been that the perspectives are initially difficult to apply but gradually become useful tools for enriching the early conceptual design and structure the group work.

6.4. A Research Agenda for Design Perspectives

We have identified some interesting possibilities for future work. Research on using the perspectives in an educational context could clarify the applicability of the presented approach to designers with limited design experience. This could be a way both to study how the perspectives could help in learning the complexity of design work and to see whether this would help the students generate alternative designs from the framework. Our experience from

using the design perspectives in education indicates that this is a promising venue of future research.

Another possibility for future work would be to refine design concepts achieved in design perspectives workshops and evaluate them with users to see whether, in use, they would display the characters of action corresponding to the design perspectives used.

The perspective descriptions may be of use also in other design activities, than in conceptual design. To evaluate the use of perspective descriptions with other design techniques, such as scenarios or personas, would be a natural continuation of the research reported here. Research could also reveal whether our kind of perspective descriptions based on an explicit framework would make the analysis of characters of action easier to conduct. Moreover, it would be important to research how including an explicit use of design rationale would affect the design workshops. Furthermore, previous research recommends shifting between different perspectives in design. However, when having a design brief with additional constraints and requirements, potentially it could inadvertently prescribe the use of a limited range of perspectives. Research could address how to create design briefs that incorporate different perspectives.

Moreover, the perspective framework could be used to create new perspective descriptions. Our somewhat old-fashioned usability perspective could for instance be compared to a modern interaction design perspective. Using the framework, different ways of going about interaction design work, historically, and within different design traditions, could be characterized, by making differences and similarities explicit. Future research could reveal what perspectives seem to be prevailing, implicitly and explicitly, in different design traditions.

Perspectives in the structured form presented here and adapted to different design genres could also complement the usage of guidelines and checklists for design since the perspectives are more holistic and focus on the conceptual levels of design, whereas guidelines and checklists tend to focus more on interaction and detailed design. In the workshop at Nokia, there was some evidence that the descriptions were used in this way, when the designers reflected on their design. Using the perspectives as checklists could for instance be useful to evaluate whether an artifact intended to have a tool character, conform to the characteristics of the tool perspective. This could be further evaluated in future studies.

Finally, our workshops were divided into phases, applying one perspective in each phase. It remains an open question to answer, to see whether this is preferable to shifting between perspectives in a less controlled way, or more frequently. For instance, as a parallel to deBono's six hats (de Bono 1993), each person in a workshop could contribute to design based on a different perspective description.

It is likely that the perspectives have different strengths in what parts of the design process they support. Future research may reveal that combining different perspectives rather than using them in isolation will give better support through the phases of design. Perspectives in the structured form presented here and adapted to different design genres can also complement the usage of guidelines and checklists for design, because the perspectives are more holistic and focus on the conceptual levels of design, whereas guidelines and checklists tend to focus more on interaction and detailed design. The framework could also be used in artifact analysis with the aim to better understand the use of objects relative to their design. Further study could investigate the difference between design priorities and actual use experience.

A scientific analysis of the influence of designers' actual perspectives in a design situation would probably be fruitful. There are multiple reasons why this kind of research could support design practice in the industry. First, the mix of perspectives will most likely affect the result of a group design. Analyzing designers' perspectives could aid participant selection in design groups where a range of competences and views are needed. Second, the individual profiles of the participants can be used in the design group both for assigning suitable tasks and to aid communication and understanding between team members as the preconceptions are made more explicit. Third, it is argued that the individual designers' style of design is actually the result of the "characteristic way of seeing possibilities through conceptual placements" (Buchanan, 1996, p. 11). Matching designers' profiles with to desires of the procurer could result in higher acceptance of the result.

6.5. Conclusions

The study showed a substantial impact of the design perspectives on the resulting IT-artifacts. Our results indicate that groups could use design perspectives to explore the design space in early phases of the design process. This can be a constructive way to better understand the design task at hand, by explicitly framing the design problem according to a set of different perspectives, thereby guiding the exploration of the design space. We suggest that the perspective approach could be of benefit when used in the conceptual activities of the design process within a cross-disciplinary design team. Such exploration of the design space may also be beneficial, in that it could reveal implicit and undesired overemphasis on one design perspective in a design brief. We present a framework of perspective dimensions, consisting of user, artifact, context, activities, communication, central relations, and use qualities. With the help of this framework, it would be possible to create new perspective descriptions, in addition to our tool, architectural, usability and me-

dia perspective descriptions. This is a part of the research agenda for design perspectives, which we have presented here. Also, we present a workshop methodology based on approach we used here, of using design perspectives, in practical design settings and in design education.

NOTES

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