VISUAL IMMEDIACY FOR SENSE-MAKING IN HCI

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ABSTRACT

In this paper, the use of concepts such as visual immediacy, metaphor, analogy, blending and abduction is proposed as a way of facilitating visual reasoning in sense-making activities in human-computer interaction (HCI) design. We argue, and provide two examples in support of our argument, that a skilful use of visual immediacy and other aforementioned concepts helps visual reasoning and assists participants in sense-making, collaborative processes to see diverse views, as well as patterns, categories and meanings easily. We also argue that the use of these concepts may lead to increasing the importance of visual methodologies in HCI design.

KEYWORDS

Visual immediacy, visual metaphor, HCI design, sense making, visual thinking, visual reasoning.

1. INTRODUCTION

Visual information, in form of paintings, sketches, maps, diagrams, photographs, charts, icons, and moving images (animations or video), has served as an effective means of communication for centuries. Today, the technology offers new possibilities for using visual information, among them, a possibility to aid thinking and reasoning: *"The power of the unaided mind is highly overrated. Without external aids, memory, thought, and reasoning are all constrained"* (Norman 1993, p.43). We believe that the power of visual reasoning in human-computer interaction (HCI) design is still underused. Thus, this paper proposes concepts that support visual thinking and reasoning in sense-making activities in HCI design.

A visual language effectively supporting reasoning is still not sufficiently developed, although efforts in that direction are many and long lasting (Horn 1998; Tufte 1997). Even a commonly agreed to vocabulary of concepts that are relevant for visual thinking and reasoning is lacking. An initial vocabulary for talking about visual and spatial reasoning was offered in (Karabeg & Akkøk 2005a; Karabeg & Akkøk 2005b; Karabeg et al. 2004; Karabeg 2006). It included concepts such as *visual immediacy*, *visual impetus*, *visual impedance*, and *visual metaphors, analogies* and *associations* in the context of information design for the web. Further, they were used in polyscopic modelling, see (Karabeg 2002), which is a methodology for structuring information, including the visual one (Karabeg & Karabeg 2005; Tellnes et al. 2004). The concept of scope, as it was used in polyscopic modeling, is similar to Klein et al.'s concept of *frame* (Klein et al. 2006). The visual immediacy was rendered by design, for the purpose of enabling one to distinguish scopes (frames) 'at a glance'. Visual metaphors were often used to describe scopes.

Expanding on the visual reasoning vocabulary and changing the context within which the visual reasoning is used to HCI design, we argue that potential for the use of visual immediacy and other concepts supporting reasoning in HCI is large. A concept of *affordance*, related to that of visual immediacy, has been widely discussed in HCI (Kaptelinin & Nardi 2012; Gibson 1977; Norman 1999). The main difference between affordance and immediacy is that immediacy facilitates reasoning, and does not necessarily call for action (instinctual or not) other than the reasoning itself. As such, it is well suited for sense-making and collaboration during design processes, although, it also has its merits in design and evaluation processes, as it should come forth from examples provided later on in the paper.

This introductory section is followed by some background on visual and spatial reasoning. In Section 3, diverse concepts supporting visual reasoning are introduced. In Section 4, we focus on visual immediacy and visual methodologies in HCI. The paper closes with conclusions.

2. BACKGROUND

In (Gardner 1983), Gardner proposed to differentiate verbal/linguistic, musical, logical/mathematical, visual/spatial, body/kinesthetic, interpersonal and intrapersonal intelligences. The last two were subsumed by Golman's emotional intelligence, see (Goleman 1997). The importance of emotions in HCI, e.g. (Hassenzahl & Carroll 2010; Norman 2004) is established, and the field embraced user experience, experience design, game design, persuasive design, etc. The HCI has since focused on *"the experiential quality of interaction, primarily the situated nature of meaning and meaning creation"* (Harrison et al. 2007, p.1). Central to this orientation towards meaning creation is the visual/spatial intelligence. The spatial intelligence is related to the human capacity to perceive the visual world accurately, to perform transformations and modifications upon initial perceptions, and to be able to re-create aspects of one's visual experience (or sensory, in case of people with impaired vision, who are certainly capable of having spatial intelligence), even in the absence of relevant stimuli (Gardner 1983). Visual intelligence, as defined in (Barry 1997), is the *"quality of mind developed to the point of critical perceptual awareness in visual communication. It implies not only the skilled use of visual reasoning to read and to communicate, but also a holistic integration of skilled verbal and visual reasoning, from understanding of how the elements that compose meaning in images can be manipulated to distort reality, to the utilization of the visual in abstract thought."* In (Horn 1998), it is explained how we recognize and interpret visual information, giving rise to the visual language, where visual representations are understood as productions of this language. In the case of interactive visualizations, both scientific and information-oriented (e.g. interactive maps), the technology has enabled direct manipulation of visual representations. However, (Hegarty 2011) points out that *"representations that are informationally equivalent (contain the same information) are not necessarily computationally equivalent."* This fact clearly implies the need for understanding how to *design* visual representations, which best support visual reasoning and, consequently, performance, both machine and human.

Despite the important role of visual/spatial intelligence in meaning and knowledge creation, there is little underlying theory and methodology to support the use of the visual, see (Rose 2012). Part of the reason for this lack is difficulty in formalization of reasoning with visual representations, requiring a synthesis of cognitive, representational, artistic, computational, logic, linguistic and psychological and phenomenological (Varela 1991) aspects of information.

Within the HCI community, some visual methods have been applied. Researchers have used video and photo-documenting, participatory video (Lindsay et al. 2012; White 2003), Photovoice (Ylirisku et al. 2009), card sorting (Wölfel & Merritt 2013), collaborative drawing and others. Photo-documenting and visual ethnography were used to inquire into emergence of creativity in HCI design teams (Culén, Mainsah, et al. 2014; Finken et al. 2014). However, both visual methods and visual reasoning are still under used in HCI.

3. CONCEPTS RELATED TO VISUAL REASONING

3.1 Visual Immediacy

Visual immediacy is a cognitive process through which understanding of information embedded in the visual representation (or parts of it) is available 'at a glance'. The term is chosen to reflect the *visual* nature of the process and to emphasize its time related quality (sometimes apparently *immediate)*, which may also serve as an indicator of how well the reasoning has been facilitated by the design of the visual representation.

3.2 Visual Impetus

Visual impetus is defined as an impulse, an incentive or a stimulus whose aim is to increase engagement, activity, interest and curiosity related to the contextual aspects of the representation. It is thus related to aesthetic aspects of representations, and has both perceptive and cognitive qualities (Tufte 2006; Tufte 1990).

3.3 Visual Impedance

Visual impedance is defined as a hindrance or (often unintended) negative implicature in the design of the representation, which causes one to be less receptive to the visual representation itself, or, causes deviance or deterioration of the message communicated through it. In relation to reasoning, impedance can be manifested as slower cognition. In that sense, it may be perceived as the opposite of visual immediacy. An experiment has been conducted and described in (Knauff & Johnson-Laird 2002). The authors show that for visual/spatial relations, if the content yields information relevant to an inference, reasoning proceeds smoothly. But, if the content yields visual images that are irrelevant to an inference, as is the case with visual relations (e.g. left and right) then the reasoning of sighted persons is impeded and takes reliably longer.

3.4 Visual Metaphors, Association, Analogy, Abduction and Blending

When a visual representation is used to understand an idea, or a domain, in terms of another, familiar idea or a domain, it can be called a visual metaphor. It was hypothesized that mapping between conceptual domains corresponds to neural mappings in the brain, and this hypothesis was explored in (Lakoff & Johnson 2003), while (McAllister 2013) explored reasoning with visual metaphors. Visual analogy and conceptual blending are similar to metaphors, where analogy may be understood as inference from one particular to another, and conceptual blending as integration of elements and vital relations from diverse scenarios. The blending takes place in a subconscious process, assumed to be ubiquitous to everyday thought and language. Visual abduction occurs when inferences are derived from series of previous similar experiences with visual material. All of the above tools of the visual language are well used by advertising companies, see Figure 1.

Figure 1. Absolute Vodka ads make great use of visual association, analogy, abduction and blending.

These concepts may also be used more widely in HCI design. In the next section, some examples of how the visual reasoning, using these concepts, was supported in HCI design.

4. VISUAL IMMEDIACY

Visual immediacy, as a concept which facilitates reasoning, has a potential to grow into a strong concept in the sense given in (Höök & Löwgren 2012). As an intermediary between the theory and instances, visual immediacy could generate new knowledge by instantiation, and help visual methodologies and visual reasoning to achieve a more prominent place in HCI design.

4.1 Visual Immediacy and Visual Methodologies in Design of Public Transport

In (van der Velden & Culen 2013), we discussed the role of information visibility in public transportation ticket systems. By contrasting the visibility of the ticket information for paper tickets and smart card tickets, we have found that what people really appreciated about paper tickets was the availability of ticket information 'at a glance' (visual immediacy). What they liked the least regarding smart cards was the lack of such information. Much of our design efforts consequently focused on how to design for visual immediacy in the smart card based transport system. Diverse issues related to visibility of ticket information were considered, and diverse solutions proposed. An augmented reality application was prototyped, where one could, using a smart phone, see all the information stored on the smart card 'at a glance' (Figure 2a)).

While considering the use of visual concepts, we also considered the use of visual methodologies in our work. A card-based tool to understand user experiences in public transport was developed, see (Culén, van der Velden & Herstad 2014). The card set allowed exploration of diverse user experiences, from preparing for the trip to arriving at the destination. The set was designed using visual methodologies, i.e., photographs taken during participant observation and photographic documentation of public transportation experiences. The cards, such as the ones shown in Figure 2b) were all representing abstract ideas, allowing for the use of associations, conceptual blending and abduction. For example, the card with the yellow line could represent any kind of limitation, the loud speaker any audio communication pushed by the transport provider, a person in a wheelchair any kind of special needs while traveling, and so on. Thus, in line with (Stenning & Oberlander 1995), we found that our images exhibited specificity, but allowed for abstraction and for use of concepts supporting visual reasoning.

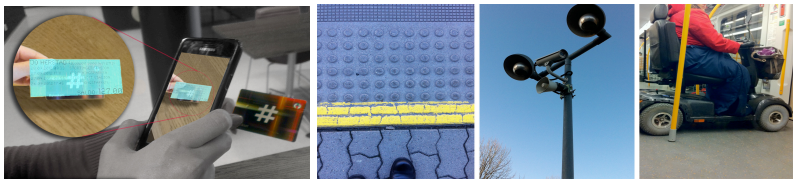

Figure 2. Visual reasoning in public transport. a) an augmented reality app allowing for smart card ticket information to be available 'at a glance'. b) a sample of user experience cards created for sense making in design interventions.

4.2 Visual Immediacy in Interactive Group Discussion

A recently completed master thesis supervised by the author, (Almsbakken & Kjerstem 2014), describes an iPad based visualization application that supports group discussions and the summary of discussions. Each group uses an iPad to provide their input on the topic of discussion. The app provides real time analysis of the input, and displays results on a large screen, which all discussion participants can see. The interface is interactive and the discussion facilitator can easily switch between a large picture and details, either by the group or by the chosen word. The design of the application was guided by the desire to support visual immediacy and visual reasoning effectively.

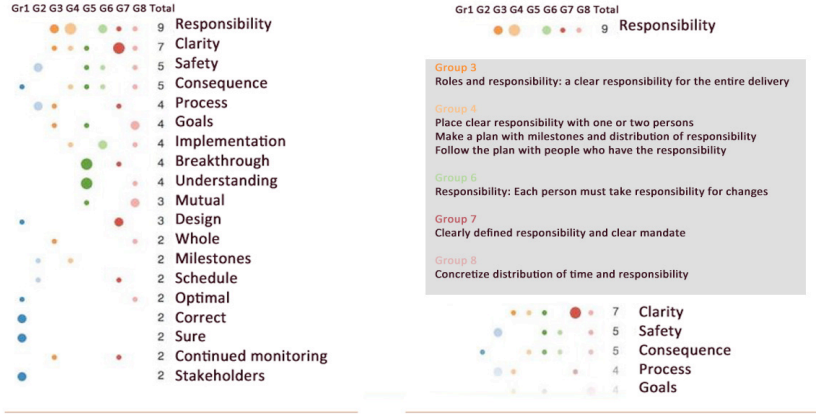

Figure 3. An interactive visualization app supports group discussions (Almsbakken & Kjerstem 2014).

4.3 Discussion

The first example above shows the use of visual methodologies in making sense of user experiences in public transportation. Instead of searching for the visual materials on the web, we have created the images ourselves. Approximately 50 images, among several hundred, were chosen to facilitate discussion around experiences in public transportation. The criteria for choosing an image were based on how well the image supported visual reasoning. Each selected image was tested with users (quick and dirty) in order to

understand how much visual impetus it gave to free associations, and if abduction, analogies, blending etc. could occur based on these images. If any visual impedance was noted, the image was discarded. The use of visual methodologies, and diverse concepts supporting visual reasoning, has facilitated later work with the card set we made greatly. The feedback from the participants who got to use the cards was very positive.

One of the benefits of learning how to support visual reasoning using visual immediacy and other visual tools is that they can then be used in diverse phases of HCI design process. One of the students who participated in workshops related to the public transport project really enjoyed using visual methodologies and applied what she learned to support, using visual immediacy, really fast evaluation of her ideas related to design of privacy settings for chronically ill young patients, see Figure 4 and (Saxlund 2014). An arrow with 'cool', neutral and 'not cool' was made, and participants could evaluate design ideas very fast.

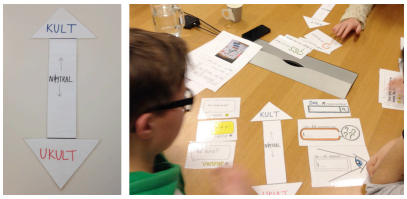

Figure 4. A tool for "on the fly" evaluation of design ideas in (Saxlund 2014).

5. CONCLUSION

Increased use of concepts such as visual immediacy, impetus and impedance, as well as the use of visual metaphors, abduction, blending and associations could benefit the HCI design greatly. The concepts can be applied both to strengthen the use of visual methodologies in HCI, and in design processes, in particular sense-making, but also in design and evaluation of new interactive tools. We have provided an example for each use. Empirical evaluation of the visual methodologies in the first example showed that they have facilitated reasoning, and added value to a card sorting technique used to make sense of experiences with public transportation. The impetus was provided to use associations, blending, analogies and ability to categorize very fast. The second example showed how the interface designed to support group discussions has made good use of visual immediacy enabling real time holistic overview of the situation, while the details were preserved and quickly accessible. Overall, the use of visual reasoning based on described concepts is strongly encouraged.

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