
Potential in Thermal Sensations and Conceptual Metaphors for Peripheral Interaction

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Abstract

We are a team consisting of an independent alumnus and a member of the Everyday Design Studio, each from Simon Fraser University. Our interest in the peripheral interaction field of research comes from our previous research on the perception of thermal sensations, and Conceptual Metaphor Theory. We have speculated that both thermal sensations and conceptual metaphors could facilitate effective peripheral interaction, particularly when in conjunction with each other. This is a conclusion we reached by assessing how each connects to the context of everyday practice, interaction over time, and meaning.

Author Keywords

conceptual metaphor; interaction design; peripheral awareness; thermal sensation

ACM Classification Keywords

H.5.2 User Interfaces: Interaction styles, H.5.2 User Interfaces: User-centered design

Introduction

Peripheral *interaction* is a more complex attribute of our experience of the world than merely peripheral *awareness*. For interaction to occur peripherally, the

user's behaviour must change in some way, as a result of being affected by information perceived unconsciously. Their awareness must either remain peripheral during this change, or shift to central attention, if conscious processing becomes necessary.

This is in line with Saskia Bakker's recent thesis, *Design for Peripheral Interaction* [1], in which there is an investigation of factors that influence peripheral interaction, types of actions that occur in the periphery, and practical application scenarios of peripherally interactive systems. The study recognizes the importance of the everyday context and of *habituated activities* for peripheral interactions to take place. The content of the stimulus and the expectations of the individual allow for a natural ability to shift their attention on activities or information between central and peripheral awareness.

It is our intention to introduce some related concepts that may be applicable to peripheral behaviour changes, in terms of how they affect individuals' expectations, which have been raised in our own work. Our research has crossed between the disciplines of peripheral interaction [1, 7, 8], thermal sensations as an interpersonal communication medium [5, 6], and Conceptual Metaphor Theory [3, 4], in the course of investigating the potential of conceptual metaphors of thermal sensations [2].

We have followed up on our work on these studies to investigate how the concepts fit within the realm of peripheral interaction. Our research has found that thermal sensations are particularly well suited as a medium for peripheral awareness. The reason for this is that the attributes of temperature perception readily

engage the periphery of users' attention. The perception of temperature is an everyday sensory experience that, in our studies, showed potential for consistent interpretation of meaning in specific contexts by the population at large [2]. This suggests that an interactive artifact that uses thermal sensations as feedback could be effectively interacted with in the periphery.

Everyday Context of Thermal Sensations and Peripheral Interactions

The everyday context that has been discussed as the foundation of the reported peripheral experiences in Bakker's study [1] leads to the observation that our ability to process information unconsciously comes from how we learn starting from a very young age. As we experience and gain familiarity with the world, we develop *routines*, which readily become a part of our long-term memory. Routines are activities repeated many times in the same way, and thus become "activities in which one is very experienced and therefore do not require much thinking." [1]. As such, to develop peripheral interaction design solutions and identify areas of opportunity in this field of study, we should focus on common types of experiences, exemplified in the peripheral activities that Bakker's participants revealed in their quotes [1].

Perception of temperature, according to Lee and Lim's study [5, 6] of the expressive potential of thermal sensations, falls into this category. In their post-interview findings, they noted that "[we] are already sensing and interpreting thermal sensations to get information about our environment, as well as setting expectations for what feeling a particular level of temperature in certain situations means." Participants

in their studies consistently felt that there was a proper temperature for describing phenomena, objects and meanings [6]. This shows that there is a high level of pre-existing experience and expectation involved in perceiving temperature, and that should minimize the mental resources required for information processing and emerging behaviour changes.

Interaction with Thermal Sensations over Time

In their study of *dynamic design elements* for peripheral interaction, Park and Nam [7, 8] point out the importance of the interactions occurring over time (4D design), and kinds of patterns that can be unconsciously perceived while this takes place. They define ambient media as being representative of giving weight to the periphery of our attention, being aware of our surroundings without attending to them explicitly, and having dynamic and temporal elements in order to do so.

The dynamic design elements themselves illustrate useful interaction patterns for peripheral systems that demonstrate the capability of managing different levels of importance, and the smooth and controlled shift of attention from peripheral to central and vice versa. In our considerations for the study we conducted to test users' perception of thermal sensations [2], we noticed that temperature could be readily presented using these design elements that, if given a separate main task, could have resulted in effective peripheral interaction. When the tempo, intensity, continuity or rhythm of a medium is designed to inform a user of something, it creates meaning in the interaction that they can "be aware of ... at a glance, without attending to [it] explicitly." [7]

Thermal Conceptual Metaphors Applied to Peripheral Interaction

Returning to the discussion of everyday context, we will now turn our attention to Conceptual Metaphor Theory (CMT). Introduced by Lakoff and Johnson [4], CMT proposes that human experience is metaphorical by nature, in that we readily make associations between things that are only loosely or subjectively tied together, and allow this abstract understanding of one concept in terms of another to give structure to our thought process. Conceptual metaphors begin with basic mappings between sensorimotor experiences, but eventually expand into image schemas, which are pre-conceptual structures based on early and recurrent experiences with the world [3].

Some simple examples involving temperature perception are: WARM is CLOSE, COOL is FAR (a measure of proximity that reflects how heat sources work in the real world) and WARM is SOFT, COOL is HARD (people think of melting butter, or expressions like "stone cold"). One of our findings during this process was that for temperature to work in metaphors with significant agreement on their meanings in terms of such concepts, they must be drawing on shared experiences or shared expectations of the meaning, in line with the everyday context necessary for peripheral interaction.

Furthermore, framing the interaction with a familiar metaphorical meaning can generate an awareness within expectations, and that awareness should remain peripheral as long as those expectations are met, minimizing the necessary mental resources to perceive what is happening. To initiate interaction beyond unconscious behaviour changes in response to what is

perceived in this scenario, the shift to conscious attention to the system can be handled similarly to the pattern changes of the dynamic design elements: importance can be tied to a specific element or meaning, causing priming [1] to begin the shift, or importance can cause changes in the meaning that break the user's expectations and cause a shift.

Conclusion

In this paper, we have combined several ideas from our studies on thermal conceptual metaphors, and from other sources, to put forward that thermal sensations are particularly well suited for a peripheral interaction context. With thermal sensations, common expectations within an everyday context can be leveraged because the perception of temperature is an everyday occurrence that carries metaphorical meanings.

We propose that interactions with thermal sensations should occur over time to engage the periphery, so that effective techniques such as establishing and changing the intensity, tempo, continuity and rhythm of what users feel during use can manage the attention level given to what is perceived.

Finally, our previous work on assessing the effectiveness of conceptual metaphors for thermal sensations shows that highly shared experiences and expectations can create an intuitive understanding of abstract concepts in terms of temperature or vice versa, which may use even fewer mental resources to perceive than an interaction rooted only in everyday practice.

The Peripheral Interaction workshop will be an excellent opportunity to begin clarifying where the use of thermal sensations and conceptual metaphors may ultimately fit into the realm of peripheral interaction, and how discussion with others in this research community may inspire the next phase in our work.

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