Sense.Seat: Inducing Improved Mood and Cognition through Multisensorial Priming

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ABSTRACT
User interface software and technologies have been evolving significantly and rapidly. This poster presents a breakthrough user experience that leverages multisensorial priming and embedded interaction and introduces an interactive piece of furniture called Sense.Seat. Sensory stimuli such as calm colors, lavender and other scents as well as ambient soundscapes have been traditionally used to spark creativity and promote well-being. Sense.Seat is the first computational multisensorial seat that can be digitally controlled and vary the frequency and intensity of visual, auditory and olfactory stimulus. It is a new user interface shaped as a seat or pod that primes the user for inducing improved mood and cognition, therefore improving the work environment.

Author Keywords
Multisensorial; priming; interactive furniture; ergonomics; input and output; interaction design; user experience.

ACM Classification Keywords
• **Human-centered computing~Interaction devices**

INTRODUCTION
Research in user interface software and technologies has devoted a significant amount of work towards creating more seamless, fluid user experiences. However, in these technologies and systems, the user is often considered as a "conscious thinking mind" [1] when in fact a significant portion of our perceptions of and our behaviors is unconscious and does not involve deliberate rational thinking, as popularized by Kahneman's System 1 and System 2: the automatic and the reflective minds [2]. There is also a growing interest in the design and development of technologies to support well-being and promote healthy behaviors. Take as an example personal informatics tools, which have been gaining a widespread adoption in recent years [3]. These devices track and collect personal relevant information and generate timelines of past events for later inspection. They provide the ability to monitor, evaluate and increase awareness of one's own behaviors, plus offering continuous opportunities for self-regulation in daily life. Yet, despite their initial premises, the reality of these technologies is discouraging. Research has been revealing high levels of disengagement among their users [4, 5]. In this scenario, researchers have been shifting their efforts towards more seamless, more engaging user experiences through the use of, e.g. subliminal priming, nudges, multisensorial technologies and many more. One approach considers the human's perception bias to automatically trigger action. For instance, designing stripes on the road was found capable to bias driver's speed perception resulting on fewer car accidents as drivers reduced their speed [6].

Changes on size and color are able also to create the illusion of larger portion of food on a place, inducing people to reduce the amount served [7]. These strategies avoid cognitive overload, yet they leverage both the automatic and the reflective mind. They provide a subtle stimulus but are still consciously detectable. Changes on size and color are able also to create the illusion of larger portion of food on a place, inducing people to reduce the amount served [7]. We present an approach based on reimagining office furniture and bringing subtle technological elements to persuade office workers towards more healthy, creative workstyles. Productivity is the effectiveness of productive effort in converting inputs into useful outputs. In general, organizations seek to improve their productivity because it is a critical determinant of cost efficiency and better outcomes. By bringing subtle technological elements to persuade office workers towards more healthy, creative workstyles one can have a significant impact on the user experience and well-being.

SENSE.SEAT
Sense.Seat is the first computational multisensorial seat that can be digitally controlled and vary the frequency and intensity of visual, auditory and olfactory stimulus. To our knowledge, it is the only furniture specifically designed and

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implemented in this way. It is a new user interface shaped as a seat or pod that primes the user for inducing improved mood and cognition, therefore improving the work environment. We only focus in the physical workspace aspects affecting creativity, which were studied and lead to the creation of a new workstation unit that can induce an improved mood and cognition. Therefore, it can be considered a creativity-supporting work environment. The physical workspace refers to the person's context in terms of the physical surroundings, such as the immediate workplace and surrounding buildings. Typical physical environment improvements, that positively affect the user's creativity, as suggested by various researchers, are: a non-crowded workspace, presence of plants, the use of inspiring colors on the walls, a new carpet in the office, more pictures and posters on the walls, windows with outside view, privacy, dim lightning, etc. [8, 9, 12, 14].

Sense.Seat uses multisensorial outputs and inputs for bringing control and dynamics to the ergonomics of a seat, in the physical shape of a pod. Figure 1 illustrates the physical, final design of the Sense.Seat full-scale prototype. We provide a video and poster which better illustrate the technology. Sense.Seat uses the three senses: dynamic multi-chromatic LED strips surround the user with either calming colors as well as alerting colors, based by default on theories around psychology of perception but fully controllable by each user via a small touch-screen or via a corresponding mobile app. This helps to induce either relaxing or alerting/working moods. Position sensors embedded in the fabric of the cushions help to induce a better sitting posture. Soundscapes (e.g. rain, forest, binaural beats, etc.) and scents also help induce a better well-being while inside the seat.

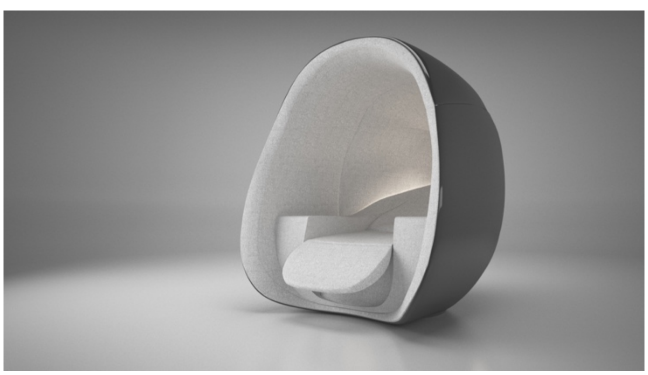

Figure 1. The final full-scale prototype of Sense.Seat.

The seat was designed after a long, laborious and iterative process involving hardware and software engineers, HCI researchers, cognitive psychologists, interior designers and architects. There are, of course, many dimensions that need to be carefully considered when creating this type of user interface software and technology. It becomes noticeable that there are many external factors that can influence one's work productivity. That includes noise and temperature, although the amount of these inputs and its influence can vary from user to user. Designing an adaptable furniture where the frequency and intensity of the multisensorial stimuli can be controlled by each user is paramount to a successful user experience. While the function concerns are relatively straightforward (connected workspace, relaxing, personal), the form concerns we are addressing include achieving a contemporary, versatile, modular piece of technological furniture that can also bring a timeless, elegant comfort to the workplace. In terms of technology, a reclining seat will provide body positions values that can provide ergonomic feedback to the user. We are using pressure-sensitive conductive sheets (Velostat) sewed to woven conductive fabric with a thin conductive thread to build two squares (matrix) for the seat and its back. These allow to track the user's posture and presence. Afterwards, we added an electronic microphone amplifier and an air-quality sensor. Both will be used to check if external factors such as noise and oxygen levels polluted would interfere with the productivity of users.

The entire system of sensors and actuators is controlled using an embedded Raspberry Pi processor. Particular care was taken to include a set of cooling fans, meaning that the user can also control the inside temperature. For the scents release we use lavender (relax mode) and coffee (alert mode). These, like all other actuators, can be controlled via an embedded touchpad with a convenient UI. The scents release module was 3D-printed. Similar to [1], we employ an encapsulated piezoelectric atomizer which vibrates at a high frequency and voltage to transform the liquid into mist. An entire software architecture for controlling all parameters of this interactive piece of furniture has been modeled in UML [11, 13] and implemented in Python.

CONCLUSIONS AND FUTURE WORK

Human-computer interaction can be used to create better workspaces, either by embedding sensors and actuators in a seat or any other tangible element (e.g. desk). The human-computer interaction will play its role solely if the technology is embedded in a visual subtle way; that is, in such a way that it contributes positively for the productivity only by giving visual or audio stimulus without distracting the user or adding a lot of complexity to adjust such ambience. The immediate future work is to solidly evaluate the Sense.Seat impact on mood and cognition in a real, full-scale setting. Since the prototype is ready and working, we will install it at a co-working space, since this interactive furniture also challenges disruptions in the workplace and that is an interesting topic to explore. The impact on cognition and mood of each sensory stimuli will also be measured using solid psychology scales and methods.

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