Book review of

In Touch with the Future: The sense of touch from cognitive neuroscience to virtual reality

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“From eating to walking, from typing to kissing, from texting to cuddling, the majority of our everyday experiences require touch.” This opening sentence sets the tone for a book that aims to show just how intimately touch is integrated into our everyday lives. It achieves this in the broadest possible sense by expertly bringing together a vast array of knowledge from cognitive neuroscience research investigating the role of the body and brain in tactile processing through to human-machine interfaces and virtual reality (VR) environments. It also stresses the importance of integration with other sensory modalities in order to create the illusion of real-life environments in virtual worlds.

Section A of the book considers the peripheral mechanisms of tactile information processing from the level of skin receptors to the neural fibres involved in transduction of the stimulus in contact with the body surface. It quickly becomes apparent how complex the interaction between the firing of different classes of sensory receptors for the different sensations of touch (i.e., vibration, pressure, grating, smoothness, temperature, pain, wetness, etc.) is. The authors stress that to reproduce believable tactile sensations in VR environments we need to fully understand the dynamics of neural transduction occurring in the skin. Yet the meaning of touch goes beyond mere stimulation of the skin surface and Section B deals with the central, cognitive aspects of tactile information processing including awareness, attention, memory and social touch from higher-order systems including integration with other sensory modalities. One of the main messages of the book is that touch never occurs in isolation and therefore we cannot meaningfully study touch without considering the other senses at the same time. Section B also shows how little we know about tactile processing on the majority of the skin’s surface. The skin is by far the largest of the sense organs covering approximately 16-18% of the body mass, yet only a tiny part of it has been investigated in any detail (as shown in Fig. 15.1 on pg. 335). For example, we are only just starting to understand the tactile pleasure receptors and nerve fibres in humans discovered in the last 20 years and only in the last 5 years has their role in human social interaction been tested (Morrison et al., 2010). The investigation of social touch may have the greatest future potential for VR and situated environments given that modern humans are progressively moving towards an ‘online’ world where face-to-face interactions are becoming increasingly rare. However, it also poses the most challenges as interpersonal tactile contacts are difficult to reproduce.

Section C of the book covers the applied aspects of touch and the advantages and disadvantages of various tactile devices such as touch screens and mobile technology. The early pioneers of applied tactile research were the military and those designing tactile vision substitution systems (TVSS) for the blind where objects are presented tactually to the person’s body to enable them to ‘see’. However, after 50 years of research many still have a sceptical view of tactile technologies. Chapter 10 discusses the use of tactile warning signals for drivers (a key research area for Spence and colleagues; see Ho and Spence, 2008, *The Multisensory Driver*), where the research shows that, when used in isolation, these devices are less effective than auditory signals. Multisensory displays combining touch with another sense can, however, capture driver attention significantly more effectively than their unimodal (i.e., tactile) counterparts and be used to transmit information more efficiently, as well as to reduce driver workload. In the final part of Section D the authors then consider the affective design of touch in two of life’s ‘most pleasurable’ activities: sex and food. Although in its infancy, this area holds promise for exciting future research and some potential novel applications of the findings!

The final chapter of the book concludes with the direction tactile research will take in the future in light of the fact that many of the predictions made about touch technologies in the past have been unfulfilled. Several possible reasons for this include the infancy of the technology, the lack of understanding of the tactile system (and more importantly it’s integration with other senses), the fact that we know so little about the majority of the body’s surface and therefore do not exploit other body parts and also our lack of understanding of the aesthetics of touch. Adding tactile contact to a VR interaction is a promising future direction for this research area and is likely to have an increased cost-to-benefit ratio than simply changing the visual or auditory components of the situated environment. It will be especially useful in enhancing the operator’s ‘sense of presence’ leading to the creation of what the authors call ‘functional virtual prosthesis’ i.e., virtual body parts or instruments that modify human anatomy and extend its functionality (such as that used in remote or telesurgery when a surgeon in New York can operate on a patient in Paris).

In conclusion, the authors speculate on the exciting possibilities of a fully integrated tactile future where devices might use ‘tactile augmented reality’ to allow people to interact with objects on a PC screen or in a shop window (through the use of haptic gloves) and have a ‘tactile glimpse’ before trying them on or buying them. Placing haptic devices into clothes that allow them to give tactile feedback (such as The Hug Shirt™) might also become acceptable in the future as we strive for a more ‘touch rich’ environment. This may be particularly important for the ageing population who live alone, or for younger adults living largely online and therefore having less direct contact with others. If technologies can be developed that are capable of providing believable surrogates of real tactile social contacts this could become an important part of our future lives. What a person believes they are feeling, regardless of the peripheral stimulation used to create it may ultimately be the most important factor in creating our tactile world. (991)

References:

Ho, C., & Spence, C. (2008). *The multisensory driver: Implications for ergonomic car interface design.* Aldershot, UK: Ashgate Publishing.

Morrison I, Löken LS, & Olausson H. (2010). The skin as a social organ. *Experimental Brain Research, 204(3)*, 305-14.