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Preface

# The applied issues in visual perception and action: Preface to a special issue

Perception and action is an essential part of human behavior. To design user-friendly interfaces and displays that provide users with precise and appropriate information, display and interaction design engineers must understand how people perceive and act in the world. Much research has studied the underlying mechanisms responsible for human perception and action (e.g., regarding perception and control of self-motion: [7,8]; regarding vergence control under accommodation mismatch: [13]; regarding ocular movements during vection perception: [6]). The findings of such fundamental research are important but usually cannot be directly applied to display and interaction designs. To bridge this gap, the purpose of this special issue is to collect a number of innovative research and review articles to highlight some interesting and important recent examples of links between human perception and action and their applications in display and interaction designs. Three related aspects of human perception and action are addressed.

First, regarding perception and control of self-motion, humans use multiple visual strategies for the control of steering toward a goal [9]. Some of these strategies are simple heuristics based on perceptual variables, which can also guide intercepting moving targets and obstacle avoidance [12]. In addition, human brain responses to visual collision events are modulated by change in size (looming) and stereo-depth (binocular motion) cues [2]. The applications of these research findings include the design of effective navigational interfaces, biomimetic robots, and unmanned vehicles. As aging affects the precision of steering control during driving under low-contrast visibility conditions [11], design engineers should take the controller's age into consideration when designing effective navigational interfaces. For brain-damaged patients, training stroke survivors with interactive motion videogames to induce constrained movement helps their balance control [5].

Second, regarding space perception, several methods are proposed to help improve the interface design of Virtual Reality (VR) systems. The proposed methods include a set of techniques that use known perceptual limitations and illusions to allow seemingly natural walking through a large virtual environment in a confined lab space [4], a novel technique to correctly render 3D virtual objects to an observer who moves freely in front of the display [14], and techniques to compensate for the underestimation of egocentric distance in large screen immersive displays [1]. To mitigate user perception of spurious image motion in VR systems arising from head tracking latency, design engineers should consider that spurious image motion is less noticeable during head motion than when the head is still regardless of whether the stimulus is presented to users via a head-mounted display or on a flat screen [15].

Last, regarding eye movements, a method is proposed to accurately and efficiently extract saccades during smooth eye tracking [10]. Given the important role that eye contact plays in daily face-to-face communication, design engineers for video-conferencing systems should understand human sensitivity to gaze direction and design video systems that facilitate eye contact to increase interactions [3].

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Li Li
*Department of Psychology,*
*The University of Hong Kong,*
*Hong Kong, China*

Richard H.Y. So
*Department of Industrial Engineering and Logistics Management,*
*The Hong Kong University of Science and Technology,*
*Hong Kong, China*
*E-mail address:* rhyso@ust.hk

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