SCOPED: The Development of an IS Design Theory from Neurologically Grounded Models of Visual Cognition

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This study presents a novel design theory for software interaction design, focused upon less-conscious human visual processes which have been identified in cognitive neuroscience. A meta-triangulation of existing human-centred IS software design research reveals three dominant engineering approaches focusing upon highly-conscious and individualistic model-based formulations of cognition. However, a sparsely populated and less acknowledged fourth category of design approach is also observed, which focuses on relatively homogenous less-conscious processes. It is found that the lack of proportionate cognitive coverage in design research has resulted in designs that are acutely user-specific and incapable of accommodating diverse or unforeseen audiences, an inability reflected by growing concerns in the design community (Norman 2005). Thus, this study builds and evaluates a design theory exploiting some of the most relevant less-conscious cognitive processes involved in software interaction, i.e. those pertaining to the visual decomposition of an interface. This is done both to address the paucity of literature in the area directly, as well as to lay a path for future design research exploiting the types of less-conscious cognitive processes documented in cognitive neuroscience literature.

The design process behind the development of such a theory presents a number of novel methodological challenges. To address such challenges, an innovative, rigorous and repeatable Design Science methodology is developed, based upon the assimilation of key IS design literature, in particular that of Hevner et al. (2004) and Walls et al. (1992). This methodology promotes the theoretical and technical validity of a design theory by evaluating the output of each stage of development against a series of requirements. The authors subsequently apply this Design Science methodology to develop the 'Shape, COlour and Position for Effective Decomposition' (or 'SCOPED') design practice theory, building upon existing literature surrounding the Guided Search model of visual search (Wolfe 2007) from cognitive neuroscience. This Guided Search model provides a neurologically grounded model of the process involved in early visual attention, beginning with the receipt of retinotopic representations of a visual scene and culminating in the recognition of visual objects and saccadic movements.

Building upon this descriptive understanding of early vision, the SCOPED design practice theory provides a set of five concrete and complementary design principles, each of which allows users to more efficiently locate individual software interface items. These design principles state the conditions under which interface items should be relatively and absolutely positioned, as well as how distinct or shared colours and shapes should be allocated to items. The set of design principles is developed over several iterations of testing, whereby the utility of individual design principles is evaluated empirically using response times from a specifically designed quantitative laboratory experiment.

Finally, the findings, contributions and implications of the research are discussed. This discussion focuses upon the utility of the design theory for industrial practitioners, the implications for software interface design research, the implications for Design Science research, as well as how this study impacts upon the emerging stream of NeuroIS research (Dimoka et al. 2011).

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