Designing for Complex, Interactive Architectural Ecosystems Developing the Ecological Niche Construction Design Checklist

JOE MANGANELLI, ASSOCIATE AIA, LEED AP BD+C, PH.D.
Founder, Designer, Researcher, xplr design, llc
Clemson, South Carolina, USA
jmanganelli@xplrdesign.com

I. EXTENDED ABSTRACT

This paper presents the rationale for and ongoing development of The Ecological Niche Construction Design Checklist[1], a designer's/researcher's checklist for assessing the usefulness of potential environmental design features on cognitive and task performance during the conceptual phase of environmental design. The rationale for developing such a tool stems from a comparative integration of concepts from ecological niche construction[2], systems science[3], embodied cognition theories of mind[4,5], and Kirsh's writings on pragmatic action[6], activity space[7,8], and performance design[9]. The checklist is developed and tested via three case studies that entail designing interactive building environments. This mixed methods case study research is organized and evaluated using the Design Science Research Method[9] and the Validation Square research method[10]. Findings, lessons learned, and next steps are discussed, especially the strengths, weaknesses, and likely preferred use cases for such a method and tool.

This research contributes to the fields of architecture and neuroscience by: (a) developing a designer's method and tool that represents possible impacts on cognition of environmental features during early conceptual design; (b) demonstrating a research framework for specifying, developing, and evaluating a cognitive method and tool; (c) and addressing a significant, emerging set of design challenges. These emerging design challenges entail degrees of complexity and interactivity that make them orders of magnitude more difficult to represent during design than traditional static environmental design challenges.

2. REFERENCES

[1] Manganelli, J. (2015). Tending the Artifact Ecology: Cultivating Architectural Ecosystems. Retrieved from: http://datastructureformdesign.com/2015/10/04/tending-the-artifact-ecologycultivating-architectural-ecosystems/

[2] Odling-Smee, F., Laland, K., Feldman, M. (2003). Niche Construction: The Neglected Process in Evolution. Princeton, NJ: Princeton University Press.

[3] Northrop, L., Feiler, P., Gabriel, R., Goodenough, J., Linger, R., Longstaff, T., Kazman, R., Klein, M., Schmidt, D., Sullivan, K., and Wallnau, K. "Ultra-large-scale systems: The software challenge of the future," Software Engineering Institute, Pittsburgh, PA, 2006.

[4] Wilson, M. (2002). "Six views of embodied cognition," Psychonomic Bulletin, vol. 9, no. 4, pp. 625-636.

[5] Robbins, P. and Aydede, M. (2009). "A short primer on situated cognition," in The Cambridge Handbook of Situated Cognition, Cambridge, Cambridge University Press, pp. 3

[6] Kirsh, D., Maglio, P . (1994). "On distinguishing epistemic from pragmatic action,"Cognitive Science, no. 18, pp. 513-549.

[7] Kirsh, D. (2001). "Changing the rules: Architecture and the new millennium," Convergence: The International Journal of Research into New Media Technologies, vol. 7, no. 2, pp. 113-125.

[8] Kirsh, D. Design in a World Gone Digital, San Diego, CA: ANFA, Interface Series Lectures, 2010.

[9] Peffers, K., Tuunanen, T., Rothenberger, M., Chatterjee, S. (2007). "A design science research methodology for information systems research," Journal of Management Information Systems, vol. 24, no. 3, pp. 45-77.

[10] Pedersen, K., Emblemsvag, J., Bailey, R., Allen, J., Mistree, F. (2000). "Validating design methods & research: The Validation Square," in Proc. of DETC'00 2000 ASME Design Eng. Technical Conf., Baltimore, MD.

3. AUTHOR BIO

Joe Manganelli, Assoc iate AIA, LEED AP BD+C, PhD
Founder, Designer, Researcher, xplr design, llc
Building Design Specialist, Fluor Enterprises
Part-Time Faculty, Kent State University School of Library and Information Science, Information Architecture and Knowledge Management Program
Member, National Institute of Building Sciences, buildingSMART Alliance Thought Leadership Subcommittee
Member, Human Factors a nd Ergonomics Society Environmental Design, Macroergonomics, and Cognitive Engineering and Decision Making Technical Groups

www.jmanganelli.net; www.da tastructureformdesign.com

Joe's goal is improving the capacity of the built environment to enhance human health, well-being, and cognition. He develops representational schemas, design methods, and tools for representing and analyzing the impact of potential environmental design features on user cognitive and task performance. His work engages the following frameworks: complex and dynamical systems science, embodied cognition theories of mind, Edelman's Theory of Neuronal Group Selection, Kirsh's concepts of epistemic and pragmatic action and activity space and performance design, Chua's theory of a cognitive dynamical system, cognitive task analysis, socio-technical systems, cyber-physical systems, ultra-large scale systems, ecological niche construction, neural networks, graph theory, and symmetry breaking. Joe's background includes: architecture, cognitive psychology, human factors, information architecture, and sustainability.