Conceptual Design Tool Requirements

Notes for the DCC-2010 Workshop:

CONCEPTUAL COMPUTATIONAL DESIGN TOOLS -
bridging the gap between abstract requirements and concrete implementation strategies

By Volker Mueller and Ivanka Iordanova, Workshop Co-Chairs

- Ease of use.

  Considering the concept of affordance the relationship to ease of use may be obvious. A high level of affordance in a tool means that those "afforded" aspects of the tool are obvious to the tool's users, and with increasing levels of digital tool literacy more aspects of the tool may offer themselves to users. When examining popular conceptual design tools and interviewing designers, one very important factor for conceptual tool selection is how transparent (i.e. invisible) the tool's use is to the design process.
- Modeling capabilities.

  Given sufficient ease of use, designers will gravitate towards tools they know will support generation of the design artifacts that will express their design intent. Designers that are "blob-oriented" will trade-off a more limited tool's ease of use for the modeling capabilities they must have to express their designs and will use more complex modeling tools. From an abstract perspective, specific modeling capabilities are prerequisites to representational multiplicity and representational flexibility.
- Visualization capabilities.

  Given sufficient ease of use and modeling capabilities, the general assertion is that designers will gravitate towards tools they know will let them show their designs in the light and visual expression (atmosphere/ambiente) that align best with the state of their design (idea sketch versus elaborately developed detail design) or highlight the experiential notion they want associated with their designs
- Multiplicity.

  Multiplicity means support of many designers and many workflows with various workflows for each designer. It affords method and tool selection based on the design problem. Necessarily it supports multiplicity of opinions in a community for knowledge exchange (DCC 2008 workshop).
- Flexibility.

  Flexibility is seen as expansion of representational flexibility and including diagram support, as well as support of changing interface modes, for example 2D, 3D, sketching, haptic devices, and true 3D devices. It also means flexibility in the choice of representational modes, including mathematical representation of geometry. It strongly corresponds to multiplicity by supporting changes in workflows. Extensibility can be considered a requirement, as well (DCC 2008 workshop; also "representational flexibility" in Berente et al. 2008.)
- Simultaneity

  Simultaneity includes synchronization and aspects of temporal and spatial traceability. It allows for concurrent models, of course with semantic coherence; pursuit of

simultaneous, parallel paths of design; and side-by-side investigations, for example of parameter set history, relationships, and solutions or solution spaces (DCC 2008 workshop).

- Environment.

  Environment is meant as providing full context for the design object and its functioning and use. For example climate, topography, and urban context (DCC 2008 workshop).

- Semantics

  The capability to express semantic information while providing semantic coherence across the design domain (Berente et al. 2008).

  Entity identity as consistent and non-redundant data objects with multiple, unambiguously linked representations.

- Entity identity vs. emergence.

  Unique objects with multiple presentations vs. emergence -possibility to change the semantics, etc. of a representation in order to let it play a different role in the object of design.

- Entity linkages

  Linkages between entities including aspects of both temporal and spatial traceability which require linkages to trace. (DCC 2008 workshop).

- Abstract objects.

  Representation of abstract objects and phenomena, like ideas, culture, experience, notions, associations, and other non-building information (DCC 2008 workshop).

- Diagram support.

  Support of diagramming and diagrams (DCC 2008 workshop).

- History and Design Space exploration

  History is an additional criterion, perpendicular to simultaneity and large part of temporal traceability. Cp. “synchronization” and “temporal traceability” in Berente et al. 2008. Design Space exploration includes possibility to browse and learn from previous designs or other objects. (DCC 2008 workshop.)

- (Re)generativity.

  Regenerativity is seen as capability to reconstruct model data. It highlights the need for designers to **re**create complicated design geometries in order to effectively understand aspects of the design – mere inspection of geometry across multiple representations and the related documentation is sometimes not enough to find inconsistencies and errors. In such situations, designers need to recreate the geometry to fully learn about it (Berente et al. 2008).

References:

BERENTE, N., SRINIVASAN, N., LYYTINEN, L., YOO, Y., 2008. *Design Principles For IT In Doubly Distributed Design Network* (innovation.temple.edu/ICIS%2008%20design%20principles.pdf)

PENG, W. AND GERO, J. S., 2006. Concept formation in a design optimization tool. *In:* VAN LEEUWEN, J. P. AND TIMMERMANS, H. J. P., eds. *Innovations in design & decision support systems in architecture and urban planning.* Dordrecht, The Netherlands: Springer. pp. 293-308.

IORDANOVA, I., 2008, Design Thinking and the Medium, presentation at the DCC-2008 Design Thinking Workshop.