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Knowledge Visualization in Design Practice: Exploring the Power of Knowledge Visualization in Problem Solving

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KEYWORDS *Design practice, insight generation, knowledge visualization, problem solving, sense making, visual modeling*

ABSTRACT This paper presents knowledge visualization as a design activity in problem solving. In contemporary design practice the increasing complexity of problems and the range of information with which design practitioners engage is driving the need for more robust processes and tools. This increased problem complexity and information range must be addressed in order to design relevant, meaningful solutions for people.

We situate visualization within a four-phased model where the intent is to understand the dimensions of a problem. Visualization aids in sense-making and cognitive processing of complex information. It accomplishes this through framing ambiguous states, bringing order to complexity, making sense out of seemingly unrelated things, and finding insights that are buried in data.

Within the problem-solving context the four-phase model's value goes beyond the functional level of simply representing information. Additionally, it operates as a powerful instrument for thinking in analysis, synthesis, and insight generation. Visual models and frameworks serve as tools to illuminate relationships and meanings within data and define the areas to explore and construct solutions.

INTRODUCTION

Complex problems require the perspectives of different disciplines to solve for them. In a cross-disciplinary team these perspectives also bring their own practices, tools, languages, and data sets. Overlaps and differences between disciplines are negotiated as teams attempt to integrate the knowledge and information each discipline brings to bear on the problem. A challenge is making sense out of the disparate sets of information describing the various aspects of a problem.

The multitude of data and information types to consider in problem solving is ever increasing: trend data, secondary research, qualitatives, quantitatives, geodemographics, and, more recently, social networks must all be considered. Another challenge is in understanding what types and combinations of information will best serve the objectives at different stages of problem solving.

The visualization examples presented here were created within the context of solving problems within a business paradigm. However, the activity of generating visual models, along with the types of thinking used in developing and working with them, can be applied to problem solving within any domain.

SITUATING VISUALIZATION WITHIN PROBLEM SOLVING

Four phases of the problem-solving model are defined by two intersecting continuums describing the nature of design activity and thinking. The first continuum, *knowing to making,* marks the beginning and ending points of a typical design process.

The second continuum involves different types of thinking applied in problem solving. At one end, *concrete thinking* uses systematic reasoning processes to sort, order and organize information. At the other end, *abstract thinking* is the application of more flexible, adaptable reasoning to conceptualize and hypothesize.

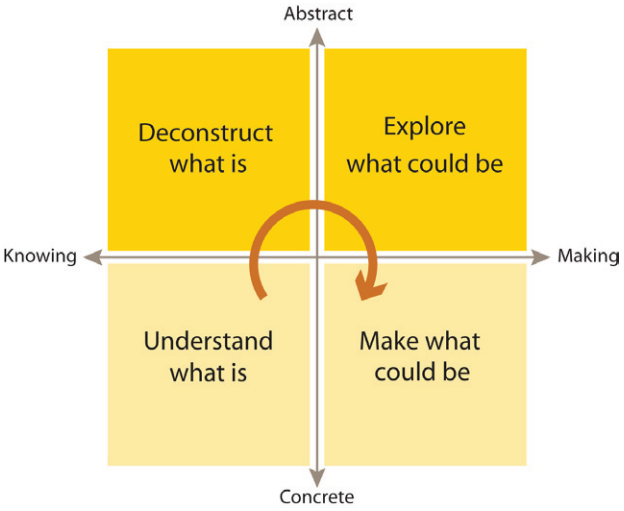

FIGURE 1: *The four phases of the problem-solving model*

KNOWING | CONCRETE: UNDERSTAND "WHAT IS"

The design activity in the lower left quadrant is concerned with discovery: What do we know? Where are the gaps in our knowledge? How can we best fill them? What is important to know? Information is gathered, often from broad and diverse sources. It is then ordered and classified through a process of analysis to identify the factors at work. As an active part of this process, visualization

serves to make the implicit more explicit. It accomplishes this through structural schemes that organize information in ways that highlight interrelationships between key factors within the problem space. The visual constructs that emerge during this process take a variety of forms depending on what is most relevant for creating understanding.

These constructs provide value on a number of levels. They facilitate knowledge transfer by enabling everyone to share clear articulation of the problem as well as the questions that need to be answered moving forward. They present a view of the world as it is—not as it's thought to be. By taking into account broader factors that are often overlooked at the outset (such as socioeconomic influences, experiential factors, or personal aspirations), they present a systems view of the situation. But these types of constructs have inherent limitations. They are descriptive in nature, and their primary function is to communicate. They do not suggest an alternative, more desirable reality.

However, if a team were to rely on the framing of a problem as the sole input when formulating a response, the resulting solution is likely to be only an obvious, incremental improvement on the current situation. While this may be sufficient for solving more concrete types of problems, it is not up to the task of unlocking complex, multi-faceted ones.

KNOWING | ABSTRACT: DECONSTRUCT "WHAT IS"

Once we agree on "what is" we're in a position to explore questions that have been raised in modeling the current state. We move into the realm of abstraction where we use a combination of analytic thinking and intuition to investigate the problem from different perspectives. Determining what models to create is a matter of play—it is directed by what is important to see about the situation. Visualization takes on a more sophisticated role here, as models become tools with which to think. They serve as the raw material for thinking more organically about "what is" in order to find new salience, relationships, and meanings that make it possible to consider the non-obvious.

This process reveals a richer understanding of gaps, unmet needs, and opportunity-areas, in addition to identifying what things are currently working well. As such, these models are goal-oriented in that they are integral to unlocking the problem. They also provide the vocabulary by which new a new language emerges for talking and thinking about the problem.

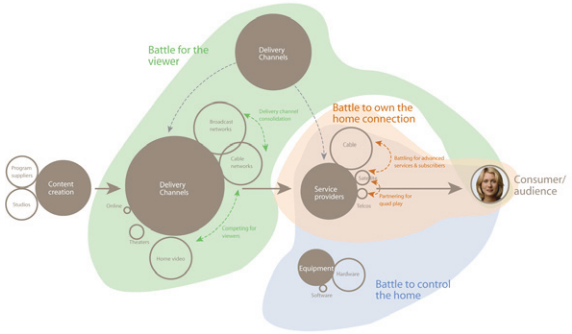

FIGURE 2.1: *A market model highlights the size and interdependencies between competitors and their position relative to the customer. It highlighted the insignificant role a company played in the space.*

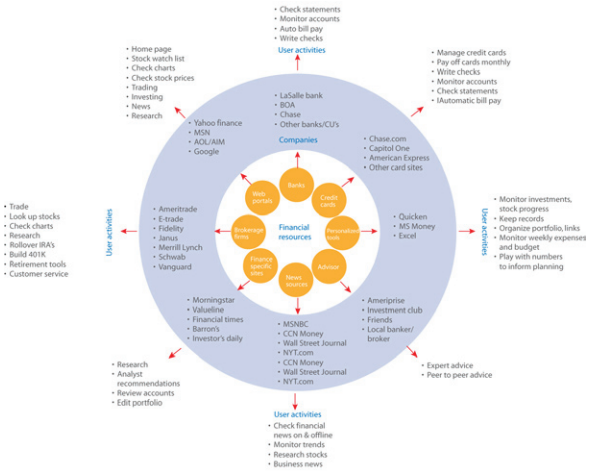

FIGURE 2.2: *An ecosystem of resources and service providers points to the world of choices available to customers for managing personal finances.*

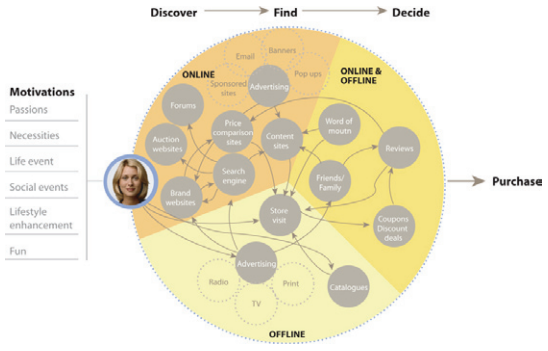

FIGURE 2.3: *An interaction model makes explicit the non-linear fashion in which customers gather information to inform purchase decisions.*

MAKING | ABSTRACT: EXPLORE "WHAT COULD BE"

"Exploring what could be" is about designing the future. Visualization comes into play through generative models that give designers agency to ideate possibilities, explore alternatives, and envision new realities that can lead to potential courses of action. Here models frame the components of the solution. The power of these models is in their flexibility: allowing us, through scenarios, to create multiple stories about what the future could look like. An example in which scenarios are created by combining a need with a context and interaction to guide ideation is shown in FIGURE 4.

MAKING | ABSTRACT: MAKE "WHAT COULD BE"

Concepts formulated in the previous phase are explored in more concrete forms to test assumptions against reality. Design has robust tools that are effective for doing this in ways that further inform the concept and iteratively evolve it to create a finished solution. (e.g., concept testing, iterative prototyping, etc.) Solutions may take the form of a products, services or experiences.

CONCLUSION

The challenge of working at the intersection of disciplines and information types is that complexity is likely to obscure the path forward when attempting to solve complex problems. As we've shown visualization is a powerful aid in problem solving and takes on different roles throughout the process. It illuminates what is important, gives us the ability to frame and try out our ideas about a potential future, and builds our knowledge along the way so that we are able to make solutions that are differentiating.

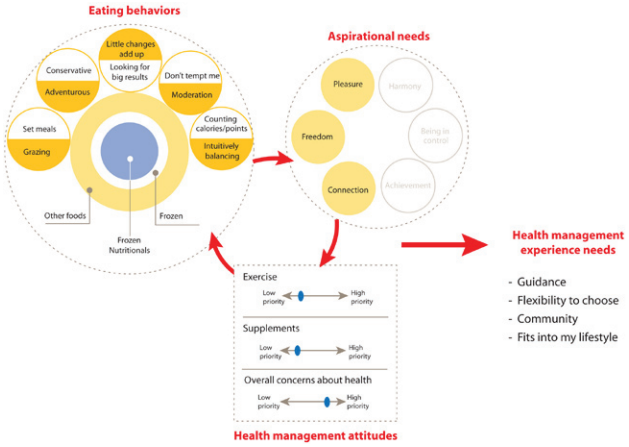

FIGURE 3: *In solving for a health management system, behaviors, attitudes and needs are cross-referenced and triangulated to uncover unmet needs.*

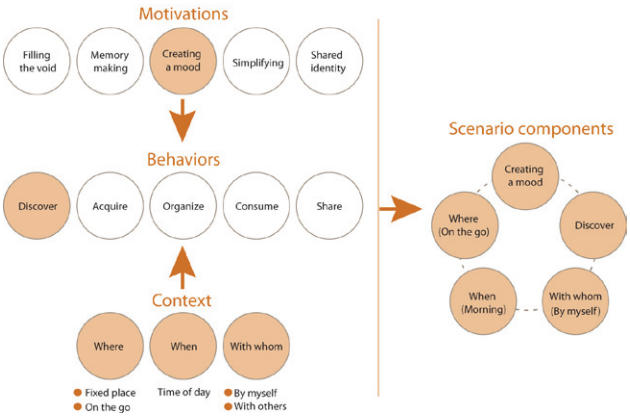

FIGURE 4: *An example of a generative model includes needs or motivations, behaviors and contexts in which situated interactions take place. Components are combined to frame a scenario for exploring an alternative state.*

BIOGRAPHIES

Joanne Mendel, MDes is a design strategist with diverse experience that spans innovation and strategy consultancies, global corporations and start ups. She's evolved human-centered product, service and brand experiences across a broad range of industry sectors. Joanne's passion is for the most information-intensive aspects of design practice where she's developed methods for revealing insights and framing solutions. She comes from a background of design research, information architecture, semiotics and graphic design.

Joanne earned a Master of Design from IIT's Institute of Design and holds a BFA in Graphic Design from California College of the Arts and a BA in General Studies from the University of Kentucky with concentration in visual semantics.

Jan Yeager, MDes is a design researcher with diverse experience in visual communications and information design. Currently her work focuses on exploring methods for enabling shared understanding of complex problems through visual models and storytelling.

Jan holds a B.A. in Anthropology from the University of Arizona, a BFA in Communications Design from Pratt Institute, Brooklyn, New York, and a Masters of Design in Human Centered Communications from the Institute of Design, Illinois Institute of Technology.

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