Information Architecture and Design Strategy:
The Importance of Synthesis during the Process of Design

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Understanding Design (with a Capital "D")

Design is the creation of a representational dialogue between people and products, services and systems encountered in everyday human experience (Kolko, 2007). This creation is grounded in a process; the process is a formal approach towards solving problems. These problems can relate to issues of complexity, or emotion, or visual aesthetics, and the solution is often manifested in a formal way.

There are many different flavors and versions of the process of design, but they all seem to encompass an aspect of research, synthesis, creation, and reflection (Zimmerman, Forlizzi, Evansen, 2004). This process, and subsets of the process, are performed iteratively until a solution is identified. Interestingly, the process remains quite similar while the scale and scope of the problem may change; thus, creating a simple object like a vase or building a complicated interface to an aircraft may require the same steps to solve (albeit contained in a much different timeframe and with a vastly different resource allocation). The continuity of this process, and the ability to apply it in a very fluid manner to problems great and small, paints the discipline of design in a unique light alongside science or art. All three subjects have methods, and techniques, and processes, and tools, and in this way all three are the same. Yet each of these disciplines has *different* methods, techniques, processes, and tools, and in this way they are all unique. The uniqueness has been obvious, perhaps, between science and art, but design has commonly been grouped alongside the other two: "Design is a blend of applied science and art," or "Design is halfway between the others." This hybrid placement does not recognize the uniqueness and depth of the subject matter itself, which is, perhaps, the subject matter of humanization of technology (Buchanan, 2000).

The results of the process of design have formal manifestations, and these then position the fruits of design within a culture. While a scientific principle transcends individual cultural beliefs ("gravity is true even if we don't have the scientific prowess to understand it"), Designed forms exist in a culture of use and it is this culture that helps to identify their subjective resonance. This means that issues of weight, line, placement, composition, color, texture and materials are not simply frames of aesthetics (as they would be in a context of art); instead, they begin to help solidify and substantiate the cultural boundaries of intention for an object, service or system. This formal presence has long been described or critiqued in contexts of architecture, transportation design or product design; it is only recently that designers have begun to examine or consider the formal presence in digital artifacts (such as computer-based user interfaces) or in systems or services. Yet the same formal principles of cultural resonance are true in these contexts as well, and the subject of design needs to better understand and identify the scaffolds of use in which this type of designed artifact is experienced.

The process of design depends on the success of two highly generative (and therefore seemingly subjective) stages: design synthesis and ideation. These phases, while delineated in design subject matter as separate stages with discrete boundaries, in fact flow and intersect over and over throughout the generative stages of artifact creation. They are driven by contextual research, and they produce design solutions with formal resonance, but these stages are the "magic" of design, and it is thus necessary to better understand what occurs during these phases of creation.

The goal of design synthesis is to develop an understanding of the design opportunity that exists. Contextual research, competitive research, or standard academic research is used to gather data, but that data alone does not indicate the potential for strategic design thinking; the data must be analyzed, organized, and understood. Thus, design synthesis is an organizationally generative process for analyzing qualitative data. This stage creates a structured framework for design solutions; it is the phase of design process in which the design constraints are identified and established, and the design problem itself begins to become better defined. It is a messy phase with strategic implications and strategic importance.

Design Synthesis and the Three Chasms

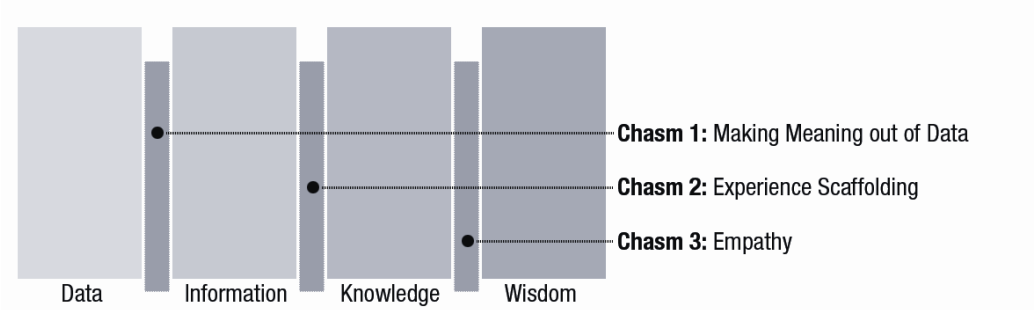
Design synthesis attempts to organize, manipulate, prune and filter gathered data into a cohesive structure for information building. This requires a number of tools and techniques, many of which are

subjective. The subjectivity of design process indicates that *the ability to replicate findings* – a critical aspect of a scientific method or process – is not a relevant part of the process of design. One quite able designer may synthesize gathered data with a certain result, and another equally capable designer may synthesize the same data with wildly different results.

The synthesis phase of the design process requires the ability of the designer to cross several increasingly difficult chasms, in the pursuit of understanding. This pursuit is both selfish and altruistic at once. The designer seeks to achieve a sense of knowledge acquisition in order to adequately begin the process of ideation. Additionally, in order to encourage a sense of timelessness in the development of designed artifacts, it is important for the designer to encourage the same sense of knowledge acquisition for the end user. If the user has learned, or felt passionately, or experienced a positive (or even negative) interaction with an artifact, the designer has created behavioral resonance.

Three chasms split the synthesis phase into several pieces, each of which is increasingly more difficult to acknowledge during creative genesis. As the designer moves from data, to information, to knowledge and then to wisdom, the problem being solved changes from a single dimensional issue of aesthetics or organization to one of selective contextualization, and then to one of experience (Shendroff).

Specifically, the three chasms separating the four phases of data manipulation can be thought of as follows:



Chasm 1: Making Meaning out of Data
As the designer concludes the research phase of the design process, they are left with a large quantity of data; the data, while potentially of great use, can be overwhelming and difficult to understand. Additionally, because of the overwhelming nature of the content and the frequently scarce resource of time, the designer is forced into an immediate conundrum: they must make sense of the data by immersing themselves in it, but the immersion takes time – and the more time spent inspecting the gathered data, the less time can be spent actually *designing*.

The goal of this immersion process, then, is to quickly make meaning out of the gathered content – to create information where before there was only data. There are several immediate ways to begin to understand the gathered data.

1. *Externalize the process.*

   The data that has been gathered from contextual research will often take many forms; designers gather and create photographs, video clips, transcripts, magazine clippings, and other artifacts related to the problem or opportunity context. In an effort to maintain some sense of coherence, young designers frequently attempt to horde the content in their laptop – the digital format allows for ease of organization, in the form of files, folders, and databases.

   This digital structure is, however, arbitrarily imposed by the constraints of the popular software tools and operating systems. The physical limitation of the laptop (the size), combined with the digital limitations of the software (the organizational schema), dramatically limits the designers' ability to see the forest and the trees: they lose the ability to understand the research *in totality* and they are limited in their ability to freely manipulate and associate the content.

   Data synthesis requires a designer to forge connections between seemingly unrelated issues through a process of selective pruning and visual organization. Because of the vastness of data gathered

while solving even a simple design problem, the quantity of data that must be analyzed is often too large to hold in attentive memory at one time, and so a designer will externalize the data through a process of spatialization and reframing. The tools to afford this are presently quite limited; “a big wall, a marker and lots of sticky notes” are some of the most common tools used by designers. These tools help the designer gain a strong mental model of the design space. The externalization of the research data allows for a progressive escape from the mess of content that has been gathered.

Ironically, Designers will frequently spend a great deal of time creating a war-room style wall of data, organizing and pinning the material up, and then ignore it for the remainder of the project. The designer needs the organization in order to gain a complete picture of the design space; they then draw conclusions, and then progressively through the phase of ideation, the synthesis wall becomes unnecessary: it has served its purpose in delineating the design space and allowing for a spatial understanding of structure.

Thus, one of the most basic principles of making meaning out of data is to externalize the entire meaning-creation process. By taking the gathered data out of the digital realm (the computer) and into the physical (the wall) – and by including it all on one cohesive visual structure – the designer is freed of the artificial limitations of technology. Content can now be freely moved and manipulated, and the entire set of data can be seen at one time. Implicit and hidden meanings are uncovered simply by relating otherwise discrete chunks of data to one another.

2. *Basic visual design begins to clean up the mess.*

Once the content has been externalized, however, the designer is left – quite literally – with a mess. The sheer amount of content can take up entire walls or offices, and the lack of consistency or cohesion between artifacts can look sloppy or disturbing; some designers describe a sense of “anxiety” from even looking at such a phenomenon.

Therefore, a second principle of making meaning out of data is to use basic visual design to begin to clean up the mess. This requires a sense of attention to detail, and craft, and patience. Designers can begin to build uniformity out of the physical structure of artifacts on the walls by using a consistent layout, by squaring off corners, and by rewriting key points in clear and crisp writing. Because the content is always in flux during the period of synthesis, a “cleanup sweep” is necessary several times throughout the process.

3. *Organization helps produce semantic relationships*

Once the data has been externalized and the literally mess is beginning to be reduced, the designer begins the more intellectual task of cleaning up the contextual mess. The content has explicit relationships and implicit relationships, and it is important to draw out these content-affinities through the process of organization.

The designer begins to move content around and place items that are related next to each other. Depending on the amount of data, this process can take some time. Additionally, the process is less about finding the “right” relationships and more about finding the “good” relationships. All of the content is related in *some* way, but the important connections are frequently those that are multi-

faceted, complex, and rooted in culture. Thus, it may be necessary to duplicate content (to allow it to connect to multiple groups), or to abandon or rearrange already established groupings several times during this process.

4. *Make semantic relationships explicit in plain language*

   Once the groupings begin to emerge through the process of organization, the groupings can be made explicit by labeling them. The grouping label captures both the literal and the implied meaning of the contents of the group – it makes obvious the meaning that has been created through the process of organization.

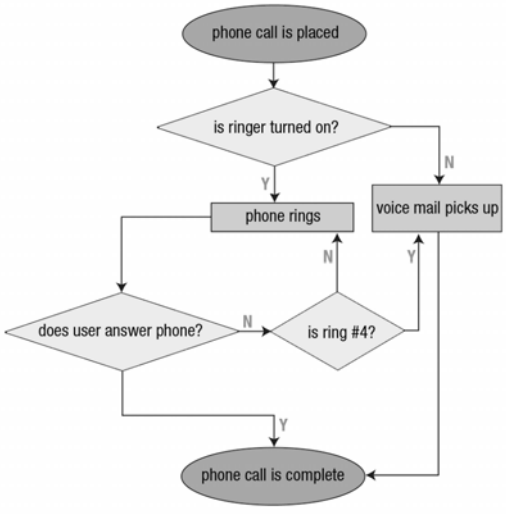
5. *Interpret gathered data through alternative visualizations – enhance the content through "best guess" intuitive leaps*

   Finally, the designer begins to visualize the relationships within each group through alternative visualizations. These relationships are interpretations of the content – they are informed by the content, but they are subjective and adductive. The designer must begin to ask "why," and do their best to answer the question with a credible, but not always logical, response.

   Some methods of visualization include process flow diagrams, concept mapping, and contextual design modeling.

   Process Flow Diagrams
   Process flow diagrams (also known as data flow diagrams or decision tree diagrams) have traditionally been used in the fields of electrical engineering and in computer science to illustrate the logical flow of data through a system. These diagrams can be created relatively quickly, prior to implementing complicated systems, and then manipulated in order to understand the optimum flow of data. This analysis tool can be used both as a generative exercise as well as an explanatory tool.

   To create a process flow diagram, a designer first identifies, through various forms of ethnography, the operators in a system and their roles. Next, the logic flow" is mapped out to connect the operators with actions. Take, for example, the phenomenon of a telephone ringing. The phone rings once, and there is a clear path of available (and logical) repercussions to this ring: the caller may hang up, the telephone may be answered, or else the phone will ring again. This will happen several times in a row, at which time a new choice becomes available: the call may be answered by a voicemail system.

   By creating a process flow diagram, the designer has formed an intimate understanding of the possible logical outcomes of use with a system. While the diagram itself can be useful throughout the project, the act of creating the diagram is of much more importance to the designer. Those involved in the production of such a diagram have created a strong mental representation of the boundaries of a complicated system.

   These diagrams can be made to illustrate the existing, or "problem" state, or can be used to show the potentially new, "fixed" state; both are useful for gaining an understanding of the structure of a design problem, and both can be used to reframe a static problem into one that crosses the fourth dimension of time.

   Concept Maps
   A concept map is a picture of understanding. It is intended to represent the mental model of a concept – to allow members of the design team to see the "forest and the trees". Generally, a

concept map links nouns with verbs. It provides a visual way to understand relationships through literal connections as well as through proximity, size, shape and scale. The tool is intended to illustrate relationships. The act of creation is generative in the sense that the designer must make subjective value judgments on the strength of the relationships.

The first step towards creating a concept map is the creation of a concept matrix or relationship tree. This matrix lists all elements relevant to a particular domain (nouns) and attempts to identify which items have a direct relationship. Consider, for example, an analysis of the game of soccer. One may identify nouns such as ball, referee, goalie, hands, whistle, and shin guard (as well as nearly one or two hundred other terms). By creating a matrix to illustrate the connections between these elements, the designer is forced to analyze the strength of the relationship. All of the words are implicitly related, as they all have to do with the overarching domain of soccer. However, ball is more closely related to goalie than it is to whistle. By analyzing the connections terms have with one another, the designer is forced to "zoom in" on the details to such an extent that they gain an intimate understanding of a discipline. They can then begin to understand the hierarchy that exists within a large quantity of data. The elements with more relationships become the main branches on the concept maps – they become the "glue" holding together the concept.

Once the matrix is created and these core concepts are identified, completing the concept map becomes a rather simple activity of connecting nouns with verbs. How are ball, goalie, and hands related? The ball can be touched by the goalie's hands. As these are added to the diagram, the designer – and eventually, the entire team – can visually trace relationships between entities and understand how a potential change to one aspect of a system may ripple through the system as a whole.

Contextual Design Modeling

Ethnographers Hugh Beyer and Karen Holtzblatt developed a set of visual models for seeing work in their text Contextual Design: A Customer-Centered Approach to Systems Design (Holtzblatt, Beyer, 1997). While the intention of these work models was to assist Usability Engineers in creating usable software, the visual style of making connections is ideal for designers focused on interpreting complicated data. Beyer and Holtzblatt developed five models in order to capture the nuances of ethnographic data: Flow, Cultural, Sequence, Physical, and Artifact.

The Flow model captures the movement of information without regard for time – it allows for a visual synthesis of data and information transfer. The cultural model attempts to illustrate only interpersonal relationships, and to articulate the affects of political or social influence. The Sequence model shows the triggers, intentions and actions that occur in order during work, allowing for an understanding of implicit task structure and hierarchy. The physical and artifact models capture the built environment and the objects used to complete tasks.

The common visual style of the models creates a language for seeing and understanding work as it occurs, and the models can then be referenced throughout design: the designed object can be introduced into the models and predictions can be made concerning the effects this object would have on the entire system of work.

Chasm 2: Experience Scaffolding

The designer has created a sense of informative meaning out of the gathered data through the various organizational and structural arrangements described above. This data may be meaningful on a pragmatic level – it will most likely be more usable and useful to people (both designers and users or consumers) than the raw words, photos, videos or artifacts captured during research. Additionally, these new visual descriptions will be easier to present to stakeholders and to others involved in the development of products. However, humanity requires a sense of emotional resonance; usability and usefulness does not recognize the subjective and rich experience of the human condition.

A great deal has been written about the nature of human experience. Philosopher and author John Dewey has made vivid and critical connections between experience, art, and education. Yet even Dewey has acknowledged that it is nearly impossible to create an experience with any degree of predictability, for the simple fact that people "complete" the experience, and people are different. Dewey explains that

“experience does not go on simply inside a person … Every genuine experience has an active side which changes in some degree the objective conditions under which experiences are had.” (Dewey, 1997). Designers have increasingly embraced the idea of experience design, but the subjective nature of human experience in life makes it difficult to truly structure a repeatable and predictable experience. Designers can approximate the human behavior associated with time-based design, however, through the creation of an experience scaffold: a framework that contains the elements of experience but allows for individual difference and expression.

There are a number of methods that can be used to build the experience scaffold; all of these techniques emphasize the unique, rich and complicated facets of human life.

1. *Tell a Story.*

   Traditional industrial and graphic designers focus on the creation of a static, two or three dimensional artifact. Designers focus on form, and function, and comfort or aesthetics, but by placing an immediate focus on an artifact, one is implicitly placing value on the creation rather than the user of the creation. When attempting to create a scaffold for experiences, the emphasis should shift to acknowledge and understand the user and their activities, feelings and desires *over time*. An easy, accessible, and relatively common way of articulating these issues as related to time is the story. Storytelling is as old as language, and allows an individual to paint an immersive scene and environment.

   The components of a successful story are subject to debate, and the ability of one to actually *tell* a successful story implies some degree of literary prowess. However, there are some fairly obvious components that can be considered and included in a tale to make it believable and easy to understand.

   The story itself should include a plot, characters, a setting, and a climax and ending. These components can be told in a precise, vivid and detailed manner, so as to encourage an awareness of sensory detail. Additionally, there should be some underlying point for the narrative; the story can be used to illustrate the problem with an existing design or situation, or can be used to better show how an artifact, service or system can be integrated into human day to day life. Whether the story points out problems or articulates a solution, however, it should still serve to humanize the design opportunity: the structure of the story, and the emphasis should be placed on people and goals rather than on technology or engineering. This will shift the emphasis from an artifact to an experience, and will help to create an experience scaffold to move from information to knowledge.

2. *Change the Scale.*

   Design problems exist in a context; one can always “zoom out”, and articulate how the context fits into the larger framework of human existence. Similarly, one can “zoom in” to identify details or nuances that are otherwise glossed over. Designers Charles and Ray Eames identified the importance of moving closer towards and further away from a design problem, and went as far as to illustrate this principle through their well known film *Powers of Ten*. The film is a literal journey through geography, space, and time, but illustrates a more important and subtle principle: changing the scale of a problem illustrates new problems, issues, and opportunities, and allows the designer to recontextualize the problem (Eames, 1978).

   For example, when attempting to design a coffee maker (usually considered as a physical artifact), one can zoom out to examine the context of use: the countertop, the kitchen, a residential location, or even a particular city or geographic region. In forcing this shift, the designer can find new points of contact with consumers, new ideas for form and function, and new cultural requirements that can affect comprehension and desirability. Similarly, the designer can zoom in to examine the details –

the details of freshly ground coffee, or the grinder, or even of the coffee tree itself where the beans are grown.

This forces the designer into a position of conceptual thinking rather than pragmatic thought; by moving in, out, or laterally around, ideation and design investigation can be extended with regard to geography, time, or even subject matter.

3. *Shift the Placements.*

Another way to understand and build a scaffold to afford experience is to understand the placements that support design, and then to consciously and very explicitly shift these placements. Theorist Richard Buchanan describes the placements in his landmark text *Wicked Problems in Design*; he explains that "… signs, things, actions and thoughts are not only interconnected, they also interpenetrate and merge in contemporary design thinking with surprising consequences for innovation …" (Buchanan, 1996). These are the placements – the boundaries, or containers, that culture (and designers) seem to gravitate towards. Signs and things represent the nature of symbolic, visual and physical communication; actions imply the idea of activities or services, while thoughts can represent complex systems. Understanding these placements allows for the designer to place their opportunity in a theoretical context, which is interesting but not altogether useful. Buchanan goes on to explain that the real value of the placements comes when a designed opportunity moves between points in the placement framework: "… innovation comes when the initial selection is repositioned at another point in the framework, raising new questions and ideas." (Buchanan, 1996).

A coffee maker is generally thought of and considered to be a *thing* – that is, an industrial designer may approach the problem of coffee making in the home by exploring various physical shapes and functions that can make coffee making more usable, useful or desirable. Truly interesting – and, according to Buchanan, innovative – results occur, however, when considering that the output of design activities may be signs, actions or thoughts. What if the designer attempts to structure a coffee solution that is part of a system instead of a physical artifact? Perhaps the designer identifies an opportunity for a coffee delivery service, or a new type of digital coffee-related experience. These interesting relationships are forged by viewing the old design opportunity in a new light: by shifting the placements of the design framework. Ultimately, this shift forces the reconception of design hypotheses and helps to create a framework for experiences.

Chasm 3: Empathy

Wisdom is created through experiences. A teen living on the streets of New York City may be considered "wise beyond their years," while an author may be praised as "wise" towards the end of the career. Experiences do not have to be long, nor drawn out; they simply have to be emotionally resonate.

As it may be impossible to design experiences, it may be equally impossible to claim the design of wisdom. Perhaps the best a designer can do is to achieve a sense of wisdom about the subject matter of design – which, for all practical purposes, may be everyday life. Thus, the path towards wisdom may be to experience human life, and to experience the beauty, pain, complexity and harmony of the human condition.

Perhaps the key to successfully creating wisdom falls directly within the emotional capacity for empathy. The designer needs to be able to truly empathize with the people who will be using, buying, considering or consuming their design.

Empathy is fairly easy to discuss, but curiously difficult to actually *do*. Most ethnographic tools are used to *understand* context – to uncover details related to work flow, or to learn vocabulary related to a particular group of people or activity. Understanding, however, is not synonymous with empathy. To compassionately feel what it is like to be another individual, one must identify with their culture, their emotions, and their style. Tools like Personas have been created as a proxy for actual comprehensive emotive immersion, but these tools may have a superficial lack of real feelings: they don't capture the depth of sorrow, or passion, or hilarity that can be found in actual life and in actual experiences.

And that's the real value of empathy for a designer: experiences involve both the pragmatic (activities, goals and tasks) but also the conceptual and fleeting (such as feelings, and irrationality, and culture).

Ralph Waldo Emerson noted that “a man who seldom rides needs only to get into a coach and traverse his own town, to turn the street into a puppet-show.” (Emerson). While observing the puppet-show of life gives a dramatic amount of insight into humanity, it provides only a sensory glance at the world around us. Intellectual discourse can serve to fill in the gaps between peculiar cultural norms and the richness of society. This discourse is found in the newspapers, magazines, and books around the world; the written word contains a magical wealth of knowledge that is waiting for be turned into Wisdom. In the same way that a story helps move structured information from information to knowledge, the act of reading can allow for the synthesis of knowledge into a world outlook.

Perhaps not that ironically, designers seem to gravitate towards design-centric magazines. They read about the newest products, and the latest technology, and the trends that are sweeping across the world. This frequently has little to do with “real life,” as designers seem to appreciate a particular type of aesthetic (modern and sleek) and generally seem to get excited about advances in technology and in materials. Most people care little about these issues; instead, they care about the subject of practical, everyday life: their jobs, and their religion, and their community, and their family. Designers may be able to glean a great deal more insight into how the majority of the world approaches life by listening to the majority of the world, rather than listening to other designers.

For a designer, the world is the puppet show; the world we have built, and the natural world we have built within, are hilariously entertaining, intellectually instructive, and curiously full of beauty when viewed as the subject of Design research. Paradoxically, the designer spends an exorbitant amount of their time in the studio or in front of the computer – far, far from the puppet show. Perhaps, in an effort to move towards a sense of humble wisdom about humanity, the designer needs to live more vibrantly.

Summary

During the process of design, designers attempt to draw connections between large quantities of seemingly unrelated ideas. Designers visually explore this data in an effort to find and understand hidden relationships. This synthesis can then be used to communicate to other members of a design team, or can be used as platforms for the creation of generative sketching or model making. The synthesis can also be used to feed the development of Information Architecture solutions for complicated systems, or can be used to develop product positioning strategies that can be used to effectively enter the marketplace with new products, services or systems. Implicit in all of these applications of synthesis is the emphasis on humanity, and the movement from data to wisdom – a path that depends heavily on experiencing all that the human structured world has to offer.

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