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Improving information design practice

A closer look at conceptual design methods[1]

Keywords: conceptual design, methods, design process, understanding, information design, professional practice

As novel tools and techniques for visualizing information grow popular, many information design solutions are increasingly demonstrating high technical and visual sophistication, but often at the expense of thoughtful, effective communication. This recurring phenomenon highlights an overemphasis on the production of design outputs and failure to understand the initial problem, content, and audience early in a project. We assert that ineffective information design results primarily from a lack of rigor in the conceptual stage of the design process, when critical decisions determine the end result. We propose 23 methods information designers may adopt to reinforce their conceptual design activities.

1. Introduction

A convergence of forces—the ready availability of design technology, the Internet explosion, and the proliferation of data—has generated considerable interest in information design in recent years. Paradoxically, as the need for information design skills to address complex challenges grow more urgent, the quality and performance of many information design outputs often falls short. Frequently, these solutions present "prettier pie-charts" but with less understandable and harder to use information (Wurman 1996; Katz 2012). This recurring phenomenon highlights a key problem facing information design: there is too much emphasis on the production of design outputs and too little attention paid to fundamental understanding. Creating effective information design "requires more than a computer drafting program or cut-and-paste template" (Heller & Landers 2014:7). Effective use of technology is governed by "a disciplined process of logic and common sense" (Wurman 1996: 5). Dubberly (2005) asserts that "our processes determine the quality of our products;" thus, to become better designers, we need to understand what we do and how we do it. This learning will help improve our practice.

This paper aims to raise awareness of the information design process and, specifically, of the early conceptual design stage, in which key activities help construct the central understanding that determines the quality of the end product and the ultimate end user/audience outcome. We focus on methods that support understanding, sense-making, and decision-making.

First, we set the context with an overview of the information design field, the process, and types of projects. Next, we unpack conceptual design, its role in the design process, and how to support this part of the

process. Then we present conceptual design methods that can be adopted by information designers, followed by a case study that shows how these methods are used in professional practice. We conclude by discussing implications of using these types of methods in professional practice and indicate further lines of exploration.

2. Background

2.1 Information design

Information design is a field of study and practice informed by graphic design, journalism, interface and user experience design, cognitive science, behavioral and applied psychology, and information science, among other fields (Waller 2011). Within the field of information design, there are numerous specializations and sub-fields, such as data visualization, visual journalism, infographic design, document design, signage design, and interactive design. Increasingly, information design skills are gaining relevance in the realms of organizational change and social innovation (Frascara 2015), thus signaling the evolving role of the field beyond visual artifacts and towards the design of systems, strategies, and experiences. Information design problems come "in all shapes and sizes" (Wurman 1996: 142), ranging from the well-defined and highly framed (e.g., infographics, bus timetables) to the ambiguous and unframed (e.g., organizational strategies, social change initiatives), often involving close interaction with individuals from other disciplines. These changes also require information designers to work in a more systematic and rigorous way, and to adopt methods to help them externalize their thinking in order to facilitate collaboration. The audience or users have a vital place in information design as decisions are made in response to their needs: without a deep understanding of people to inform the design process, an information design solution is highly unlikely to succeed.

Given the cross-disciplinary and multi-faceted nature of information design, it is challenging to arrive at a concise definition that accurately captures its breadth and depth (Gobert & van Looveren 2014). However, at its core, we recognize that information design work of any kind seeks to facilitate understanding—of a situation, concept, space, place, time, quantity, phenomenon—for an intended audience (Wurman 1996). For the purposes of this paper, we broadly define information design as the process of facilitating understanding in order to help people achieve their goals. We hasten to add that the domain of information design problems need not be limited only to the complex; even the simplest of concepts can be miscommunicated and call for no less rigor and attention to be conveyed clearly (Siegel & Etzkorn 2013; Pontis & Babwahsingh 2013; Frascara 2015).

2.2 Understanding how information designers work

There are many theories, models, and frameworks that shed light on how designers think. Similarly to Dubberly's work (2005), we argue that while in practice all designers seem to work differently, they all also share some kind of process. Some authors and theories describe this process as involving an 'Aha! Moment' characterized by pure inspiration or intuition (e.g., Arnheim 1993; Klanten et al. 2008). Other authors assert that the process can be externalized and its key actions or steps identified and studied (e.g., Jones 1992; Cross et al. 1996; Lawson 2008; Dorst & Lawson 2009).

To better understand how information designers work, we asked five information design professionals with more than five years of experience and 19 undergraduate students taking their first design course to visualize their processes. For the purposes of this paper, we only present a summary of relevant findings; the full study is reported in Pontis (in preparation). In line with prior studies, all 24 process diagrams indicate the

beginning of the process with a problem or a situation in need of change, and typically end with a proposed solution or improvement of that state. Additionally, not all the processes are strictly linear or sequential; certain steps are indicated as cycles or iterations (Simon, 1995). Students' process diagrams were in general more visual but more cryptic than those from professionals. While six of the 19 students describe detailed steps of their process (e.g., P6, P7, P8 and P9—Figure 1), the remaining 13 students drew their process without naming specific steps (e.g., P12 and P13—Figure 2). Rather than using words to explain what they do and how they move forward in the process, these students mostly drew shapes to symbolize chains of activities. As first year students, they are still gaining an understanding of how they work, which may explain why they could not clearly explain how they solve problems or come up with ideas; instead, they used words such as "ideas" and "incubate," and drew "black boxes" to illustrate still unknown parts of their process. On the other hand, in most cases, professional designers described their processes in great detail by either using words or visually explaining what each step involved (Figures 3 to 7).

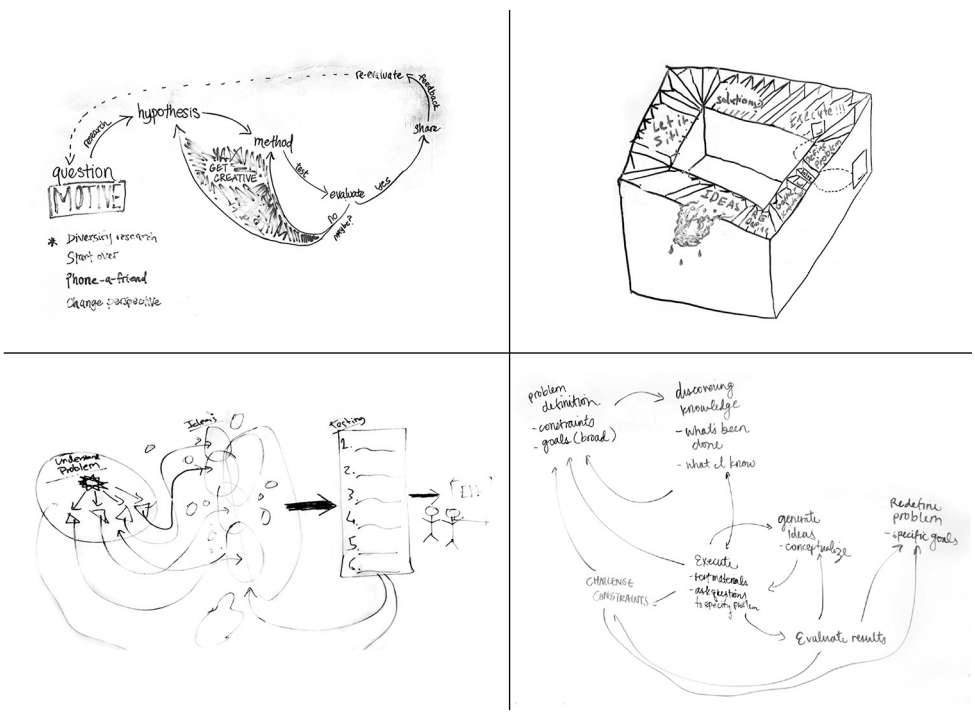


Figure 1. Process diagrams from students describing steps. From left to right and top to bottom: P6, P7, P8 and P9.

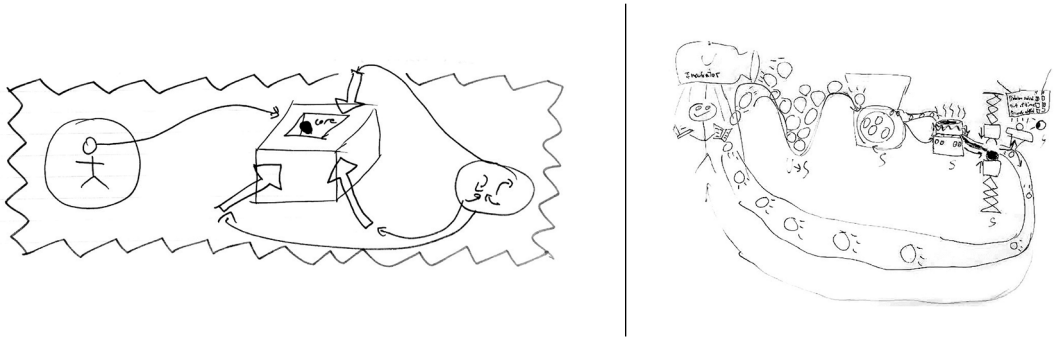
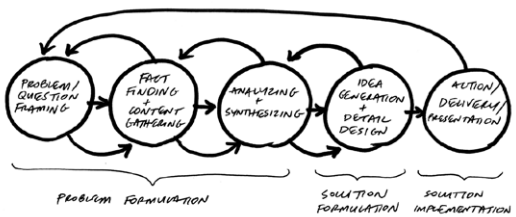


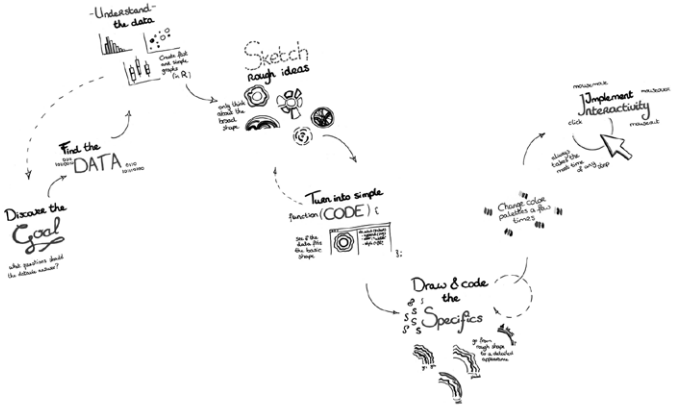
Figure 2. Process diagrams from students without descriptions of specific steps. Left to right: P12 and P13.

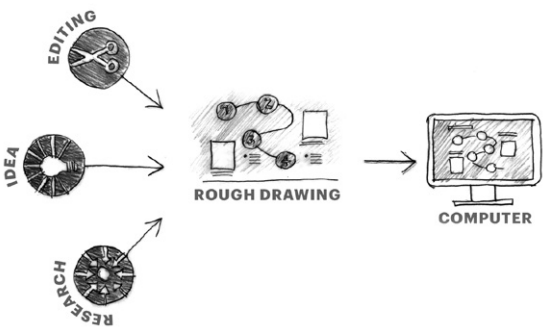
The analysis indicates that younger designers still go through the process in a less conscious way than professionals do, and that they use different terminologies. However, most process diagrams we analyzed share similar steps and phases that support previous studies (e.g., Parnes 1967; Treffinger et al. 2006; Lawson 2008; Pontis 2012; Frascara 2015). For example, while students did not describe the process with much detail, most of them indicated "understanding problem", "defining problem," "gathering knowledge" and "testing" as key steps. This was in line with professionals' way of working: they start with "question framing", "discover[ing] the goal" or "research", and at some point later in the process, they "verify" initial ideas. For professionals, the middle part of the process is more clearly articulated than it is for students, involving a series of well-identified activities: "rough drawing", "understanding the data", "analyzing and synthesizing", "sketching rough ideas", creating "second and third drafts", "turning [data] into simple codes", "drawing and coding specifics", "design", "delivery and presentation."

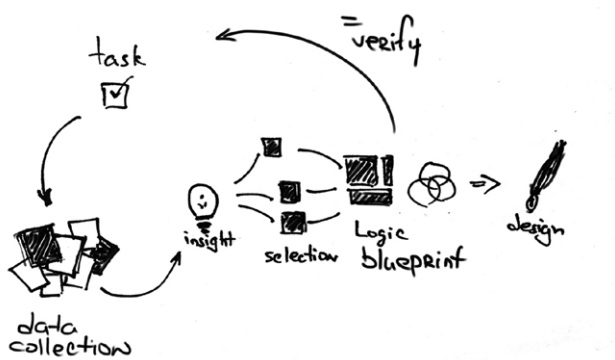
With regard to solving information design problems, the steps and phases identified in prior process models, and also from our analysis, can be arranged into two broad parts: thinking and doing. Table 1 indicates that although these two broad parts of the process seem to manifest themselves in different ways, both parts can be distinguished in most diagrams. This distinction emerged in a clearer way in the professionals' processes than in those of students'. In addition, these diagrams show a strong beginning of the process, involving various steps to gain an understanding of the problem before actually describing the execution of an idea or making decisions on visual design aspects. As Wurman (1996: 142) put it: "first is to 'engineer' the solution correctly, focusing on the invisible infrastructure until the raw concept emerges. Second is to provide a visible 'architecture' which communicates how the system works and engages people to try it, trust it and ultimately rely on it".

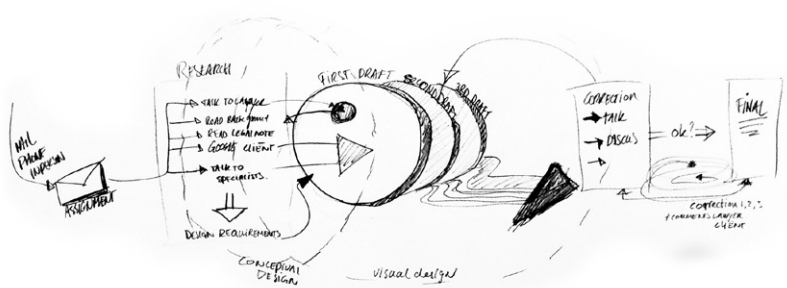
As a large part of an information designer's job involves making sense of raw data, disorganized information and unstructured situations, having a strong initial focus on figuring out the design problem is essential to making well-supported decisions and effectively creating meaning. Regardless of context or project type, the goal of the information designer is to maximize benefit and value for the client and end user by driving the











Figures 3 to 7. Process diagrams created by experienced information designers (P1 to P5).

Table 1. Steps provided by participants' process diagrams aligned with our proposed information design model

		Thinking (conceptual design)					**Doing (prototype design)**		
	Proposed model	**Problem understanding**	**User/audience understanding**	**Subject matter understanding**	**Simplification**	**Design proposal(s)**	**Design**	**Evaluation**	**Refinement & implementation**
Professionals	P1	Problem/ Question framing	Fact finding + content gathering		Analyzing + synthesizing	Idea generation + digital design	Action/ Delivery presentation		
	P2	Discover the goal		Find the data/Understand the data		Sketch rough ideas/Turn into simple—Code	Draw & code specifics/ Change colour palettes		Implement interactivity
	P3	Research/idea/editing		Rough drawing		Computer			
	P4	Data collection		Insight	Selection	Logic blue print		Verify	Design
	P5	Assignment	Research		First draft	Second + third drafts	Correction	Verify	Final design
Students	P6	Question/ Motive		Research/ Hypothesis/Method				Evaluate	Share & Re-evaluate
	P7	Define problem		Gain knowledge	Redefine	Ideas/Let it sit	Solutions		Execute
	P8	Understand problem				Ideas		Testing	
	P9	Problem definition		Discovering knowledge		Generate ideas/ Conceptualize	Execute	Evaluate results	Redefine problem
	P10	Find problem		(Gather related information & Acquire knowledge)	Idea creation (idea selection & idea combination)		Externalize/ Execute		
	P11					Idea		Rejection	Execution
	P12–P24	*Visual processes only; no descriptions of steps provided*							

performance of their intervention and solution. As we will show in the following section, although the effectiveness and impact of any information design work depend on the orchestration of a number of factors, every work must begin with a solid foundation. This key aspect of information design work was to some extent reflected in both the students' and the professionals' process diagrams. Building on the work of Pontis (2012, 2014) and Pontis and Babwahsingh (2015), we present a two-part process model that combines steps from all processes analyzed to clearly show information designers' emphasis. We refer to the first part as 'conceptual design' and to the second part as 'prototype design' (Figure 8); each part involving a "sequence of operations" (Lawson 2008: 119), which here we refer to as phases. These phases summarize prior studies and insights from this analysis and aim to provide a cohesive model that may shed light on how designers work. We discuss the first part of the process, conceptual design, in the next section.

2.3 Information design performance today

According to Frascara, there is "enough knowledge today to produce good information design", but information design solutions repeatedly display basic problems (e.g., lack of information hierarchy, poor choice of color use,

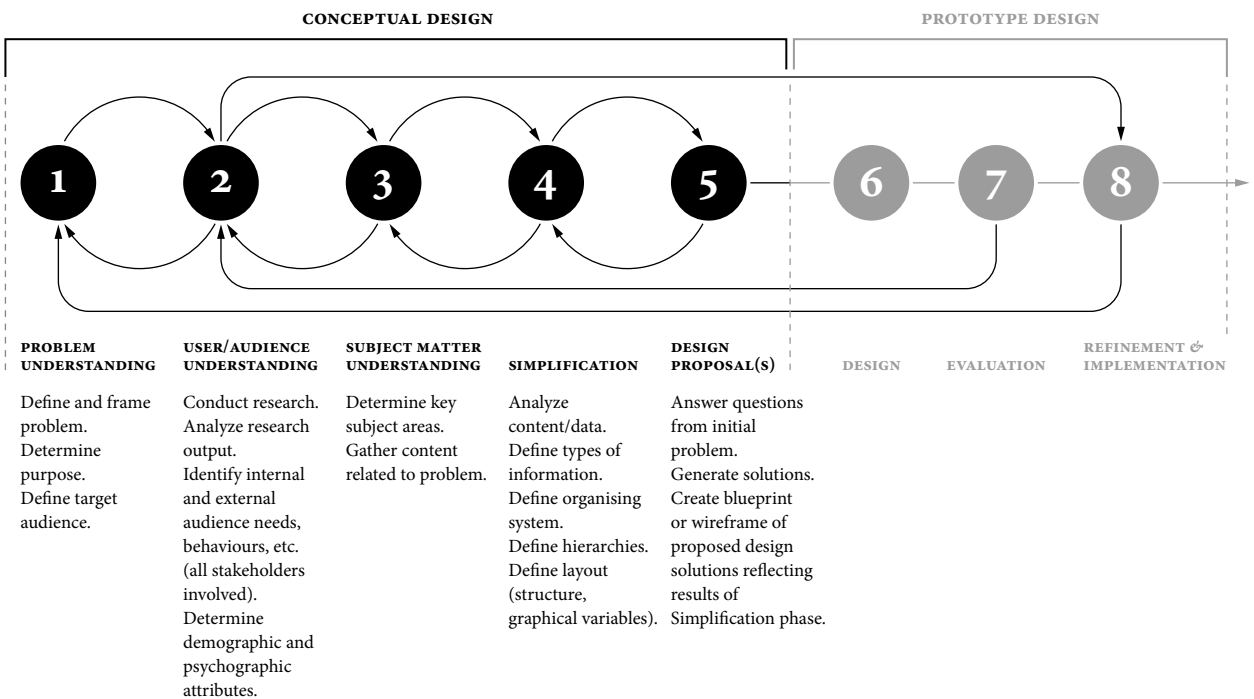


Figure 8. Overview of the design process building on Pontis (2012, 2014) and Pontis and Babwahsingh (2015).

unclear message, inappropriate use of graphic language), which indicates that "this knowledge is not getting to where it should be" (Frascara 2015: 49). Building on Frascara's viewpoint, we argue that there is no need to create new knowledge or techniques, but to reflect, revise, and put the knowledge we already have into practice. By directing attention inwards to reflect on our processes, and, particularly, by shedding light on the very first steps that designers need to perform in order to solve a problem, designers' awareness of fundamental issues may increase. When working with teams on large or interdisciplinary projects, having this awareness becomes indispensable to obtain successful results. In line with Dubberly's work (2005: 6), we argue that achieving effective solutions is the result of determining and planning the process, tasks and roles in advance, recording all the steps carried out in the process, and identifying and addressing gaps and areas for improvement.

The adoption of conceptual design methods can help designers develop the necessary sensitivity to become more aware of the consequences of their ideas before they start prototyping them or putting them into practice. Overall process awareness reduces risk and raises chances of success, clarifies and narrows potential outcomes by decreasing uncertainty, and optimizes execution of tasks by enabling modification and improvement at key points (Dubberly 2005). However, thorough attention during the early stages of the process will enable designers to "recognize and appreciate deficiencies, shortcomings and loopholes in ideas" (Parnes 1967: 29). Ultimately, this change would cascade to the rest of the process, and the overall performance of the solutions would improve.

3. The beginning: Conceptual design

Conceptual design is the part of the process where the definition and exploration of the design problem and the conception of ideas occur (Ware 2008; Pontis 2012). The main goal of Conceptual design is *understanding* and it involves:

1. Understanding of the **problem** itself (what needs to be fixed)
2. Understanding of the **content or data** (what will be translated and communicated)
3. Understanding of the **audience** (who is at the center of the problem and what their levels of visual literacy, education, needs, behaviors, and familiarity with content are)

To achieve that, conceptual design consists of five core phases and a series of actions which analyze, simplify, and compile content into an understandable and usable form. Building on the work of Parnes (1967) and Jones (1992), we identify three modes of activities in each of these five phases: exploring or diverging to learn, gaining understanding and evaluating ideas; analyzing or converging to extract meaning, selecting and making decisions; and creating or synthesizing to develop ideas into tangible outputs. Throughout this part of the process, designers cycle many times through these modes of activities, starting with more general cycles and moving to more detailed ones (Jones 1992).

The first phase requires considerable effort in identifying, understanding, and framing the problem (Ware 2008; Lawson 2008) by defining questions that should be addressed by a solution at the end of the process. In some cases this phase "is explicit and well-defined", whereas in other cases it can "be quite informal" (Ware 2008: 156–7). In both cases, Ware (2008) stresses that the aim of this phase is to "understand and define a problem before attempting to solve it." Designers' explicit and implicit knowledge have a key role in gaining all forms of understanding (Bektaş et al. 2008). To make sense of the problem and understand its requirements and

relevant content, designers move through information cycles (Wang et al. 2002), first relying on their implicit knowledge (e.g., past experiences, principles, strategies, and tactics) (Klein et al. 2007; Bektaş et al. 2008), and then supplementing it with explicit knowledge obtained through external sources of information (e.g., clients' input, research). The more complex and specialized the problem is, the greater the designer's need to gather explicit knowledge by learning about the problem domain and interacting with experts in the subject. In parallel with content understanding, the second phase focuses on gaining a deep understanding of the audience and identifying their needs. This understanding determines the criteria for decisions made in the next phases.

At the end of the first three phases, large amounts of information from different sources compose the raw data sets to be used as the basis for creating a solution. During the fourth phase, raw data sets are analyzed to identify and extract more specific information to help address the initial questions. The last phase of conceptual design involves the visualization of the learning obtained in the previous phases, the generation of ideas to answer the initial questions, and the creation of concept solutions or proposals for some of those ideas.

Ideas generated and decisions made during the conceptual design stage affect later decisions related to formal execution of the solution (Jones 1992; Wurman 1996; Senechal 1997; Ware 2008; Pontis 2012). It can be hard to "compensate or to correct the shortcomings of poor" conceptual design decisions later in the process (Wang et al. 2002: 981), because they can have strong repercussions across various aspects of the project, such as time management, budget estimates, solution quality, overall performance and audience response.

The relevance of this part of the process has been highlighted in previous studies (Senechal 1997; Pontis 2012). However, conceptual design actions are often underestimated, with some designers "going to the computer sooner rather than later" (Heller & Landers 2014: 302). In addition, growing demands for faster results and tightening time constraints on the design process make designers more impatient and less willing to spend time just thinking and working with their hands, away from the computer. Jones (1992: 65) argues that designers are "far too speculative" at the beginning of the process and this is why they "fail to see the point of fact-finding" before making key decisions or understanding "what it is they are looking for." For some designers, this understanding crystallizes while they are "working with real elements—typography, dimensions and data" (302), and exploring "problem and solution space together iteratively" (Heller & Landers 2014: 308). Lawson (2008: 182) asserts that, unlike with scientists, this is common behavior among designers because they tend to focus more on "reaching a solution rather than understanding the problem," even if this way of working can increase the risk of creating ill-conceived solutions and having to deal with major changes later in the process (Ware 2008; Mueller 2009). This indicates a need to support the phases of conceptual design and make designers aware of the impact the decisions made at this stage have on the whole process (Mueller 2009).

4. Methods for supporting conceptual design

Conceptual design methods can provide guidance or a logical structure on which to support decisions, thus minimizing the risk of making arbitrary decisions (e.g., trying out random solutions, making choices based on personal tastes) (Jones 1992; Cross 2000; Conley 2004). Consequently, these methods can enhance both designers' implicit and explicit knowledge: in the former case, by deepening designers' thinking and understanding, and strengthening their information management skills, while in the latter case by helping designers define more focused and robust data collection

strategies. Bektaş et al. (2008) refer to this type of methods as "knowledge management tools" because they aim to externalize implicit and explicit knowledge, the sharing of this knowledge with others, and the reuse of knowledge in further projects. These methods do not replace creative thinking or professional experience, but rather, they support them.

The key to gaining the most value from these methods is rigor. Wood (2000) proposes the idea of *Studio Theoria* as "a shift away from academic rigor towards studio rigor" (in Russell 2002: 3). This shift is more in line with professional design practice needs and indicates that rigor can take different forms—not necessarily the "logical accuracy and exactitude" demanded by more theoretical fields (Wood 2000: 48). Rigor in design practice manifests itself in the designer's commitment and ethic when doing the work. It is essential that designers apply methods in a disciplined, deliberate manner, so that they yield the greatest benefit and utility from these methods. For example, visual thinking methods should be used to represent concepts and ideas in concrete, understandable terms, not simply to create beautiful pictures with decorative elements. Similarly, color-coding should be used to aid data analysis by revealing patterns and systems of defined categories, rather than arbitrarily enhance pieces of information without reinforcing meaning.

When conceptual design methods are used rigorously and regularly in professional practice, designers can make better-supported decisions than they would if they relied only on their implicit knowledge (Conley 2004; Pontis 2014) because they would have evidence to back up their decisions. Similarly, Parnes (1967: 7) asserts that merely having the expertise or "knowledge does not guarantee the formation of new patterns" and creation of effective solutions. Designers must expand knowledge by adding new facts, and combining and rearranging all facts into ideas. Externalizing ideas, either as sketches or lists, in a way that they can be contemplated, reorganized, restructured, and reinterpreted promotes the generation of new ideas (Zahner et. al. 2010).

Many types of conceptual design methods are based on their goal and on the phase they support (e.g., Jones 1992, Wang et al. 2002; Bektaş et al. 2008; Pontis 2012). However, Wang et al. (2002) and Pontis (2012) argue that, within the conceptual design stage, the majority of the information technology-based tools available (e.g., digital drawing, 3D modeling, statistical data analysis) support the later phases (simplification process and design proposal) rather than the earlier phases (problem understanding, audience understanding, content understanding). The earlier phases involve imprecise and incomplete information and concepts, which are hard to "capture, visualize or communicate electronically" using specialized software or other IT-based tools (Wang et al. 2002). Towards the later phases, concepts start to crystallize into more tangible ideas as designers move into the prototype stage of the process.

In Table 2, for each conceptual design phase, we present a selection of methods that do not require digital devices or advanced technology. The 23 methods are organized based on the three modes of activities present in conceptual design: explore, analyze, and create. These methods have been gleaned from secondary research from books, papers and Ph.D. theses of the last 50 years, the analysis of 10 case studies from various design fields (service design, wayfinding design, information design, website design and graphic design), and our nearly 20-years of experience working in professional design practice. Some of the methods presented here are borrowed from human-centered and participatory design, creative problem solving, social science, psychology and anthropology, and have been adapted to support the needs of information designers. The list is not exhaustive and most methods are not novel. Nevertheless, these methods provide an overview of how the thought

Table 2. Twenty-three methods to support conceptual design phases proposed in this paper

		Conceptual design methods				
		1 Problem understanding	2 User/audience understanding	3 Subject matter understanding	4 Simplification	5 Design proposal(s)
Explore	Facilitated sessions (McQuaid et al., 2003a)	✓	✓	✓		
	Fact finding (Roam, 2008)	✓				
	Visual facilitation (Sibbet, 2010)	✓				
	Mind mapping (Buzan, 2002)	✓			✓	
	Sketching (Zahner et al., 2010)	✓				✓
	User studies (Lupton, 2014)		✓			
	Contextual interviews (Patton, 2002)		✓			
	Walk a mile in user's shoes (McQuaid et al., 2003a)		✓			
	Design probes (cultural probes) (Mattelmäki, 2008)		✓			
	Shadowing (Davis & Wilson, 2013)		✓			
	Literature searching (Jones, 1992; Frascara, 2015)		✓	✓		
	MapCI cards (Pontis, 2012; 2014)		✓	✓	✓	
	Cross-disciplinary meetings (Treffinger et al., 2006)			✓		
	Subject matter experts interview (Schriver, 1996)			✓		
Analyze	MapCI cards (Pontis, 2012; 2014)		✓	✓	✓	
	Creating informations fields/panels (Doorley & Witthoft, 2012)		✓	✓	✓	
	Stakeholders analysis (Schriver, 1996)				✓	
	Personas and scenarios (Stickdorn & Schneider, 2012)				✓	✓
	Affinity diagram (Gray et al., 2010)				✓	
	LATCH (Wurman, 1989)				✓	✓
	Brainstorming (Parnes, 1967; Jones, 1992)					✓
Create	Direct-experience storyboards (McQuaid et al., 2003a)				✓	
	Co-creation sessions (McQuaid et al., 2003a)				✓	✓
	Service design blueprint (Stickdorn & Schneider, 2012)					✓
	Sketching (Zahner et al., 2010)					✓
	Wireframe/schematic (Baer, 2008)					✓

process can be enhanced at each step of the conceptual part of the process.

4.1 Bridging theory and practice

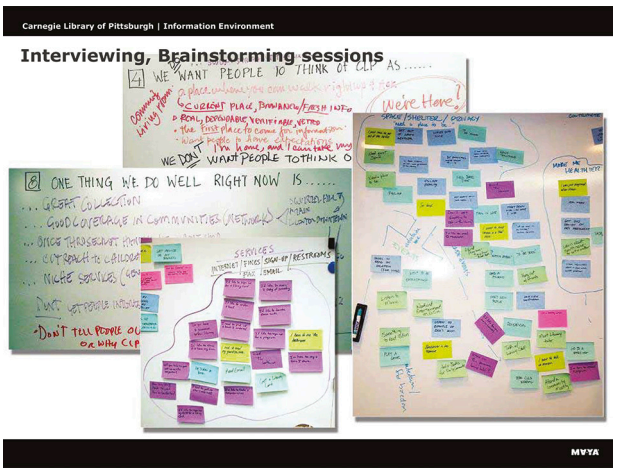
This case study illustrates ways in which methods can support each conceptual design phase. It is also an example of the increasingly ambiguous cross-disciplinary challenges facing information designers today. This case study is representative of non-traditional information design challenges involving collaboration with service design, wayfinding, architecture and website design professionals, and it captures the range of activities involved in the information design process. The solution did not involve the design of a tangible artifact, but the redesign of a service experience.

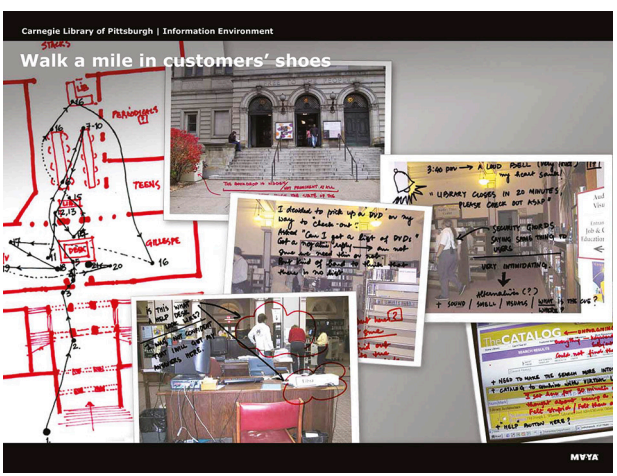
4.1.1 Case Study: The Redesign of the Carnegie Library of Pittsburgh (USA, 2002–2004). The team for this project was composed of librarians and library directors (responsible for setting the vision, employing vendors, and finding funding), architects (responsible for renovating the library) and designers (responsible for understanding library users and visualizing ideas) (McQuaid et al. 2003a: 120). The goal of the project was to "change the public's perception of [The Carnegie Library of Pittsburgh (USA)] as a dark, forbidding place full of old, irrelevant books to one of a bright, inviting place, teeming with up-to-date, relevant information" (McQuaid et al. 2003b: 1). The project involved deep organizational changes and the adoption of new technology (Bell & Shank 2007). MAYA Design, a Pittsburgh (Pennsylvania, USA) design consultancy hired by the library to spearhead the transformation, organized the project into four stages including research, analysis, design, and refinement and implementation. The first three stages are aligned with the conceptual design process phases we discussed in the previous section.

Research (Conceptual Design Phases 1 to 3): To gain a better sense of the problem, MAYA first had to understand the scope and complexity of the project and the library's organizational structure. They also had to determine who would be interacting with the information, and what the most frequent kinds of information that they were interacting with were (McQuaid et al. 2003b; Bell & Shank 2007). The design team facilitated several "*input sessions* with the key stakeholders" (McQuaid et al. 2003a: 121), and *interviewed*, *observed* and *shadowed* librarians to identify their key tasks and activities (Figure 9). One key constraint of the project was that the MAYA team could not talk directly with library users due to privacy concerns. So the team decided to use non-obtrusive ethnographic methods to gain an understanding of users' cognitive and emotional needs: *observe* and *walk a mile in library users' shoes* for half a day (Figure 10). Additionally, members of their team acted as *participant observers*, and used the library to experience first-hand the common tasks faced by library users daily. As a result of this experience, the team compiled and shared what they learned in *Direct-Experience Storyboards*. These four methods combined helped the team create a more complete picture of library users' behaviors, demographic, and flow accessing and navigating the library. Furthermore, this data allowed the team to better frame the challenge and identify key areas that needed further exploration, such as information seeking strategies and types of information sources.

Analysis (Conceptual Design Phase 4): The analysis involved the definition of *personas*, and the creation of *use case scenarios* and diagrams or *concept maps* visualizing the components of the library experience (Figure 11). These *concept maps* had two purposes: act as a tool to visualize learnings within the team, and communicate findings to stakeholders, such as how library users were interacting with and accessing information. This helped

to identify the exact moments of the journey where the system was failing to support its users: unclear system usability, hard to find sources, hard to understand and use information.





Figures 9 and 10. Outputs from brainstorming sessions and interviews with librarians, and annotated images created from the learning obtained after walking a mile at library users' shows.

Design (Conceptual Design Phase 5): MAYA used a *co-creation approach* employing three "tiger teams" to crystallize findings into *design concepts*. Teams worked independently and were assigned a specific persona and scenario. Three design concepts emerged: a clearer wayfinding strategy to help reduce uncertainty and confusion when navigating the library (Figure 12), a more inviting librarians' desk, and better education for users about library processes. All concepts helped demonstrate "how negative experiences could be eliminated, how positive ones could be retained and enhanced, and how new, pleasurable experiences could be created." (McQuaid et al. 2003a: 121). These concepts were compiled into a set of recommendations or design principles, and into an information system for the library.

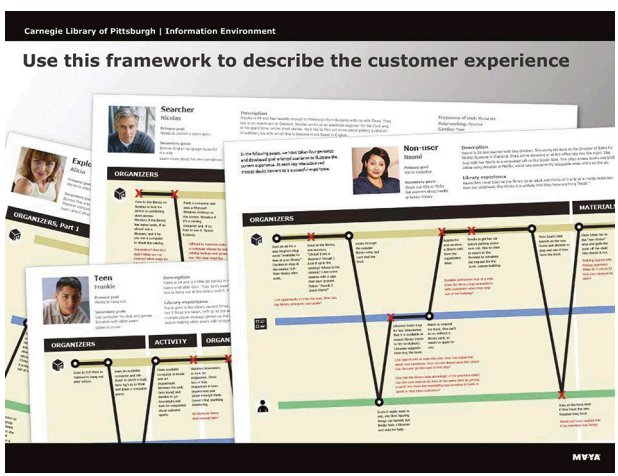


Figure 11. Personas and customer journeys representing library users' experiences.

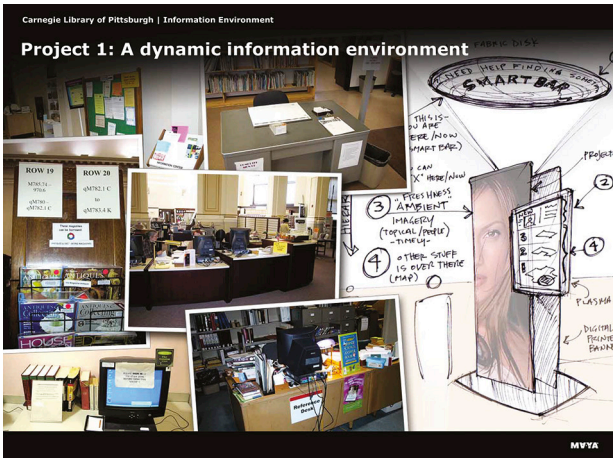


Figure 12. First design concept representing a new wayfinding strategy for navigating the library. Case study images 9 to 12 from MAYA Design (www.maya.com): http://legacy.maya.com/portfolio/carnegie-library

Refinement and Implementation. After this stage, the three concepts were further explored and piloted. The initial design recommendations were evaluated by library users, and then implemented in the library. As a result, after completion of this project, the Carnegie Library has become an "inspiring center of information and discovery" (Bell & Shank 2007: 35).

5. Implications of adopting conceptual design methods

The use of conceptual design methods has strong implications for information design professional practice. However, experienced practitioners and junior designers will apply these methods in different ways. Experienced design practitioners are most likely to have developed a robust body of experiences to determine when and how to move from one conceptual phase to another, make confident decisions, critically evaluate their outcomes, and reassess unsatisfactory situations (Kennedy 1987; Dorst & Lawson 2009; Pontis 2012). Most junior designers, on the contrary, have not yet gained enough first-hand work experience to deal with a design problem without external supervision and are still in the process of developing skills to critically analyze their own actions (Dorst & Lawson 2009). These differences influence how the methods presented here are used.

Although more experienced designers argue that they do not need conceptual design methods to support their practice because they have already acquired the necessary skills (Cross 2000), Parnes (1967: 15) explains that "each acquired attitude or habit, useful though it may be, makes [a designer] a little less receptive to alternative ways of thinking and acting. [The designer] becomes more competent to function in [their] own environment, less adaptive to changes." Using conceptual design methods in professional practice will force designers to expand their implicit knowledge and look for relevant information outside their immediate thoughts. It will also minimize the tendency of falling in love with the first idea that they come up with (Jones 1992: 70).

Although the impact of design decisions is very high at the beginning of the process, it decreases as the design evolves (Wang et al. 2002: 981). This indicates that making well-supported design decisions early in the design process benefits the overall process.

6. Conclusions and further work

Supporting the initial part of the information design process, i.e. the conceptual design, is one way to enhance designers' work and the overall productivity of the process and quality of solutions. The adoption of conceptual design methods could benefit information design practice: practitioners would enrich their existing

approach with complementary techniques to improve their decision-making.

This awareness of the role of conceptual design should start with design education. Working with these methods will provide a more structured approach to this part of the process, thus facilitating the externalization of the thought process and development of deeper awareness of its different phases. Externalizing the process in some kind of visual or textual form would help design students make "inferences that would be difficult or almost impossible to make without [the visuals]" (Simon 1995: 249). These inferences make it easier to understand why something works or does not work, and how decisions were made.

Particularly, conceptual design methods which support the third and fourth phases can provide a systematic and structured way to collect, analyze, and make sense of data, helping information design students develop information management skills and learn how to identify trends and patterns in the data. Both sets of analytical skills are considered essential for information design education (Gobert & van Looveren 2014). Appreciation of conceptual design phases would encourage self-reflection, increase knowledge about the conception of solutions, enhance understanding of how to make more confident and independent decisions, and enable students to start working with less supervision much earlier in their careers. As a result, students would develop a strong foundation in the design process, which would promote more thoughtful information design problem-solving practices in the professional world.

Future lines of investigation would involve further studies with information design practitioners and students working with conceptual design methods, in their respective environments, to determine the impact of the use of such methods.

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1. This paper was adapted from *Start with the basics: Understanding before doing*, a talk presented at IIID Vision Plus 2015 Symposium: Information + Design = Performance, at Birmingham University (UK) on September 4, 2015.

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