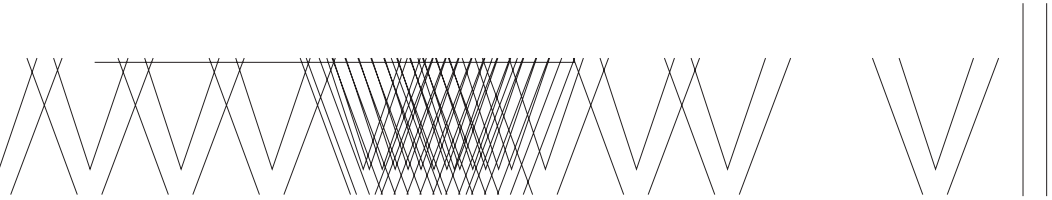
Visible Language – 50 . 3

the journal of
visual communication
research

Reflecting on 50 years of History +
Visible Language



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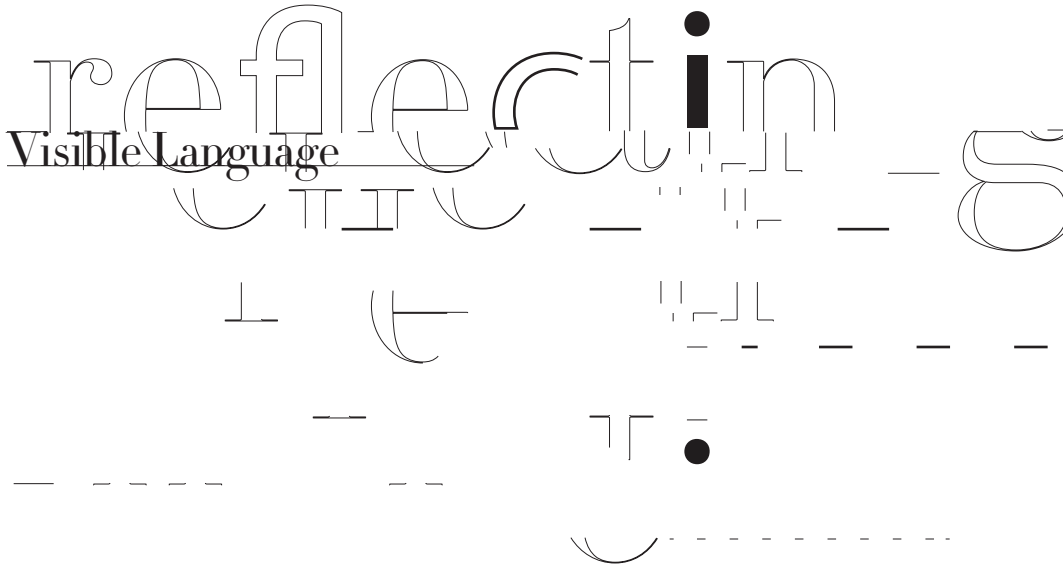


Visible Language

50.3

Reflecting on 50 years of Design History + *Visible Language*

This year we have celebrated 50 years since *Visible Language* began. This issue's special article traces the journal's contributions to graphic design history (Griffin). This compliments previous 50th anniversary articles on:

changing practices of design and design education (Davis, 50.1);
the evolution of design journals (Poggenpohl, 50.1);
design research (Zender, 50.1);
the evolution of digital typefaces (Baudelaire & Carter, 50.2);
the historic development of TEX (Beeton, 50.2);
the history of the @ sign (Mosley, 50.2);
letterform research (Beier, 50.2);
Orthographic reading (Grainger, 50.2);
and digital reading for those with low vision (Legge, 50.2).

The typography articles in 50.2 were accompanied by remembrances of eminent contributors to *Visible Language* who have passed away and a 'reader's choice' list of the top 50 typography books.

Acknowledgements and Thanks

We appreciate the generosity contributions of the authors who contributed to this year's celebration, in particular, Chuck Bigelow and Kevin Larson who guest edited 50.2. They epitomize the voluntary contributions of passionate experts whose contributions have made *Visible Language* something worth reading for 50 years. mz - Editor

The Role of *Visible Language* in Building and Critiquing a Canon of Graphic Design History

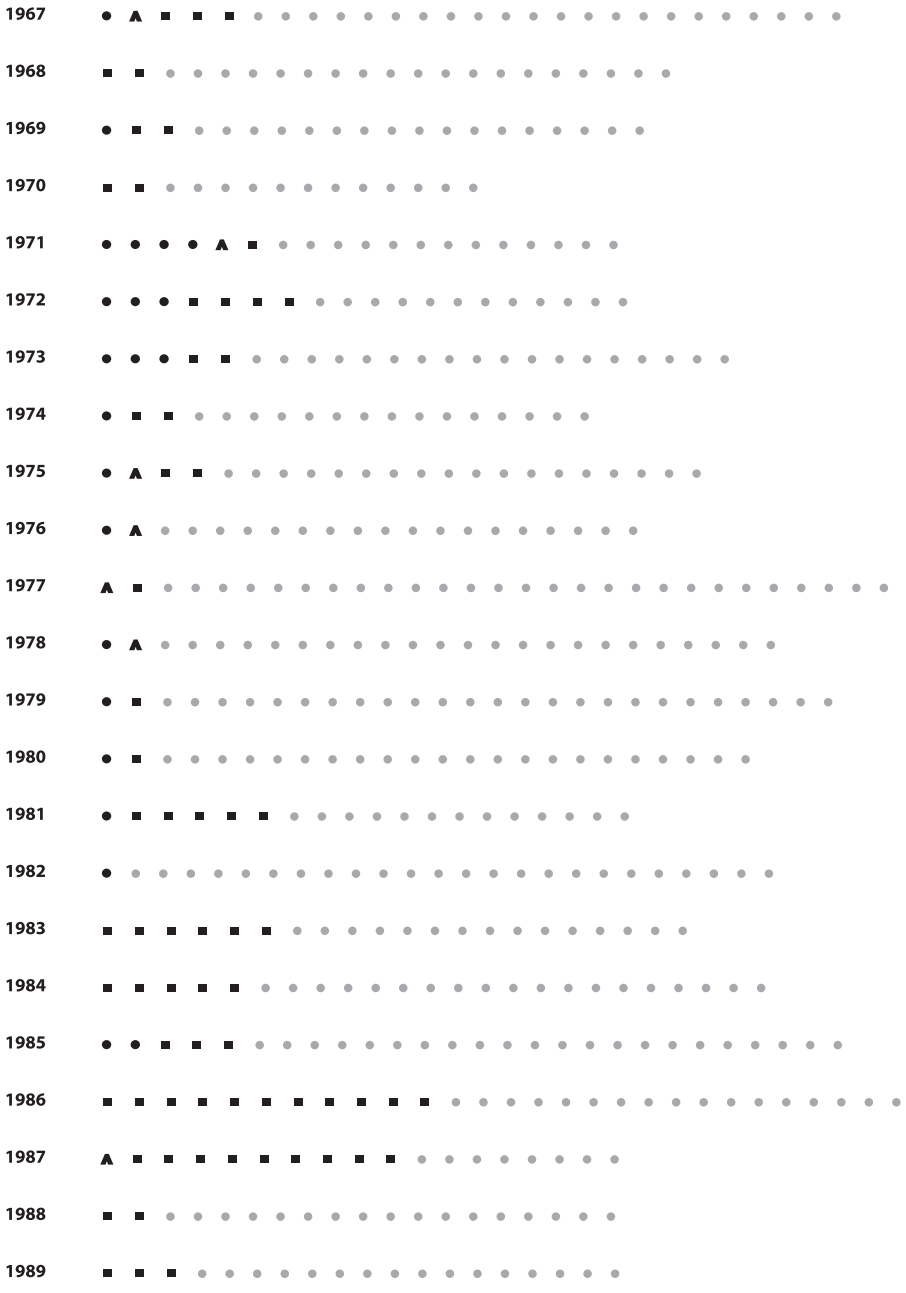
Dori Griffin

Abstract

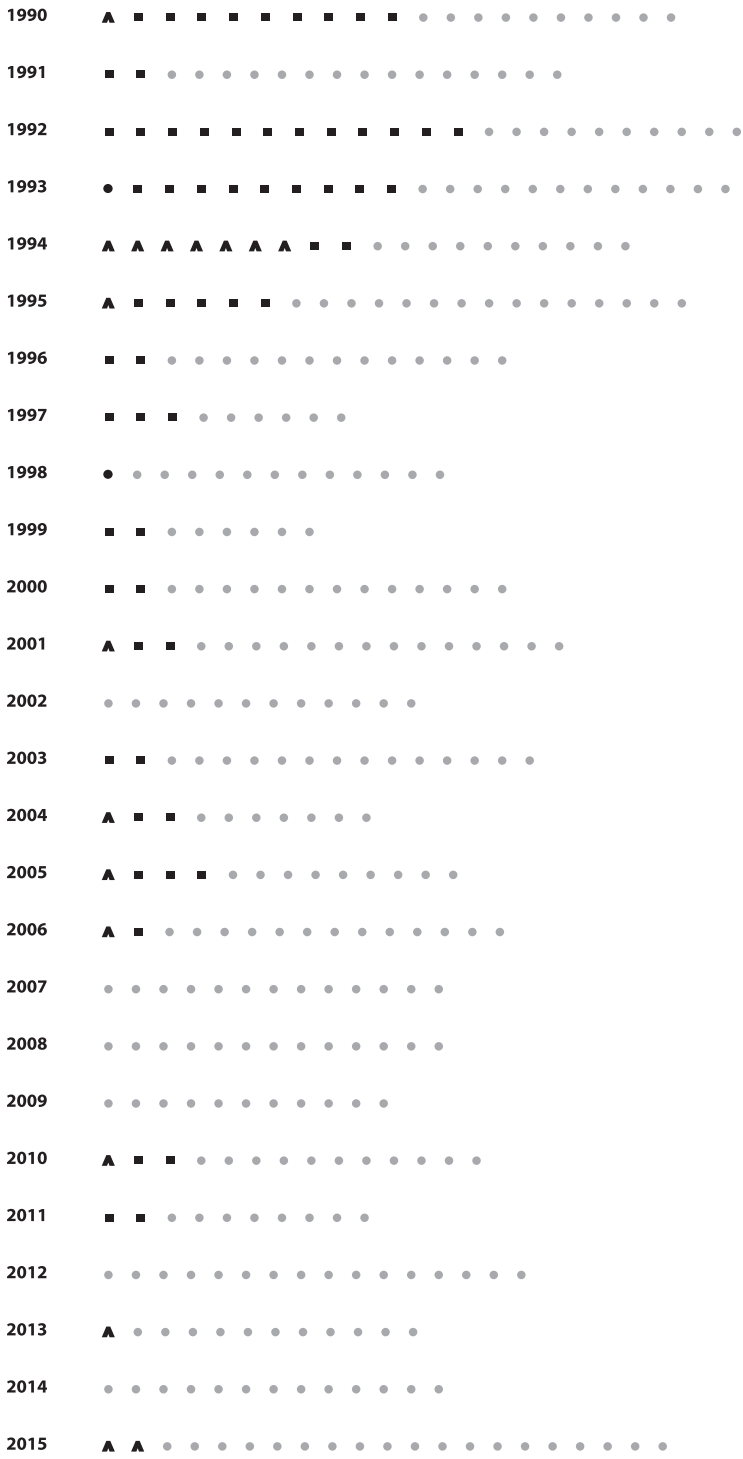
Throughout its first half-century of publication, *Visible Language* has contributed to the construction and deconstruction of a "canon" of graphic or visual communication design history. By including and excluding objects, practices, and makers from its literature, the journal has helped to establish a normative definition of what design history is and how it should function. The historical literature of *Visible Language* both participates in and, at notable moments, critiques a traditional canon: Eurocentric, male-dominated, artifact-focused, and professionally-oriented. This article views the historical literature of *Visible Language* through quantitative and qualitative lenses. Quantitatively, the article establishes how much of the journal's literature is historical in content, what explicit purposes this literature serves for the discipline, and what areas of geographical and subject-matter emphasis emerge over time. Qualitatively, the article explores how this historical literature has influenced the conceptualization and practice of graphic or visual communication design history as an activity, how it has contributed to the self-conscious construction of the formal discipline, and how the existing literature has both shaped past developments and suggested as-yet unrealized future trajectories.

Keywords

Graphic design history, visual communication design history



- Explication / history
- Contextualization / history
- Discipline-building / history
- Non-historical article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Introduction

Visible Language, as the journal's online homepage puts it, "advocates the potential for the research and practice of visual communication to enhance the human experience." As a leading voice in the field of visual communication and the oldest peer-reviewed design journal, *Visible Language* has helped to shape any number of disciplinary dialogues and has framed many practical, pedagogical, historical, and theoretical design problems. This article engages with the ways in which *Visible Language* has shaped our disciplinary understanding of the history of visual communication – both as an academic subject and as a collection of objects, practices, and practitioners. To map out this territory, the abstracts of all 892 articles published in volumes 1-49 were reviewed and coded based on their primary purpose and their subject matter. The first section of this article describes the coding procedure and discusses the three types of basic purposes advanced by the historical literature: explication, contextualization, and discipline-building. The second section investigates how the historical literature has framed the self-conscious construction of the discipline itself: what are the methods, subject matters, and boundaries of the field, and what are the influential moments that helped to define these? The third section discusses the dominant thematic categories that emerge from subject-matter groupings, revealing how *Visible Language* has simultaneously constructed and deconstructed canonical notions of graphic design history. The fourth and final section looks back holistically at all of the data, contextualizing the history of visual communication as suggested by the literature included in the first forty-nine volumes of *Visible Language*.

Coding the data

To begin, the abstracts of all 892 titled articles published in volumes 1-49 of *Visible Language* were qualitatively analyzed to determine if their content was historical in nature. As necessary, in the small number of articles without abstracts, reference was made to the article's introduction. For the purposes of coding the articles, an "historical" article was defined as one that focused on explicating or contextualizing objects or practices as historical phenomena or building the discipline of design history by defining the subject area or interrogating the practice of design history. As a matter of clarity, where distinctions between historical and non-historical approaches were less clear-cut, priority was placed on the language of the abstract itself. For instance, the only abstract in a special double-issue devoted to Dada (issue 21.3-4) that was not coded as historical stated the article's purpose as

"identifying the problematics inherent in the communication by an artist, through a text, to the audience(s)." The focus is on the mechanics of how and why "the ideal correspondence between the artist's intended purposes and the audience's reception" is more or less functional in individual instances (Greenberg, 1987, p. 454). The article – though it uses historical documents as examples – explicitly concentrates its attention on the functionality and linguistic implications of specific design strategies rather than the historical contexts of the works/makers/audiences themselves. Might the article be read as historical in some sense? Certainly. But the author clearly indicates that the focus of the research lies elsewhere, and the coding procedure reflects such authorial decisions when they are indicated. Clear-cut examples of subjects not coded as historical would include legibility or functionality studies, such as "Legibility of Numerals Displayed in a 4 x 7 Dot Matrix and Seven-Segment Digits"; literary, philosophical, or psychoanalytic interpretation of specific texts, such as "Lex Icon: Freud and Rimbaud" – a Freudian reading of the work of nineteenth-century French poet Arthur Rimbaud; and what might be loosely defined as contemporary criticism – that is, engaging the oeuvre of a practicing artist/designer on a primarily formal or conceptual level, without significant emphasis on placing that individual's work into a broad historical context, such as "The Collages of William Dole" (Dole & Norland, 1975; McKenna, 1980; Wendt, Weckerle, & Orth, 1976). In volumes 1-49, 177 articles (21.35%) were coded as historical in nature (Figure 1).

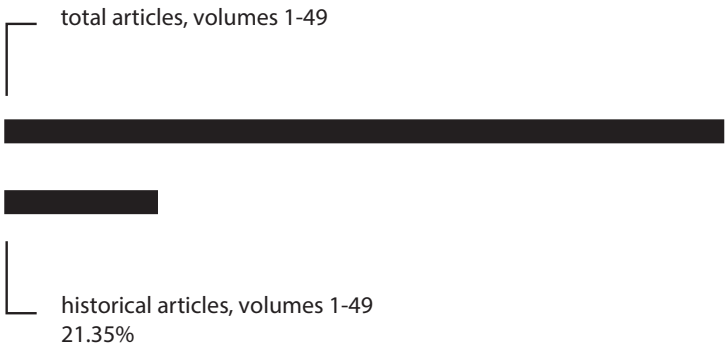

Figure 1

Out of a total of 892 articles in volumes 1–49 of *Visible Language*, 177 articles (21.35%) are historical in focus. Here, an "historical" article is defined as one that either (a) explicates or contextualizes objects or practices as historical phenomena or (b) builds the discipline of design history by defining the subject area and/or interrogating the practice of design history.

Once identified, the 177 historical articles were further coded into three broad categories based on their primary goal: explication, discipline-building, and contextualization. While these categories are broad, they do offer a way to differentiate between varying purposes within the literature of graphic design history. Articles with a primary focus on explication define or describe an historical object or practice, primarily in relationship to itself or others of its precise kind. Those concerned with discipline-building interrogate or define the subject matter and/or methods of graphic design history with an eye toward improving future outcomes in the field of historical research. Those with a focus on contextualization place objects or practices into a broader temporal and/or social framework, indicating how and why a specific instance (or set of instances) fits into a wider historical narrative. Quantitative analysis reveals that, by far, the most extensive category is that of contextualization – 130 historical articles out of a total of 177 (73.45%). Explication and discipline-building are almost equal, representing 13.56% and 12.99% of the literature respectively (Figure 2).

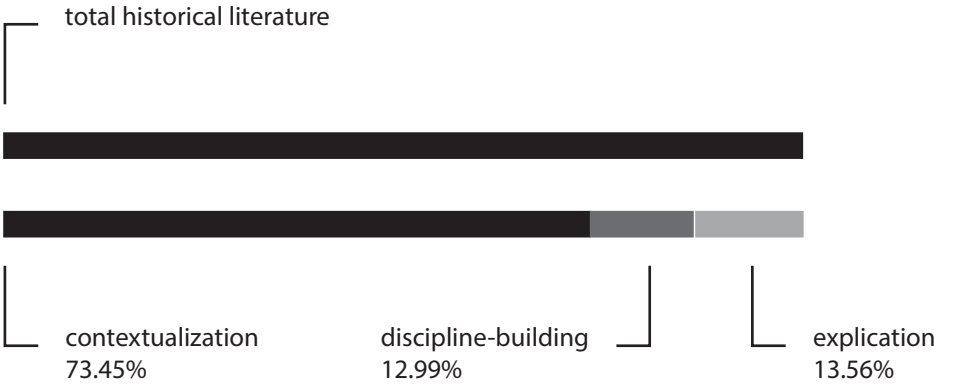

Figure 2

Of the articles coded as historical, 73.45% have as their primary purpose the contextualization objects or practices within a broad temporal and/or social framework. 12.99% focus on discipline-building by questioning or defining the subject matter and/or methods of graphic design history. 13.56% have as their primary purpose explication: describing an historical object or practice in relationship to itself or others of its kind.

Only two articles coded as explicative were published after 1985, indicating that description without critical contextualization grew less acceptable over time (Hailstone, 1993; Navarro Tapia, 1998). The discipline-building literature, on the other hand, is dispersed throughout the five decades of the journal's publication. It is interesting to notice how the presence of design history as subject matter has waxed and waned over the past half-century. 28.57% of volume years reflect historical content at or above 25% of that volume's total content: volumes 5-6 (1971-72), 15 (1981), 17 (1983), 20-21 (1986-87), 24 (1990), 26-29 (1992-1995), 31 (1997), and 38-39 (2004-05).

Measured by percentage throughout all its years of publication, the most significant historical contribution of *Visible Language* is that of expanding the body of literature devoted to the meaningful contextualization of historical figures, objects, and practices within or related to the field of visual communication. Within this body of literature, further qualitative

content analysis revealed a set of more specific groupings by subject matter, which will be discussed in the third section. Though it is numerically a much smaller contribution, however, the role of *Visible Language* in shaping the disciplinary understanding and practice of graphic design history should not be overlooked. The inclusions and exclusions of this field of research have been shaped by the 23 historically-focused articles that address discipline-building. What is the territory of graphic design history, and how should that territory be investigated? Which ideas, objects, practices, and practitioners are most relevant to the history of visual communication? *Visible Language* has been influential in asking and answering these foundational questions.

Constructing a Discipline

Though only 13% of the historical articles in *Visible Language* are engaged primarily with discipline-building, their collective contribution to the shape of graphic design history is significant. In particular, the three-issue special series "Critical Histories of Graphic Design," guest-edited by Andrew Blauvelt in 1994, has exerted a great deal of influence. In 1983, Philip B. Meggs' *A History of Graphic Design* had answered numerous calls for a comprehensive survey of the discipline's history. That same year, Massimo Vignelli offered his much-anthologized keynote address at the "First Symposium on the History of Graphic Design" at the Rochester Institute of Technology. Rick Poynor notes, without offering a counter-argument, that the 2012 edited volume *Graphic Design: History in the Writing* dates the birth of the discipline itself to this moment (Poynor, 2012). Almost a decade after that symposium, Martha Scotford Lange's 1991 article for the AIGA *Journal*, "Is There a Canon of Graphic Design History?" – now a canonical reading, itself – pointed to the tendency of survey texts to highlight certain moments in the history of graphic design and erase others from view (Lange, 1991). Meggs' text, of course, was one of those that she quantitatively analyzed in order to arrive at the conclusion that, yes, graphic design history had seemingly developed an operational canon of key designers and works. Scotford argued that the curatorial conneisureship and authorial priorities represented in the discipline's foremost survey textbooks had constructed a canon focused almost exclusively on white, male, western European and American designers. Her articulation of a canon of graphic design history resonated, both with those who shared her wish to critique such a canon and with those who accepted its construction as necessary. A number of frequently-anthologized responses followed, including Philip Meggs' direct rejoinder, "Is a Design History Canon Really Dangerous?" (Meggs, 1997). In 1994, *Visible Language* entered this discussion with Blauvelt's series of issues dedicated to the subject of "Critical Histories of Graphic Design." Here, some of the most respected voices in the field discussed questions of discipline-building. They examined

how and why histories of graphic design had been and were being constructed. They also explored how future conceptualizations, methods, and outcomes might be improved. As a contribution to the ongoing disciplinary discussion sparked in part by Scotford's question, the series was pivotal.

The voices included in this three-part dialogue asked questions that helped to shift the trajectory of graphic design history as a discipline. Ellen Lupton and J. Abbot Miller probed the relationship between deconstruction – easily the most influential theoretical model for typography at that moment – and graphic design history; Victor Margolin questioned the methods through which historical narratives of graphic design had been constructed; and Martha Scotford critiqued conventional histories focused on mainstream, male accomplishments (Lupton & Miller, 1994; Margolin, 1994; Scotford, 1994). In particular, Margolin's focus on narrative methods illuminated questions that the second generation of graphic design history survey texts would strive to answer. "What then might a history of graphic design that respected the varied discursive locations of visual design activity be like?" Margolin asked. His answer follows:

> It would preserve many elements of the narrative sequences established by Meggs, Satué, and Hollis, but it would be more attentive to a close reading of professional practices in order to discriminate between the different types of work. As a result, we would understand better how graphic design practice has been shaped by borrowings and appropriations from other discourses instead of seeing it as a single strand of activity that embraces a multiplicity of things (Margolin, 1994, pp. 242–3).

Like Margolin, all of the authors in this three-part series, in their own way, engaged with one critical subject: methods. By drawing attention to the methodological dimension of graphic design history, the series strove to move the discipline beyond simplistic chronological and descriptive narratives. In the words of Gérard Mermoz, "chronicles of 'natural,' untheorized objects" should no longer be allowed to "assume the role and claim the status of history-writing" (Mermoz, 1994, p. 261). In many ways, the series asked the very questions that the next generation of historical survey texts would strive to answer. Eskilson's 2007 *Graphic Design: A New History* and Drucker and McVarish's 2008 *Graphic Design History: A Critical Guide* can both be read in this light – as answers to the questions that *Visible Language*'s critical histories series asked. In particular, these textbooks responded to Blauvelt's call for "a reconfigured alternative to the prevailing conceptions and practices of graphic design history" and Margolin's simultaneous call for a "narrative strategy" that accounts for the evolution of graphic design as a practice not fully explained by its constituent parts, such as typography or illustration (Blauvelt, 1994a, p. 199; Margolin, 1994, p. 233). In short, the disciplinary conversations underway in the mid-1990s advocated for more complicated, complex, even contentious histories. They called for scholarly rigor and

theoretical sophistication. In both of these regards, *Visible Language*'s critical histories series was very much of its moment in time.

In the critical histories series, untheorized chronological narratives and individual theories applied without justification to isolated objects had been called into question. This is not to say that theory was absent from the historical literature of *Visible Language* before 1994. Using a specific theory as the primary tool to explicate or contextualize particular objects and practices had been a part of the literature in *Visible Language* almost since its inception. Linguistics, semiotics, philosophy, psychology, and literary theory all played a role in its early historical content. Gerald L. Bruns's 1969 treatment of Mallarmé was an early example; the article explored issues of language and meaning in Mallarmé's 1887 poem *Un Coup de dés* (Bruns, 1969). Semiotics played a key role in John J. White's 1976 "The Argument for a Semiotic Approach to Shape Writing: The Case of Italian Futurist Typography" (White, 1976). In 1988, a special issue on theory was devoted to offering explicitly theoretical, often didactic readings of objects, images, texts, and communication practices (issue 22.4). These examples, far from being an inclusive list, simply offer a snapshot of how theory either contributed to historical contextualization or constituted a separate area of inquiry in *Visible Language* prior to the mid-nineties. However, Blauvelt's 1994 series marked a turning point in the way that theory was methodologically applied to the broader questions of graphic design history as a discipline – both for the journal and as part of a larger shift for the field. Prior to the 1994 series, all of the discipline-building articles coded as "historical" in this study had engaged with highly specific, non-theoretical methodological questions. Examples include articles about bibliographic tools for typography research, calligraphic analysis as a tool for determining cartographic attribution, or research methods for studying Renaissance manuscripts (Kristeller, 1975; Osley, 1971; Tanselle, 1967). After the publication of the 1994 series, on the other hand, most discipline-building articles evidenced a much more critical orientation. Examples include the problematics of using typographic printing and/or typographic style as a factor in determining the relative sophistication of graphic artifacts; the interaction between human identity and historical narrative; and using emergent technology as a technique for cultivating historical understanding (McKee, 2010; Salen, 2001; Sayers, 2015; Williamson, 1995). This more explicitly critical approach of the mid 1990s and beyond highlighted, among other issues, the ways in which, "by allowing only one definition of practice to be operative, graphic design history has effectively foreclosed the possibility of locating and understanding alternative practices that fall beyond the range of its [current] interests" (Blauvelt, 1994b, p. 289). In other words, a newly critical lens allowed for an expansion of the operative definition of "graphic design history."

Thematic Categories – (De)constructing a Canon

Many of the discipline-building historical articles of the mid-1990s and beyond critiqued the notion of a canon of graphic design history. Either implicitly or explicitly, they asked for a re-evaluation of the discipline's territory and an expansion of its borders. Whose histories are being shown and told? What standards are being used to determine inclusion and exclusion in the historical narrative? What and who has been overlooked through the racist, sexist, classist, or naive methodologies of prior historical research? In other words, what is our canon, and how should we move beyond it? The canon of graphic design history that Martha Scotford identified in 1991 was a notion that she continued to critique, and one forum for this critique was *Visible Language*. In her 1994 article "Messy History vs. Neat History," she called into question the ways in which "canons of designers and design works have been established and accepted through publication and exhibition" and suggested that historians should begin "to study design activity, to study design roles, to study response to design, rather than to concentrate on individual designers and their artifacts and use these as the sole filter for graphic design history" (Scotford, 1994, pp. 369, 386). Though significant time has passed since Scotford first introduced the question, the construction of a canon of graphic design history remains relevant today. In 2011, Teal Triggs introduced a thematic collection of *Design Issues* articles devoted to graphic design history by positing that "graphic design, it seems, is still searching for its past"– and, furthermore, is still engaged with "the question of the canon and 'whose history'" is being shown and told as the discipline develops (Triggs, 2011, pp. 3, 5). The precise boundaries of a canonical history can be slippery to define, particularly as they continue to evolve – albeit slowly – in relationship to calls for increased inclusivity and diversity. Yet there certainly exists a set of familiar historical works: one which is repeated with minor variation and which reflects less cultural diversity than it might. Documenting the physical shape of a body of literature, revealing its inclusions and exclusions, its priorities and assumptions, sheds light on the still-critical question of "whose history?"

As the oldest peer-reviewed design journal, *Visible Language* has participated directly and indirectly in establishing a historical narrative of graphic design as a discipline. In dialogic relationship with other journals in the field, *Visible Language* has both contributed to and critiqued emergent canons of graphic design history. The explicative and contextual articles that make up 87% of the publication's historical content make no claims to define the full scope of graphic design's history. Indeed, the vast majority engage with discrete sets of objects or practices, seeking to place these within the context of a specific place or time or within the context of

related objects and practices. Even collectively, as an edited body of literature, they make no claim to outlining a complete narrative with well-defined boundaries. Yet the subject matter that they include and exclude is suggestive. It points toward a wider historical narrative that embraces a given set of designers, objects, and practices while excluding others. In this way, the historical content of *Visible Language* participates in the definition and critique of a canon. The journal's content both falls within and extends beyond the familiar boundaries of such a canon. A quantitative and qualitative overview of the specific areas of historical inquiry to which *Visible Language* has made notable contributions reveals how the journal has helped to define "the history of graphic design."

Quantitatively, three areas of interest emerge as dominant in the historical literature of *Visible Language*: concrete or visual poetry, the European Avant Garde of the first half of the twentieth century, and the emergence of early writing systems, particularly in Mesopotamia and Meso-America (Figure 3).

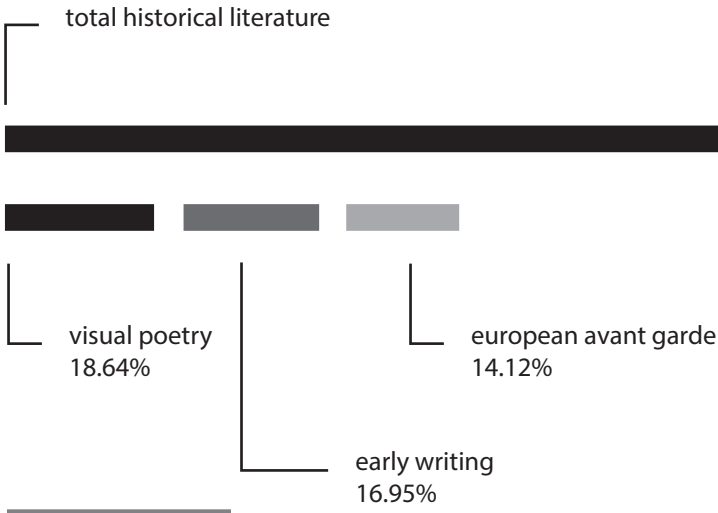

Figure 3

There are three primary areas of interest represented in the historical literature of *Visible Language:* concrete or visual poetry; the emergence of early writing systems, particularly in Mesopotamia and Meso-America; and the European Avant Garde of the first half of the twentieth century.

Less dominant but still numerically significant are the Fluxus movement, handwriting and calligraphy, printing technologies, and systems of non-alphabetic graphic notation such as punctuation or musical notation (Figure 4). Highlighting the more and less familiar contributions to these areas of inquiry sheds light on how *Visible Language* has simultaneously contributed to and critiqued the notion of a canon of graphic design history.

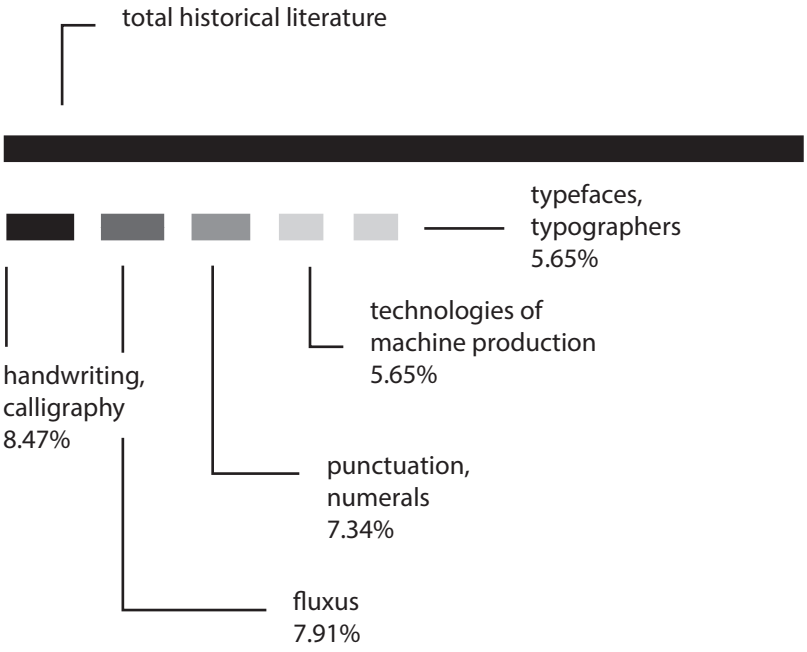

Figure 4

Five subjects fall within an area of secondary interest, each representing between 5% and 8.5% of the total historical literature: handwriting and calligraphy, punctuation and numerals, technologies of machine production, individual typefaces and typographers, and the Fluxus movement.

Unsurprisingly, *Visible Language* has made an extensive contribution to documenting the literal intersection of visibility and language – concrete or visual poetry. 18.64% of the historical articles in volumes 1-49 are devoted to the subject, beginning in volume 1 (1967) and continuing through to volume 35 (2001). Numerically, this is the most significant area of interest within the literature printed in the journal. Special issues 17.3, 20.1, and 27.4 are devoted to Lettrisme, pattern poetry, and international visual poetry, respectively. These three special issues account for roughly a third 63.64% of the literature on the subject. As one might expect, the early twentieth century Avant Garde movements of France, Germany, Italy, and Russia figure prominently into the narrative, constituting 15.15% of the articles for this subject. But the depth of inquiry into visual poetry extends well beyond the expected examples from the Dada, Futurist, and Constructivist movements. Alongside French, German, Spanish, and English examples from the Renaissance through the Baroque, the literature also addresses labyrinth poems in the Greco-Roman and medieval Christian and Jewish traditions;

Chinese patterned poems; and early computer poetry (Bootz, 1996; Franke, 1986; Rypson, 1986) 27.27% of this literature address places and cultures outside of western Europe and the United States – not bad odds, though Russian Constructivism boosts this number. Special issues devoted to the mid-twentieth century French Letterisme movement (17.3, July 1983) and to international visual poetry (27.4, October 1993) further expand the subject beyond its most familiar boundaries. In particular, the anthology of international visual poetry demarcates a more inclusive geography: Brazil, Cuba, Mexico, and Uruguay are present alongside the more-expected Italy, Portugal, and the United States. Each of the articles in the issue begins with a historical overview of visual poetry in that country, then places a selection of more recent work into the context of that history.

The emergence of early writing systems is the second area of numerically dominant focus, constituting 16.95% of the total historical literature. Beginning in 1971 and continuing through 2006, the journal has devoted considerable space to a wide-ranging and diverse exploration of early writing systems. With one exception, all of the articles are authored by different scholars; three articles are by Denise Schmandt-Besserat (Schmandt-Besserat, 1981, 1984, 1986). And while two special issues, numbers 15.4 and 24.1, account for some of the numerical density, the journal's contributions to this field of inquiry are otherwise spread throughout the years from 1971 to 2006. Primarily, the literature focuses on Mesopotamia and Meso-America; each comprises 40% of the literature on the topic. The remaining 20% discusses developments in Egypt, Greece, Rome, and Palestine. Here, *Visible Language* has again expanded upon the canonical range of objects and cultures. Survey textbooks that begin with cave art rather than the Industrial Revolution certainly mention early writing systems, though not in any great detail. Tracing a relatively direct lineage for the Latin alphabet is usually the goal in most historical surveys; alternative models are presented as exotic outliers. Drucker and McVarish, for instance, show only one Meso-American image in their survey text, the Dresden Codex, a noted pre-Columbian Mayan text most familiarly known by the name of the German city in which it has resided since 1739 (Drucker & McVarish, 2012, p. 7). Such reductivism is not the case in *Visible Language*, where the sum total of the literature can be seen as complicating, rather than simplifying, the question of origins. A fully robust approach to the historical roots of visual communication would also include a variety of early examples from Asia, a subject that the literature in *Visible Language* unfortunately excludes. But the focus on Meso-America, in particular, pushes the literature well beyond the boundaries of the canonical.

Finally, there is a numerically significant focus on the early twentieth century European Avant-Garde. 14.12% of the historical articles in volumes 1-49 of *Visible Language* are devoted to the subject, beginning in the first year of publication and continuing through 1996. The artists and designers of the Bauhaus, Constructivism, Dada, and Futurism figure

prominently into commonly-accepted canons of graphic design history, and they play a correspondingly large role in the narrative set forth by the historical content of *Visible Language*. The journal reflects the professional and intellectual priorities of a set of disciplines long conditioned to read early Modernism as a touchstone moment in the history of visual communication, so it is unsurprising that its historical literature reveals this prioritization. The early European Avant-Garde is perhaps one of the most notable examples of problematic canonization as Scotford describes it. It is a brief and exclusivist, albeit profound and visually engaging, moment in time that exerts a significant influence on how disciplinary history is seen and understood. Quite literally, the European Avant-Garde disappears from *Visible Language*'s historical literature after 1996 (Storkerson, 1996) This might be read as yet another response to the discipline-wide call in the mid 1990s for a more critical and inclusive history, one moving beyond familiar favorites and opening up room to consider as-yet unexplored objects, makers, and practices.

Concrete or visual poetry accounts for 18.64% of the historical literature in *Visible Language*; the emergence of early writing systems accounts for 16.95%; and the early European Avant Garde accounts for 14.12%. These three subjects, then, can been read as defining the core territory of the history of visual communication as represented in *Visible Language*. Content analysis also reveals a secondary level of emphasis, which encompasses five subjects: handwriting and calligraphy (8.47% of the historical literature), punctuation and numerals (7.34%), technologies of machine production (5.65%), individual typefaces and typographers (5.65%), and the Fluxus movement (7.91%).

Within the thematic categories of secondary interest, most maintain a focus on European and American subject matter. However, *Visible Language*'s treatment of the historical dimensions of handwriting and calligraphy is its most culturally and geographically diverse engagement with a single subject area. Beginning in 1967 and continuing through 1993, the literature investigated the history of handwriting practices and handwritten texts in Chinese, Hebrew, Japanese, Maori, and Maya, as well as Latin, Italian, French, and English. 40% of the articles represent cultures outside of the typical reach of the western European / North American canon. None of the articles emerge from a special issue and only one author is represented twice (A.S. Osley, in issues 5.1 and 13.1). Punctuation and numerals account for 7.34% of the historical literature, starting in 1972 and continuing through 2011. Here, western examples dominate, with the exception of one article devoted to the adoption of punctuation in Japanese script (Twine, 1984). Technologies of machine production account for 5.65% of the historical literature, beginning in 1967 and continuing through 1990. All of the articles address western printing technologies. Exactly half of the articles discuss the introduction of the Gutenberg press and its impact on the production of texts in western Europe. Individual typefaces and typographers likewise account for 5.65% of the literature, beginning in 1968 and continuing through

2010. Three articles address Russian faces or designers, two are twentieth-century American, and the rest are western European. Finally, the Fluxus movement registers as a numerically significant area of secondary interest, representing 7.91% of the total historical literature. Two special issues (double-issue 26.1-2 and issue 39.3) account for all but one of the articles. As was the movement itself, the literature is largely focused on activity in New York during the 1960s and 1970s. Fluxus is unlike any of the other areas of interest identified by the quantitative content analysis, in that thematic special issues account entirely for its numerical significance.

Other possible thematic groupings of the literature lend sets of articles that fall well below the threshold of 5% of the total literature. Icons and information graphics, for instance, represent only 2.82% of the historical literature, and book design (the largest category not coded as an area of emphasis in this study) represents 3.95%.

Contextual Meanings

What does a numerically-oriented content analysis reveal about the nature of a canonical history as constructed (and deconstructed) in the pages of *Visible Language*? First, and perhaps most importantly, it shows how scholars in the field have both made and responded to calls for a more "critical, engaged, historically grounded [discipline], fueled by the emerging voices of hitherto excluded constituencies, and enriched by participation in massively significant reorientations of thought and practice in the humanities in general" (Pollock, 2014, p. 9). It is easy to call for a fuller and more critical history and difficult to do the work of building one. Throughout its history, *Visible Language* has been engaged with the latter as a forum for diverse scholarship. In spite of genuine engagement with diversity, however, the dominant paradigm of a conventional canon remains difficult to escape. 82.5% of the historical content in *Visible Language* is centered around western Europe and the United States (Figure 5). Within this territory, familiar narrative choices are evident, such as the dominance of Gutenberg in histories of printing or an emphasis on early twentieth century European Avant Garde Modernism. However, in other areas, such as early graphic writing systems and handwritten or calligraphic forms, less familiar choices have opened up the dialogue into more inclusive territory. These choices represent important opportunities, not only for the specific subjects themselves but for the discipline as a whole to recognize the importance and vitality of a diverse history. In this regard, *Visible Language* has contributed to the cultural and geographic diversification of graphic design history as a disciplinary practice and as a body of objects/makers. 17.5% of the articles coded as "historical" in this study deal with places and cultures outside of western Europe and the United States. This includes all of Asia, Africa, and South America, as well as

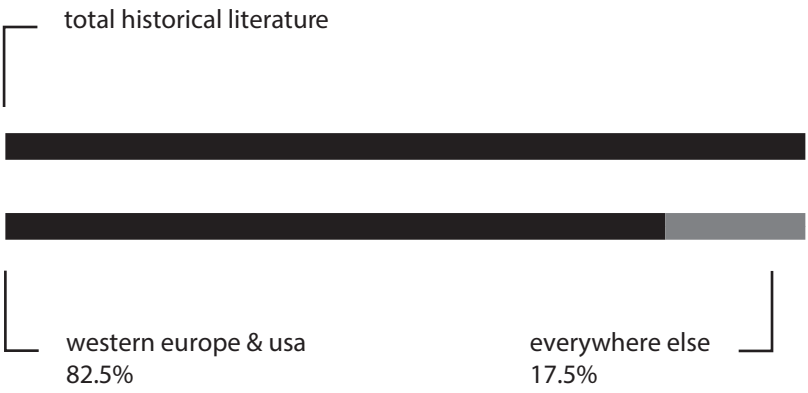

Figure 5

Visible Language has, throughout its years of publication, made significant contributions to building a genuinely global history. Still, the familiar paradigm of a conventional canon is difficult to escape, and western Europe and the United States dominate the historical narrative to date.

eastern Europe (primarily Russia) and Mexico (technically North American but underrepresented in surveys). Should this number grow as the discipline moves forward and corrects for past oversights and discriminations? Certainly. But all efforts at diversification must start from somewhere, and the historical literature of *Visible Language* progresses beyond tokenism when engaging with cultural and geographic diversity. Furthermore, this has been the case throughout the journal's half-century of publication; attention to global diversification is not a new development.

Second, the data suggests that the interests of the journal's founding editor, Merald Wrolstad, have shaped the journal's de facto definition of "visual communication design history" in ways that continue to resonate. The inaugural issue of *The Journal of Typographic Research* (as it was called for its first four years) opened with a clear and succinct statement of purpose: "to report and to encourage scientific investigation of our alpabetic and related symbols." This subject matter was to be explored through the lenses of "pure communications theory, practical application of legibility results, [and] artistic intuition of experimental typographic design" (Wrolstad, 1967, p. 3). The majority of historical articles within the journal's first four years were of two broad types. First, there were considerations of the typographic oeuvre of important figures in the history of art and design: Modernist painter Paul Klee, Constructivist designer El Lissitzsky, and Renaissance painter Andrea Mantegna and calligrapher Felice Feliciano (Leering-van Moorsel, 1968; Meiss, 1969; Pierce, 1967). Second, there were accounts of the historical development of new categories of alphabetic or typographic form, often in relationship to new technologies of production or emergent social structures: the development of Russian Civil Type; the change of letterform designs in relationship to printing technologies; the emergence of Gothic handwriting styles; the Siloam Inscription's relevance to the origins

of the alphabet; and an overview of Japanese calligraphy (Boyle, 1970; Kaldor, 1969, 1970; Patteson, 1970; Tomohiko, 1967; Zapf, 1968). This focus on typographic and alphabetic research demarcated a clear territory for – or perhaps within – the history of visual communication, one that has continued to inform the conceptualization of which objects and practices are most relevant to that history. In 1971, when the journal's titled changed to *Visible Language*, Wrolstad wrote that "no matter how broadly we attempt to define 'typographic research,' it no longer adequately describes the research efforts in the field or the major concerns of this Journal." Rather, the journal and its contributors were involved with "the investigation of any expression of a language in visual form" (Wrolstad, 1971, p. 5).

When Sharon Poggenpohl assumed the editorial role after Wrolstad's death in 1987, the journal was described on its opening page as "concerned with research and ideas that help define the unique role and properties of written language" (volume 21.1, winter 1987). Andrew Blauvelt's 1994 "Critical Histories" series broadened the journal's focus; both the individual historical articles in that series and the historical content that followed in subsequent years expanded beyond the typographic and linguistic (Remington, 2004; Scotford, 1994; Williamson, 1995). But it was only as Mike Zender assumed editorship in 2013 that the journal's self-described editorial focus explicitly "transition[ed] to sharper focus on research in visual communication" more broadly defined. An exploration of "all forms of visual communication: perception, symbols, 3-D objects, user experiences, contexts and interactive systems" joined the long-established exploration of "all things typographic and literate" (Poggenpohl & Zender, 2013, pp. 9–10).

Throughout most of its history, the journal's foundational and persistent interest in the typographic expression of linguistic communication has been reflected in its historical content. Therefore, the primary and secondary areas of historical focus revealed by the content analysis do not function as a comprehensive survey of visual communication, nor were they ever intended to. Rather, they – like all curated texts – reveal a distinct editorial focus. There are entire subject areas that do not register as numerically significant players in the history of visual communication as outlined by the historical literature of *Visible Language*. Posters, advertising, and illustration are familiar categories within the history of visual communication, though they are not (always) explicitly alphabetic or writing-based. Way-finding, mapping, symbol systems, and book and periodical design are, however, explicitly language-based, and these are likewise notably absent from a numerical evaluation of the literature's emphasis areas. As the journal continues to explore "all forms of visual communication," its historical focus will no doubt continue to evolve in ways that reflect the evolution of both practice and scholarship within the field of visual communication.

As a graphic design historian and teacher of graphic design – and as the researcher who has framed the construction of both the qualitative and quantitative data in this study – I view both of these broad

observations in much the same way. They are indicators that the work of graphic design history is ongoing. Today, the discipline's intentions, as well as its theoretical and methodological foundations, are increasingly well-defined. The body of work that we tend to read as "canonical" is firmly established. Furthermore, this work is accessible through a variety of outlets, including multiple survey textbooks and online media outlets of varying levels of scholarly reliability and cost to access. (To use early twentieth century European Avant Garde Modernist typography as an example, Jan Tschichold's full typographic teaching collection is viewable online both through the MoMA website, which is open-access, and ARTstor, which is subscription-based.) Needless to say, this observation about wide availability is not one that could have been made when *Visible Language* first began publication, and it is an indicator that the field has grown significantly since that time. Alongside simple growth, the discipline of graphic design history has made progress toward interrogating and expanding its canon to more fully reflect the range of human diversity. However, the difficult work of recovering lost, forgotten, and intentionally neglected objects, makers, and practices continues. Elizabeth Beidler has pointed toward the tendency of graphic design historians to offer the "relentless deduction that the history produced thus far isn't enough, isn't right and ultimately fails to deliver" (Beidler, 2012), particularly when discussing historiography, methods, or the state of the discipline. Over the past half-century, *Visible Language* has certainly contributed to disciplinary critique of this kind. More importantly, however, the journal has made significant contributions to building a body of literature that genuinely expands our understanding of the history of visual communication. This contribution continues – one object, one maker, one practice at a time.

References

Beidler, E. (2012). Uncharted Territory (review). Retrieved June 9, 2016, from http://www.eyemagazine.com/review/article/uncharted-territory

Blauvelt, A. (1994a). Foreword: Disciplinary Bodies: the Resistance to Theory and the Cut of the Critic. *Visible Language*, *28*(3), 196–202.

Blauvelt, A. (1994b). Foreword: The Personal is Political: The Social Practices of Graphic Design. *Visible Language*, *28*(4), 289–295.

Bootz, P. (1996). Poetic machinations. *Evolution of French Computer Poetry*, *30*(2), 118–137.

Boyle, L. E. (1970). The Emergence of Gothic Handwriting. *Visible Language*, *4*(4).

Bruns, G. L. (1969). Mallarmé: The Transcendence of Language and the Aesthetics of the Book. *Visible Language*, *3*(3).

Dole, W., & Norland, G. (1975). The Collages of William Dole. *Visible Language*, *9*(1), 47–56.

Drucker, J., & McVarish, E. (2012). *Graphic Design History* (2 edition). Boston: Pearson.

Franke, H., 1914-. (1986). Chinese patterned texts. *Visible Language*, *20*(1), 96–108.

Greenberg, A. (1987). Between text and audience: a path to the future. *Visible Language*, *21*(3–4), 454.

Hailstone, M. (1993). Te Tiriti (the treaty). *Treaty of Waitangi*, *27*(3), 302–319.

Kaldor, I. L. (1969). The Genesis of Russian Grazhdanskii Shrift or Civil Type—Part I. *Visible Language*, *3*(4).

Kaldor, I. L. (1970). The Genesis of the Russian Grazhdanskii Shrift or Civil Type—Part II. *Visible Language*, *4*(2).

Kristeller, P. O. (1975). Methods of Research in Renaissance Manuscripts. *Visible Language*, *9*(3), 263–275.

Lange, M. S. (1991). Is There a Canon of Graphic Design History? *AIGA Journal of Graphic Design*, *9*(2).

Leering-van Moorsel, L. (1968). The Typography of El Lissitzky. *Visible Language*, *2*(4), 323–340.

Lupton, E., & Miller, J. A. (1994). Deconstruction and Graphic Design: History Meets Theory. *Visible Language*, *28*(4), 346–366.

Margolin, V. (1994). Narrative Problems of Graphic Design History. *Visible Language*, *28*(3), 233–243.

McKee, S. (2010). How print culture came to be indigenous. *Visible Language*, *44*(2), 161–186.

McKenna, A. J. (1980). Lex Icon: Freud and Rimbaud. *Visible Language*, *14*(3), 219–240.

Meggs, P. B. (1997). Is a Design History Canon Really Dangerous? In S. Heller & M. Finamore (Eds.), *Design Culture: An Anthology of Writing from the AIGA Journal of Graphic Design* (pp. 228–232). New York: Allworth Press.

Meiss, M. (1969). The First Alphabetical Treatises in the Renaissance. *Visible Language*, *3*(1).

Mermoz, G. (1994). Masks on Hire: In Search of Typographic Histories. *Visible Language*, *28*(3), 261–284.

Navarro Tapia, C. (1998). Pre-Columbian stamps: pintaderas. *Visible Language*, *32*(3), 256–263.

Osley, A. S. (1971). Calligraphy – An Aid to Cartography? *Visible Language*, *5*(1).

Patteson, R. K., Jr. (1970). The Siloam Inscription and Alphabetic Origins. *Visible Language*, *4*(3).

Pierce, J. S. (1967). Pictographs, Ideograms, and Alphabets in the Work of Paul Klee. *Visible Language*, *1*(3), 219–243.

Poggenpohl, S., & Zender, P. M. (2013). Visible Language in Transition. *Visible Language*, *47*(1), 5–10.

Pollock, G. (2014). Whither Art History? *Art Bulletin*, *96*(1), 9–23. https://doi.org/10.1080/00043079.2014.877301

Poynor, R. (2012, June 18). Updating the Maps of Graphic Design History. Retrieved June 9, 2016, from http://designobserver.com/feature/updating-the-maps-of-graphic-design-history/34818

Remington, R. R. (2004). A Case Study in Collaboration: Looking Back at the National Geographic Design Archive. *Visible Language*, *38*(2), 158–167.

Rypson, P. (1986). The Labyrinth poem. *Visible Language*, *20*(1), 65–95.

Salen, K. (2001). Surrogate multiplicities: typography in the age of invisibility. *Visible Language*, *35*(2), 132–153.

Sayers, J. (2015). Prototyping the Past. *Visible Language*, *49*(3), 157–177.

Schmandt-Besserat, D. (1981). From Tokens to Tablets: A Re-evaluation of the So-called "Numerical Tablets." *Visible Language*, *15*(4).

Schmandt-Besserat, D. (1984). Before Numerals. *Visible Language*, *18*(1), 48–60.

Schmandt-Besserat, D. (1986). Tokens: Facts and Interpretation. *Visible Language*, *20*(3), 250–273.

Scotford, M. (1994). Messy History vs. Neat History: Toward an Expanded View of Women in Graphic Design. *Visible Language*, *28*(4), 368–388.

Storkerson, P. (1996). Jan Tschichold and the language of modernism. *Position Developed in The New Typography*, *30*(3), 314–339.

Tanselle, G. T. (1967). Typographic Research and Bibliography. *Visible Language*, *157–163*(1), 2.

Tomohiko, H. (1967). Japanese Calligraphy. *Visible Language*, *1*(4), 409–426.

Triggs, T. (2011). Graphic Design History: Past, Present, and Future. *Design Issues*, *27*(1), 3–6.

Twine, N. (1984). The Adoption of Punctuation in Japanese Script. *Visible Language*, *18*(3), 229–237.

Wendt, D., Weckerle, H., & Orth, B. (1976). Legibility of Numerals Displayed in a 4x7 Dot Matrix and Seven-segment Digits. *Visible Language*, *10*(2), 145–155.

White, J. J. (1976). The Argument for a Semiotic Approach to Shape Writing: The Case of Italian Futurist Typography. *Visible Language*, *10*(1), 53–86.

Williamson, J. (1995). Embodiments of Human Identity: Detecting and Interpreting Hidden Narratives in Twentieth-Century Design History. *Visible Language*, *29*(1), 37–70.

Wrolstad, M. E. (1967). A Prefatory Note to the First Number. *Visible Language*, *1*(1), 3–4.

Wrolstad, M. E. (1971). Visible Language: The Journal for Research on the Visual Media of Language Expression, A Report from the Editor. *Visible Language*, *5*(1), 5–12.

Zapf, H. (1968). Changes in Letterforms Due to Technical Developments. *Visible Language*, *2*(4), 351–368.

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Graphic Designers' Sense and Knowledge of the User: Is thinking differently the groundwork for acting differently?

Dr. Nicole Wragg and Dr Carolyn Barnes

Abstract

Graphic designers' lack of concrete knowledge of their audience has drawn strong criticism from within the field, without seemingly prompting broad uptake of user research in design practice. This article reports on an unanticipated and ambiguous finding from an interview-based study with nine graphic designers, which sought their views on how graphic design practice had changed through the addition of web design to the former concentration on design for print; one catalyst for the adoption of the new title of communication design. The interviews elicited many unprompted comments claiming strong knowledge of the user, but also other statements showing the designers worked with little or no actual information about their audience. Two inferences are drawn here. In discussing how the participants resolved this situation, the article proposes that despite an interest in the agenda for user-centered design, most graphic designers currently lack the enabling skills and opportunity to carry through on this. Yet seeing a simple binary division between intent and its lack of fulfilment may not be the most useful way to consider the issue of graphic designers' knowledge of the user, a changed discursive position being an important conceptual rehearsal for new approaches to graphic design practice.

Keywords

Graphic design, web design, user-centered design, design intuition, user research

Introduction

Graphic design has a rich history as a commercial and creative practice, standing today as a main design discipline that makes a significant cultural and economic contribution to societies. The field, however, is often judged to be ineffective in explaining the nature and value of its practices (e.g. Heller, 2006a; De Vries, 2010) while being reluctant to adapt these to changing cultural, social, and philosophical frameworks for design (e.g. Davis, 2008; Poggenpohl, 2009; Frascara & Nöel, 2012). Various writers attribute this to the stress on visual thinking and communication in graphic design (e.g. Crilly, Blackwell & Clarkson, 2006; Drucker & McVarish, 2009). Others see graphic designers' reliance on creative intuition in the design process as removing the need to explain and evidence graphic design practice (e.g. Nini, 1996; Cross, 2006; Nini, 2006; Frascara, 2007; Forlizzi, Zimmerman & Evenson, 2008; Fulton Suri, 2008). Yet others still attribute such unwillingness to graphic designers' capitulation to the dictates of the client (e.g. Heller, 2004). This situation is seen as a problem for the field with the rise of the culture of co-creation (Sanders & Stappers, 2008), which has challenged designers' authority and knowledge, the principles of user-centered design holding that the specific situation and interests of users should be established and accounted for within the design process. Segments of the graphic design field have long claimed to work on behalf of audiences. Modernist graphic design strove to optimize communication through a commitment to aesthetic simplicity (e.g. Dexel, 1927; Kepes, 1949). Postmodern graphic design sought to deliver heightened sensory, emotional, and intellectual experience to audiences through the play of forms and meanings while recognizing audience members' varied identities and subjectivities (e.g. Poyner, 1991; Unger, 1992). Who benefits from graphic design, however, is contested due to the fact that graphic design studios are businesses, the impetus for concept and content creation entangled in the designer-client-end-user relationship while being focused on deliverables (Forlizzi & Lebbon 2002, p. 3). Highlighting another tension within the graphic design enterprise, the leading US designer Paul Rand (1985) has described graphic design as a "twofold" enterprise requiring designers to satisfy their own aesthetic objectives while anticipating an audience response.

From the late 1990s, the graphic design field began to experience criticism from within for prioritizing aesthetic and client objectives over audience needs and wants (Frascara, 1997; Frascara, 2004; Cross, 2006; Nini, 2006; Forlizzi, Zimmerman & Evenson, 2008; Fulton Suri, 2008). Reflecting the focus of this article, the rise of web design contributed to calls for a change of perspectives and practices to include knowledge of the audience, newly referred to as "users", especially in respect to how their capacities and objectives influenced use (Buchanan, 2000; Buchanan, 2001; Davis,

2008). Crawford (2005), for example, argued that interactive media required changed thinking around user experience due to the temporal unfolding of communication. Drucker and McVarish (2009) contended that the greater number of elements influencing communication and experience in web design required designers to better understand how users might engage with media content when planning websites. Graphic designers did not significantly contribute to broad academic or practitioner debate on user needs and behaviour in web design. Veen (2001) argues that initially the sheer extent of work available from clients wanting to stake a claim in the web saw designers overwhelmed with learning the technical aspects of web design while adapting their creative strategies to the new platform. Despite web design requiring graphic designers to make decisions about the behaviour, organization, and tone of a website, their absence from debates about user-centered approaches in web design enabled the depiction of graphic design as restricted to the visual appearance of a website to the neglect of issues of use and the user to propagate and persist (e.g. Blevis, Lim & Stolterman, 2006; Forlizzi, Zimmerman & Evenson, 2008).

The evidence provided in this article demonstrates that the user is present in graphic designers' thinking. The article grows out of a study into whether the practice of graphic design has changed since the emergence of web design, having a focus on how graphic designers approach the design of the interactive components of websites. It reports on data gathered from nine graphic designers working across web and print. On analysis, the data revealed frequent unsolicited and intriguing comments on the user as a consideration in website design, including the interviewees' sense that they had good knowledge of the needs and preferences of the audience they designed for. In thinking about designing for interactivity, the designers discussed the complexity of web-based communication and the consequent need to project how people would engage with the form and content of their work. The interviewees spoke of engaging specific audiences through their designs and discussed motivating them to respond in particular ways as a main aim in designing for interactivity. At the same time, their comments revealed they worked with little or no direct knowledge of their audience, consulting or undertaking user research being revealed as a rare element of their design practice.

The article has three main sections. The first section examines the graphic design literature to establish its main positions on knowledge of the user in the design process, including the criticism that a lack of attention to this indicates graphic design's outdated perspectives and reluctance to adapt to change. This section also briefly discusses literature from Human Computer Interaction (HCI) and communication theory, which introduced concepts of the user to the graphic design field. The second section presents the research results to show how the designers in the study posit seemingly contradictory positions on their concern for and knowledge of the user. The third section discusses the significance of the designers' stance on user-

centered design and graphic design practice to consider whether speaking differently about the place of the user in the design process is a precursor to graphic designers acting differently in practice, counter to common representations of the communication design field as resistant to renewal in this respect.

Literature Review

Perspectives on the user in the graphic design literature

The appearance of the term "the user" in the graphic design literature derives from the expansion of graphic design practice to interactive and networked media, the terms audience, spectator or target market preceding it and still being widely used. The designer-client-audience triumvirate is well-established, but often problematic in the discourse of graphic design. Typically, the graphic designer is framed as working to fulfil a client-defined purpose in creating visual communications (e.g. Hollis, 2001; Meggs & Purvis, 2006; Drucker & McVarish, 2009), with the additional objective being added in some instances that design outcomes should resonate with people to motivate a response (e.g. Frascara, 1995, 2004). However, priority is unevenly distributed across this continuum. Resnick (2003, p. 17) highlights graphic designers' close relationship with clients, who provide the content and impetus for communication, by commenting that "listening to the client articulate" their intentions for a project is fundamental to design.

Building on graphic design's role as a service to clients, its literature positions designers as the arbiters of the audience to the extent that they are agents of clients (e.g. Bennett, 2002). In discussing this relationship, however, Forty (1986) argues that designers lack autonomy over the designed outcome. Yet there is also discussion in the literature of graphic designers' disdain for the influence of clients. When graphic design is perceived as too client-centric and profit-driven, sections of the graphic design literature seek to reorient its values towards higher aesthetic and conceptual aims: this sometimes includes audience needs and interests. Meggs [1983, p. ix], for example, describes graphic design as creating "a cultural legacy of beautiful form and effective communication", which if ignored risks its practice "becoming buried in a mindless morass of commercialism whose mole-like vision ignores human values and needs as it burrows forward into darkness" (Meggs & Purvis, 2006, p. x).

The graphic design literature recognises modernist graphic design as striving for truth to form and clarity of communication (McDermott, 2007; Gomez-Palacio & Vit, 2009; Davis, 2012). Bennett (2002), for instance,

emphasizes the achievements of modernist graphic designers in creating designs "intrinsically, culturally appropriate for the prospective audience". The linking of aesthetic clarity and effective communication for the benefit of audiences continues as a theme in recent writing on graphic design (e.g. Hollis, 2006; Meggs & Purvis, 2006). In the 1990s and early 2000s, however, some commentators challenged the scope for graphic designers to originate or control meaning in their work. Wide citing of Roland Barthes's 1967 essay "The Death of the Author" depicted audiences as active interpreters of the complex, culturally and socially-determined meanings inhabiting works of culture (e.g. Poynor, 1991; Lupton, 1994; Rock, 1996; Helfand; 2001; Lupton 2006). These ideas were also debated though discussion of contemporary graphic design practice. Poynor (1991), for example, took the multi-layered elements in new wave typography as acknowledging the audience as more than passive recipients of design. By contrast, Drucker and McVarish (2009) discuss new wave typography as emphasizing design authorship to the exclusion of audiences.

There is some discussion in the graphic design literature of audiences as active contributors to the production of meaning and experience (e.g. McCoy, 1995; Myerson & Vickers, 2002; Lupton, 2006; Davis, 2008). Davis (2008, p. 28), for example, describes "networked communication" as demanding "new skills in building and managing systems that have less to do with inventive form than with understanding users and technology". Discussion of design for interactive media contributed to arguments that graphic designers should design with specific knowledge of their audience. This knowledge included people's varying cognitive abilities and behaviours (Helfand, 2001; Shedroff, 2001; Frascara, 2004; Lupton, 2006; Drucker & McVarish, 2009), social diversity and differing cultural literacy (Bennett, 2002; Forlizzi & Lebbon, 2002; Davis, 2008), specific emotional, physical and social needs (Forlizzi & Lebbon, 2002; Shedroff, 2007), and shifting expectations (Forlizzi & Lebbon, 2002; Lupton, 2006; Barnum, 2010).

The call for an evidence-based approach to graphic design has initiated diverse, interwoven discussions about how this should happen. This includes discussion about the source of relevant knowledge from fields such as marketing, psychology, and social research (Buchanan, 2000; Helfand, 2001; Forlizzi & Lebbon, 2002; Hanington, 2003; Heller, 2006b; Frascara, 2004; Nini, 2006). Here, Frascara (1995) and Young (2005) acknowledge the established use of research from marketing and psychology by graphic designers to enhance the commercial impact of their work, particularly those working in advertising. By contrast, recent debate on graphic designers' need to work from knowledge of the user focuses on delivering benefits to audiences. Frascara (2007) represents the analysis and synthesis of research data as a way to ensure that design is "effective and sensitive to users, contents, and contexts" (p. 67). Discussion proposes that graphic designers make research an integral part of the design process. Hanington (2003) discusses the adoption and adaptation of varied research methods from outside design to

ultimately argue for the development of innovative methods oriented to the nature of design. Poggenpohl (2009) calls for designer-conducted research to be in-depth and systematic, extending beyond basic visual research, creative exploration and peer feedback. The literature of co-design discusses shared creativity between designers and users in the design development process. Nini (2006) contends that effective designed communications depend on the inclusion of audience members in a user-centered design process. Sanders and Stappers (2008) frame co-design as a solution to the complexity of contemporary design projects in informing designers of the cultural characteristics and diversity of audiences within the design process.

Writers propose various benefits of user research from its scope to enhance both decision-making and outcomes in graphic design (e.g. Chu, Paul, & Ruel, 2009; Cooke, 2006) and to boost designer's creativity (Storkerson, 2006) to validating design decisions in the minds of clients and end-users (Bolton & Green, 2007), thus raising graphic design's credibility as a discipline (Bennett, 2006). Davis (2008) discusses growing business recognition of design's strategic role in differentiating products and services but argues this will only endure if designers can evidence their expertise. McKerlie (2011, p.36) argues that business increasingly recognizes the importance of understanding user behaviour, appreciating that if a web experience, for example, is not "immediately relevant and meaningful, then the moment passes [and] the end user has moved on".

A section of the graphic design literature discusses why user research is rarely incorporated into projects. Oudshoorn, Rommes, and Stienstra (2004) blame commercial constraints of time and budget. Roth (1999) links communication designers' neglect of user research to the ephemeral nature of many graphic design projects. Sanders and Stappers (2008) note that despite participatory design being a major approach to the practice of user-centereddesign, it is seen as having little relevance to commercial projects, being restricted to academic research, with Cross (2004) adding that participatory design is commonly conducted with students in the designer role. Nini (2006), Forlizzi, Zimmerman, and Evenson (2008), Fulton Suri (2008), and Gothelf (2011) suggest that the strongest influence on graphic designers' work is their faith in their abilities and experience as creative thinkers and problem-solvers. Taking this further, Raisanen (2012a, 2012b) depicts research as a constraint on creativity. For Frascara (2007), however, the words "intuition" and "creativity" do a disservice to the graphic design field, portraying the designer as an "illuminated magician" (p. 62). Frascara argues that graphic designers' sense that they design intuitively is a misapprehension, intuition being a "combination of knowledge, skill, sensitivity, [and] experience that involve significant work" (ibid., p. 63).

Given the significant epistemological and methodological difficulties in investigating and conceptualizing audiences, it is understandable that the model of graphic design as an intuitive creative practice takes priority over evidence-based designing. The reception of graphic design by

audiences is little researched in practice and academia, neglecting contemporary cultural and social diversity and their associated politics of recognition (Taylor, 1994). The graphic design literature remains polarized around the issue of the need for concrete knowledge of the user; Jeon *et al.*, (2012, p. 98) claim that graphic designers are by nature "sensitive to the unique cultural and environmental aspects" of different user groups, where Frascara and Noël (2012, p. 40) argue for the need for graphic design "to be user-centered, evidence-based and results-oriented".

Perspectives on the user linked to web design

The expansion of graphic design in the 1990s to include design for screen-based media and the web exposed graphic designers to the literature of HCI and communication theory. Widely read books and articles by Norman and Draper (1986), Winograd and Flores (1986), Nielson and Rolf (1990), Laurel (1993), and Moggridge (1999) introduced the concept of the end-user and the principles of user-centered design (UCD). Communication theory proposed the idea of two-way communication in electronic media and associated concepts of meaning, message, and narrative, prominent publications here include Jensen (1996), Rafaeli and Sudweeks (1997) and Rafaeli (1988), Ha and James (1998), Downes and McMillan (2000), McMillan and Hwang (2002) and Stromer-Galley (2004).

Following Donald Norman's introduction of the term user-centered design in 1986, parts of the HCI literature discuss understanding the user as fundamental to approaching interactivity, albeit with a focus on basic functionality to reduce user frustration, words such as usable, effective, efficient, satisfying, and easy-to-learn become the main concepts in HCI's discussion of computational design. Other writers give shape to the nature of the user research in arguing that HCI's mission is to ally psychology, sociology, and computing to create digital artifacts and systems with a human focus (e.g. Winograd & Flores, 1986; Sutcliffe, 2002; Carroll, 2002; Hewett *et al.*, 2009). The emergence of web design saw the graphic design community following the discussion of the user through the HCI literature and related forums on usability and interface design. Jacob Nielson's *Designing Web Usability* (2000) and website (useit.com) were influential in positioning usability and the user at the forefront of web design. This included discussion of the role of graphic design in the context of the web. Nielsen (1999) represented graphic designers as wholly concerned with aesthetic appearance and lacking the expertise to design for usability. Although significant reduction of the early web's technical constraints has enabled design considerations to come to the fore in web design, the literature related to web design contin-

ues to question graphic designers' capacity and commitment to prioritizing the user (e.g. McGovern, 2007, 2009; Naughton, 2012).

The literatures on interaction and user experience design that emerged out of HCI in the 1990s has served as mediators between HCI and graphic design in discussing the nature and scale of people's interaction with digital environments (e.g. Shedroff, 1994; Bonsiepe, 1999; Grefé, 2000; McCarthy & Wright, 2004; Buxton, 2007; Moggrigde, 2007; Saffer, 2010). Crampton Smith, for example, describes interaction design as inherently experiential and increasingly ubiquitous, writing that it "shape[s] our everyday life through digital artefacts – for work, for play, and for entertainment" (Quoted in Moggridge, 2007, p. xi). The interaction design literature stresses that staging interaction is not simply concerned with functional outcomes, but also encompasses symbolic function (Crampton Smith quoted in Moggridge, 2007), the identification of appropriate forms of expression (Moggridge, 1999) and the meaning of digital artefacts (Rettig quoted in Saffer, 2010). A range of writers center the enterprise of interaction design on people, their goals, and the systems developed to facilitate these (Norman, 2002; Forlizzi, Zimmerman & Evenson, 2008; Saffer, 2010). Fallman (2008, p. 4), for example, defines interaction design as "an orientation towards shaping digital artifacts … with particular attention paid to the qualities of the user experience … including physical, sensual, cognitive, physical, emotional, and aesthetical issues; the relationship between form, function and content; as well as fuzzy concepts such as fun and playability." Although often focused on games development, discussion of user experience in the interaction design literature extends to visual language, linking arguments on the user in HCI to graphic design.

The scope of communication theory is broad, but at its core is the impact of technology on communication and hence audiences. The figure of the user is common in discussion of the transmission and reception of messages through digital media, where, much like HCI, notions of the user and interactivity are seen as synonymous. Steuer (1992, p. 84), for example, describes interactivity as "the extent to which users can participate in modifying the form and content of a mediated environment in realtime". Ha and James (1998, p. 461) identify five characteristics of interactivity directly related to the user, listing these as "playfulness, choice, connectedness, information collection, and reciprocal communication". Manovich (2001) relates new media to cinematic paradigms where the user is actively engaged in the interpretation and layering of meaning. McMillan and Hwang (2002) propose a typology of interactivity pertaining to the processes, features, and perceptions that invest the users of digital media, including websites, with agency through active involvement in the production of meaning, this last point being a feature of graphic designers' discussion of web design.

The addition of web design to graphic design practice through the advent of digital and networked technologies in the 1990s is a major topic in the graphic design literature. Most early writing on web design is technical in focus, comprising books and blogs describing how to build

successful websites (e.g. Siegel 1996; DiNucci, Guidice & Stiles, 1998). Written by graphic designers, and multimedia designers and developers, it discusses the aesthetic value graphic design brings to websites, design principles for web design (e.g. Seigel, 1996; DiNucci, Guidice & Stiles, 1998) and the application of the new platform to commercial projects (e.g. Veen, 2001) to the exclusion of discussion of user needs and experience. A broad graphic design literature discusses the impact of the web and screen media on graphic design (e. g. Helfand, 2001; Julier, 2000; many articles in *Emigre* magazine c.1995-2005). A mix of graphic designers and design commentators consider the future web, challenging graphic designers to discover new ways of designing for the screen (e.g. Julier, 2000; Helfand, 2001).

Such discussions have diminished over time as web design has become routine for graphic designers, the graphic design literature being more explicit in stating graphic design's contribution of the nature of digital applications. Engholm (2002), for example, discusses the important role of graphic design in forging the aesthetics of the web. Wroblewski describes graphic design as "the voice of interaction design and information architecture … communicat[ing] the importance of (and actions between) the content and actions within an application" (Quoted in Saffer 2010, p. 172). Elsewhere, however, criticism continues of graphic design's approach to design for digital applications. Locher, Overbeeke and Wensveen (2010), for example, argue that interactive experience has an aesthetic quality, but that this is a product of the texture of dynamic interactions between a user and a digital artefact in addition to the visual design of an interface. The sense of graphic designers intuitively developing the aesthetic characteristics of digital artefact or focusing remains an issue. For writers such as Blevis, Lim and Stolterman (2006) and Forlizzi, Zimmerman and Evenson (2008), graphic design in a digital context without recourse to robust user research is inherently self-limiting.

Summary and research question

The literature review has shown some contributors to the graphic design literature calling for the inclusion of user-centered design practices to better accommodate the interests, needs, situation, and wants of users in their diversity, including as a result of the emergence of web design. In examining the influences on graphic designers' thinking in approaching web design, the literature review has discussed the focus on user experience and user research in the HCI literature and the communication theory literature's framing of communication in a digital context as an active, two-way process in which users construct meaning and experience for themselves. Despite the passage of time since the emergence of the web and the focus on user needs and experience in its academic discussion, there has been little scholarly interest in how working graphic designers perceive their relationship to the user. This study is timely in showing that the user and user-centered

design are present in the thoughts of graphic designers. It is compelling in that the interviewees' comments about their sense and knowledge of the user were not directly solicited. At the same time, in investigating the interviewees' perspectives on how the web might have changed graphic design, the study found little evidence that awareness of user-centered design has changed processes in graphic design appreciably, hence the focus in the following discussion on whether graphic designers' discussion of user-centered design is evidence of change in established practice models.

Research Design and Methods

The study from which the article derives sought to understand if the experience of designing for the web and interactivity had changed designers' perspectives on graphic design. In seeing designers as discursively creating their practice, it preceded from a constructionist perspective, employing an exploratory, qualitative research design. In developing the research design, Schön's (1983) concept of 'the reflective practitioner' was to the fore. Schön places reflection at the core of design practice to argue that practitioners break from codified professional knowledge to develop tacit understanding of their professional enterprise through their daily practice. Usher (1997, p. 143), teases this out by arguing that the role of reflection on practice is "to resolve the dilemma of rigour versus relevance confronting professionals". In the study, distinguishing between theory and theory-in-action was a critical to understanding the difference between what designers say and do.

The data gathering had two components, an interview and a visualisation exercise. Each designer was firstly interviewed about their understanding of web design, interactivity, and its relationship to the graphic design enterprise. The interviews followed Kvale's (1996) schema for conversational, qualitative interviewing, which stresses that the main themes of the interview should relate to the everyday experience of the interviewee; the interview should seek rich, nuanced qualitative information; interviewees should be encouraged to provide descriptions of specific situations and action sequences of relevance to the research question; and although the interview should focus on particular themes, its character should be open to unexpected directions.

The interviews were organized into three sections: 1) examining the designers background; 2) discussing their industry experience and practice; and 3) exploring the designers' perception of designing for the web and interactivity. Some of the questions included:

> How do you design for different media?
> Would you describe the web as a more interactive medium than print?

Is considering interaction important in the web design process?
Do you design interactions?
Do you think web design is its own design discipline?

Designers spend a majority of their professional lives using visual forms to express ideas (Harper, 2002), the production of visual images being central to their communicative activities (Crilly, Blackwell & Clarkson, 2006). At the end of each interview, the interviewer asked each designer to visualise their idea of interactivity. There is much debate over the validity and methods of visual research. Fyfe and Law (1988), discussing the field of sociology, argue there is no agreed "methods for identifying, discriminating and counting" visual research, reasoning visual research thus lacks rigour and credibility. Hewson (1991), however, contends that despite its complexity, much can be gained from the interpretation of visual material. Indeed, Knowles and Sweetman (2004, p. 7) argue that visual materials generated by research participants can "reveal what is hidden in the inner mechanisms of the ordinary and the taken for granted."

Nevertheless, Crilly, Blackwell and Clarkson (2006) and Shedroff (2007) recommend careful planning when including visualisation in the interview process. Where the aim is to produce data of social scientific value, Newbury (2011) specifies systematic analysis to avoid researchers being seduced by images and misinterpreting their meaning. Alexander (1994) argues that analyzing visual material requires the researcher to possess an understanding of visual language, the culture in which it is generated, and the conventions of the material they are researching to identify and decode meanings. Following Crilly, Blackwell and Clarkson (2006), the visualization exercise in this research sought to enable participants to clarify their perspectives on the interview topic through a medium in which they felt comfortable. The visualizations provide an index to the analysis of the interview data while the interviews provide a context for the analysis of the visual material.

The data gathering was conducted at the designers' offices and lasted approximately 45 minutes, with the final five minutes being devoted to the visualization exercise. The first author conducted the interviews. The study was carried out with the approval of Curtin University of Technology, with due consideration of the requirement for informed consent and confidentiality.

Participants

Nine graphic designers, seven male and two female, from design consultancies in Victoria, New South Wales, Queensland, and Tasmania, volunteered to take part in the study for no financial reward. Their average age was 32 years. The participants were chosen for their active involvement in graphic design

for print media and design for the web. Effort was made to recruit designers of varied experience to gather a range of attitudes and participants practicing across advertising and graphic design, while all having worked on projects related to the web. To reflect a broad range of professional situations, effort was made to recruit designers working in their own businesses, those employed in other's design businesses, and freelance designers. A balance of female and male designers was sought, but the majority of the female designers approached declined to participate with the reason being given as a lack of time. Table 1 sets out the background of the interviewees, their education, current work, years working as graphic designers, and years of working in web design or with multimedia applications before that.

DESIGNER	AGE	EDUCATION	Area of Graphic design	BACKGROUND
Designer A Alan	35	Graphic Design	Creative Director/Owner: Graphic design Strategy – Print and Web.	15 years Graphic Design 3 years Web Design
Designer B Brian	37	Graphic design and Multimedia Design	Creative Director: Advertising and Strategy – Web and Digital Design	13 years Multimedia and Web Design
Designer C Charles	42	Graphic Design	Creative Director/Owner: Advertising and Strategy – Web and Print.	20 years Graphic Design 11 years Web Design
Designer D Dean	36	Graphic Design	Creative Director/Owner: Graphic design Strategy – Web and Print.	14 years Graphic Design 11 years Web Design
Designer E Ewan	40	Fine Art	Freelancer/Design Educator: Strategy and Design – Web and Digital Design.	17 years Graphic Design 14 years Multimedia and Web Design
Designer F Felicity	25	Graphic design	Senior Designer: Strategy and Design – Web and Digital Design	4 years Web Design
Designer G Gary	32	Industrial Design, Multimedia Design	Creative Director/Design Educator: Strategy and Design – Web and Game Design	12 years Industrial and Multimedia Design 10 years Web Design
Designer H Harry	35	Graphic Design	Creative Director/Owner: Advertising and Strategy – Web and Digital Design	14 years Multimedia and Web Design
Designer I Irene	37	Studio Art	Creative Director/Owner/Design Educator: Advertising and Strategy – Web and Digital Design	20 years Graphic Design 15 years Multimedia and Web Design

Table 1

Details of participants

Data analysis

Data analysis proceeded from the perspective that how people represent things matters. This follows the position of Critical Discourse Analysis (CDA), which Vaara and Tienari (2010, p. 245) describe as "a theoretical and methodological framework that allows one to examine the constitutive role that discourses play in contemporary society." A list of high-frequency words and phrases was created from the interview data. Next, key visual concepts from the diagrams were identified and compared to the interview results, consolidating insights and enabling causal inference (Strauss & Corbin, 1998). As themes emerged, including the unanticipated thread of visual concepts

and discussion across both sets of data around the designers' sense and knowledge of the user, new sets of questions were asked of the data in an iterative approach that moved between the data and existing discussion of user-centered design from relevant literature, initiating concept formation (Ragin, 2013), which suggested evidence of a discourse on the place of the user in graphic design framed from the practice of web design.

Research Findings

The literature review identified both acceptance and criticism in the graphic design literature of graphics designers' recourse to intuition in the design process, with critics of this approach arguing that effective, responsible graphic design is audience-focused and incorporates specific knowledge of its audience. The literature includes little evidence of where most graphic designers stand on this issue or what happens in practice. Taking the interviews first, an unsolicited theme was the designers' discussion of their sense and knowledge of the user in the implementation of web design, exemplifying the value of exploratory, qualitative studies in discovering the expression of actions and ideas in practice contexts.

The majority of designers spoke at length about users' centrality to their design decisions, from concept development that considers choice of aesthetics, language, and tone to the functional behaviour and operation of websites. They ascribed themselves the role of arbiters of the user in providing users with an effective, efficient, and pleasurable experience when engaging with the websites they design, stressing their decisions are made with the best interests of end-users in mind. As set out in Table 2, the designers used various terms to refer to the user, including "audience" and "target market", the greater frequency of user suggesting knowledge of the discussion of user-centered design in relation to web design.

WORD	USER	AUDIENCE	TARGET MARKET
Frequency	83	39	9

Table 2

Frequency of use of the terms user, audience and target market

Table 3 shows the eight different contexts in which the words user, audience, and target market appeared, the main categories being "user experience" and "user testing", then "user behaviour", "user perception" and "cognition". The term audience was used less frequently. The data suggests that the designers saw themselves and their work as having a relationship to an audience, which needed to be understood in order to engage with users to produce desired outcomes. The term target market was the least used term, although the data shows its use still linked the graphic design enterprise to engaging with people.

CONTEXT	FREQUENCY		
	User	Audience	Target market
Experience	31	8	
User testing	15		
User behaviour	11		
Perception/cognition	6	2	
User profiling	5		
Communicating/connecting	4	12	8
Design innovation	4	4	
Empowerment	3	1	
Understanding the user, audience,		10	
Evaluation		2	1

Table 3

Context for the use of the word user, audience and target market.

Approaches to User Research

The interviews contained 74 references to methods actually or potentially used to provide knowledge of the users of a website. These references fall into three categories as shown in Table 4. The highest frequency references were to the designer intuitively projecting a sense of the audience, their needs and interests. This including office polls, the experience of practice and empathetic role-playing where the designer projected assumed characteristics of the user. This category was followed closely by references to user testing of live websites to identify any issues of use for remedial adjustment. The lowest frequency of comments referred to gathering actual data about end users. Table 4 provides counts of the references to different approaches to researching the user, with methods for collecting or applying data including focus groups, surveys, webinars, analytics, user modelling, channel planning, and prototype evaluation.

APPROACH	FREQUENCY
Designer projection: Empathy, intuition, experience of practice	34
User testing or evaluation of live websites	30
Data gathering: focus group, survey, webinars, analytics, user modelling, channel planning, prototype testing	10

Table 4

Approaches to understanding the user.

The research revealed a disparity between the designers' sense that they knew and understood their target audience and both their knowledge and implementation of user research. Only four designers, Brian, Charles, Harry, and Irene, who each practiced web design within the context of advertising — a seeming influence over their familiarity with user research — named specific data gathering methods, making frequent reference to market research approaches. Brian, Charles, and Harry mentioned channel planning and the creation of user profiles within the design process. Harry commented:

> *"One of the steps that we go through is a thing called user modeling where we think about who are the different audiences coming to the website, what do they want to achieve from a visit, and then we think about content and functionality in the context of what that user wants to achieve first and foremost."*

They specified the use of factors including the age, gender, location, patterns of activity and technical acumen of predicted users in the development of hypothetical user profiles and scenarios of use in establishing key aspects of a website. It transpired, however, that the use of these design tools and research methods was not grounded in concrete research data, but rather based on assumed characteristics. Charles, for example, explained, *"What I've always done is I've considered the person I am designing for, so if I'm designing for an 80-year-old woman … [who] might want to feel secure and she may need bigger fonts. And she may not want to be frightened by the language."*

Only Irene discussed the application of user research within an actual project. Describing a complex web project with varied expected users, she explained how during its development the design team conducted "*surveys, asking 'What do you want?' Then we brought two people in from each of the four target audiences after we had built the interface. We gave them a series of tasks that we wanted the target audiences to achieve to test that they were getting what they needed.*" Brian, Charles, Dean, Ewan, Felicity, Harry, and Irene all spoke positively about the value of user testing in improving overall user experience during the development of a website. Dean, for instance, remarked that *"as a methodology, we provide a decent amount of testing and are always encouraging a greater level of diligence in doing so."* However, further scrutiny of comments from Brian, Charles, Dean, Felicity, and Harry revealed such testing to be in-house evaluation in which members of the design team or other colleagues in the studio took the role of site users.

Interactivity driving a new user focus

When asked in which design field they practiced, no interviewee described themselves as graphic designers or web designers. They referred to them-

selves as thinkers, problem identifiers, and problem solvers through the combination of design and technology. Unprompted, a majority discussed how working in the context of web design had changed their awareness of the audience for their work, the dimension of interactivity introducing a focus on users' needs and preferences into their designing. Here, Brian, Charles, Dean, and Harry reasoned designing for the web had transformed the perspective on designed communications due to the awareness that people were now actively engaging with media content. Harry, for example, described the web as a lean, progressive medium with users visiting websites to accomplish a task, noting, *"It's got to be about the end user on the web. The second it's not about them is the second they'll go somewhere else … on TV, you're getting free content in return for watching ads. If the web's not about the user, it's like watching ads without getting your favourite TV show."*

A number of interviewees argued that their perspectives on knowledge of user needs, preferences, and behaviours differentiated them from designers working with print, the dimension of interactivity making them more accountable to an audience for their design. Ewan nominated the web as the catalyst that had elevated graphic design to that of communication design, an expanded field of practice with more complex expectations. Harry believed that graphic designers working with print *"don't have that empathy for usability; they're thinking about the aesthetics rather than communicating through design and functionality."* Charles saw that when working in the fluid environment of the web, his focus on the user was integral to building brand loyalty in ways not previously explored in graphic design for print or traditional broadcast media, commenting that "*the worst thing you can do is to motivate someone to act, but you don't give them an outlet to act … What we do in [web] design is to help the user to take the next step and continue the relationship."*

User-centered design driving innovation

All nine designers saw themselves as forward thinkers who delivered innovative designs. Their remarks on innovation suggest how the discourse of the user has changed perspectives in graphic design. Mention of the user made them the beneficiary of innovation, where if the designer linked innovation to their own creativity and ingenuity, no benefits for the user were stated, the focus rather being on creative invention and problem-solving for clients, often spurred by working within project constraints. Table 6 sets out the designer's perceptions of the sources and effects of innovation in their work.

DRIVERS OF INNOVATION	DESIGNERS' COMMENTS	VALUE FOR THE USER
The user	Does the client trust you to come up with concepts that are innovative and shape the relationship with the user? (Brian)	Engaging
The user	… innovation comes from considering the user, what they need. Innovation comes from that. (Charles)	Enabling
The user	… you don't want to have innovation for its own sake. Like, innovation is only useful if it brings you [the user] closer to your goal. (Harry)	Enabling
The user	Sometimes innovation means doing things in a completely new way and takes us out of our comfort zone … or if you can come up with some innovative way of improving navigation that still utilizes people's familiarity. (Harry)	Enabling
Designer invention	I think that innovation and creativity is important and should be part of every design process and I really like to start every process with a blank page questioning what can we really do. (Dean)	Not specified
Designer creativity	Something we hope to do at this place is do some research and innovative thinking without any client in mind. Sometimes I feel that I draw on previous things and mash them up in a new form … if you combine existing things that's when innovation starts. (Brian)	Not specified
Designer creativity	From a technology point of view, I'd say we are very innovative … it's business communications that is essentially our business and we reserve a portion of our resources to do exploratory stuff [that] filters into our commercial jobs. (Dean)	Not specified
Designer creativity	The generation of ideas comes from us and we are the innovators. You can't always ask the audience what they want because they can't always see what's coming, where we can. (Harry)	Heightened outcomes
Ingenuity around project constraints	Some [projects] can be quite innovative, some of the ones with lower budgets. (Ewan)	Not specified

Table 5

Drivers of innovation

Visualizing interactivity and the user within web design

Eight of the nine designers represented the user in some way in their diagrams, echoing discussion of the user in the interviews. In focusing on nature and process of web design, the diagrams suggest some level of awareness of concepts from HCI on the priority of the user in interaction and from communication theory on how the interactive aspect of digital communications has changed the agency and experience of audiences. The two-way arrow in Alan's diagram (Figure 1) suggests the ideas of reciprocal communication and information flow in interactivity as well as the connectivity between media platform, media content, and the user. Suggesting the discussion of interactivity in the HCI and Interaction design literatures,

Brian's diagram (Figure 2) represents the intermingling of user's individual goals, expectations, and experience during engagement with a website.

Figure 1

Alan's diagram of interactivity within web design

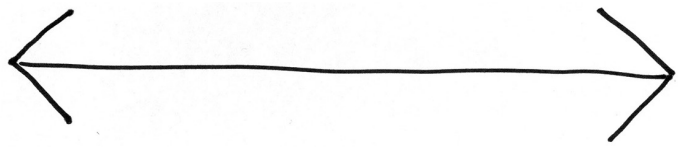


Figure 2

Brian's diagram of interactivity within web design

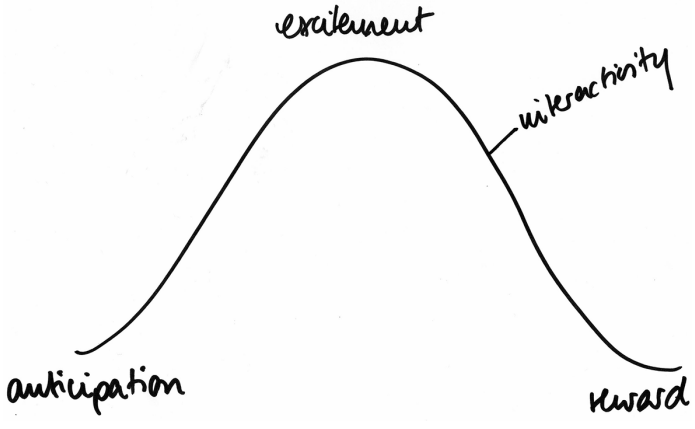
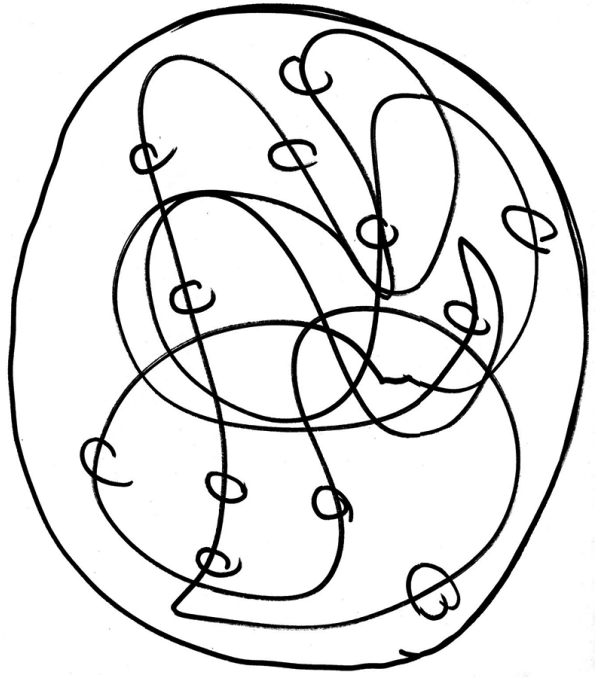


Figure 3

Charle's diagram of interactivity within web design



Charles's diagram (Figure 3) suggests the agency of people interacting with technology by visualizing the number of encounters that can potentially take place within a digital environment and the diffuse relations between these. Dean's diagram (Figure 4) represents how an interactive experience can connect and engage the user in the act of communication.

Figure 4

Dean's diagram of interactivity within web design

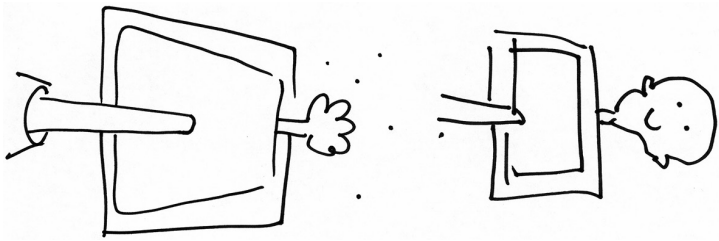
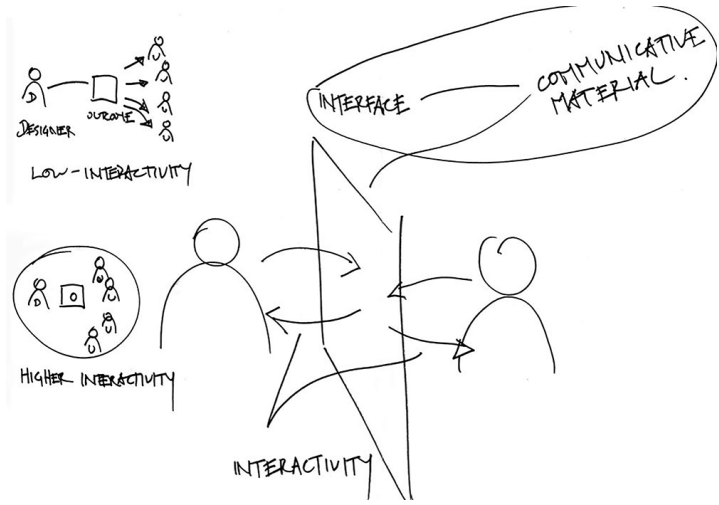


Figure 5

Ewan's diagram of interactivity within web design



Ewan's diagram (Figure 5) depicts three models of interactivity within web design in which the user is a clear presence in the process of design for interaction. The main diagram represents interactivity as a backwards and forwards process of interaction via a screen interface, similar to definitions found in communication theory. The two additional diagrams compare high and low levels of interactivity, with clear differentiation between the role of the designer and the user, who are labelled "D" and "U". Felicity's diagram (Figure 6) evokes concepts of interactivity from communication theory, such as Stromer-Galley's (2004) representation of interactivity as a distinct phenomenon that transpires between people and technology and between people facilitated by technology. Gary's diagram (Figure 7) represents interactivity as a user-centered process shaped by human factors.

Figure 6

Ewan's diagram of interactivity within web design

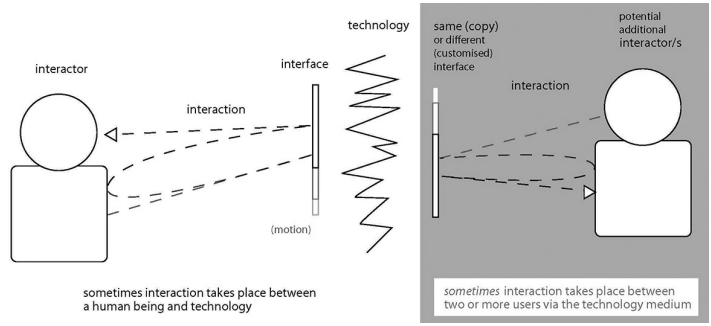


Figure 7

Gary's diagram of interactivity within web design

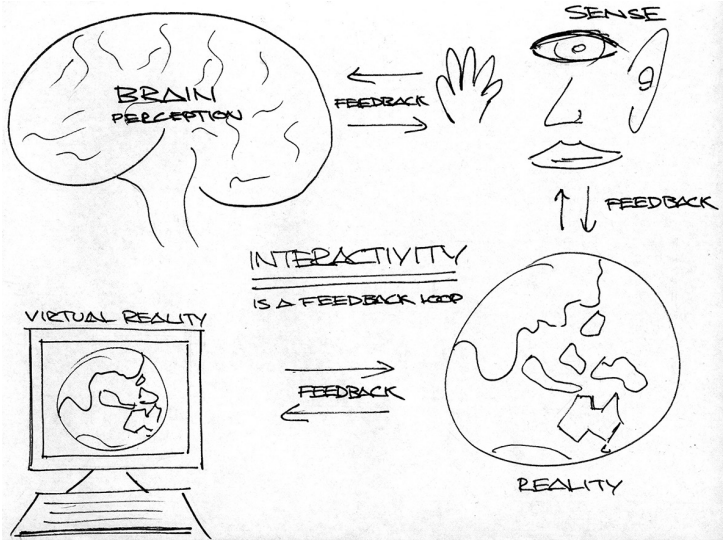
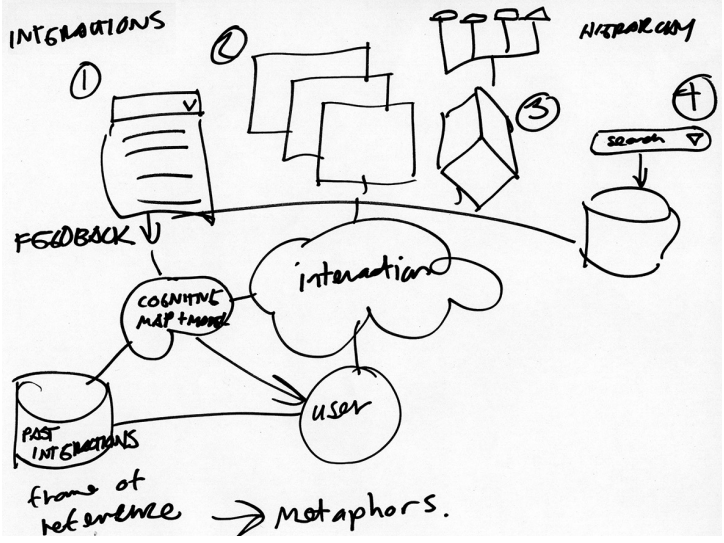


Figure 8

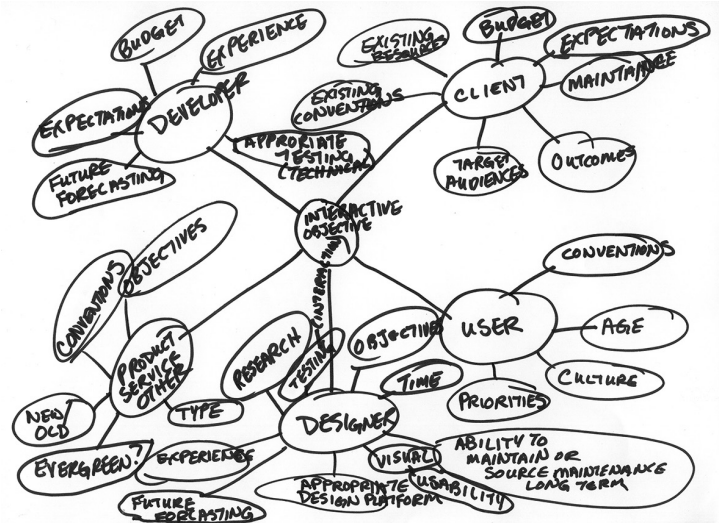
Harry's diagram of interactivity within web design



Harry's diagram (Figure 8) includes a depiction of a sitemap — a visualisation tool born of website development — to represent the elements that constitute interactivity; his drawing including the user, their cognition and previous experience as well as the role of user feedback in website development. Irene's diagram (Figure 9) depicts the multiple contributions from different stakeholders that inform the design process, highlighting the complex network of constraints, interests, objectives, and processes that comprise website design. Reflecting Irene's detailed discussion of user research in her interview, her diagram is the only one to include specific reference to user research as a component of the process of website design although both Gary (Figure 7) and Harry (Figure 8) allude to its place in the design process. Harry and Irene's drawing (Figures 8 & 9) depict the complexity of web design projects and the range of design tools needed to accommodate the characteristics, needs, and preferences of a target audience. Ewan's drawing (Figure 5) suggests knowledge exchange and possibly co-creation between designers and users.

Figure 9

Irene's diagram of interactivity within web design



Some of the designers who give physical form to the user give a level of detail in their drawing that includes varied characteristics of the user and the different dimensions of user experience. Brian recognises users' emotions (Figure 2). Gary gives the user identifiable features that make reference to cognition and the senses (Figure 7). Dean's diagram (Figure 4) depicts users' agency and presence within interaction, suggesting these have a measure of power. Ewan and Felicity use featureless, generic figures to represent the user (Figures 5 & 6), but the user remains a dominating presence in the design process in their drawings, suggesting awareness of the requirement to give consideration to user needs in web design.

Discussion

The field of critical discourse analysis holds that dominant discourses drive how people think, talk, and act (e.g. Fairclough, 2003; Wodak, 2004; Blommaert, 2005). In recent times, the discourse of user-centered design and its key concepts of the user and user research have achieved broad currency in design debate, although our review of relevant literature shows that this is to a limited extent in graphic design. Discussion of the user in our data does not indicate comprehensive adoption of research-driven, user-focused designing in graphic design. Moreover, our findings show that the linked ideas of intuitive creativity and problem-solving are also present in the interviewee's comments, these being enduring concepts having been constituted in and through countless instances, commentary, and contexts over time to be normalized in graphic design. As such, the research findings show competing discourses to be acting on graphic designers' thinking, the discourse of user-centered becoming more relevant to graphic designers through the expanded context for graphic design practice, web design providing a strong sense of interaction between media content and the audience for design in generating different practical challenges and discursive positions from designers.

The question to ask of the research findings is whether this duality, born of the rhetorical practice of consciousness-raising within the broad design literature, represents an uncritical construction of user-centeredness and lip service to the need for and actuality of its practice or whether it is evidence of an important shift away from the paradigm of designer-led, client-focused intuitive designing. Here it is important to stress the workings of discourse. The research findings could suggest that normality has been open to a measure of change given the evidence of these designers discussing the user and the imperative to establish knowledge of their needs and preferences. Or perhaps nothing has changed. As much as the interviewees discuss the user, they also use appeals to common sense in respect of the challenges of working within everyday practice constraints to restore priority to the model of the designer as the arbiter of the user guided by intuitive creativity.

A main argument for researching users' capacities, needs, and situation is to prompt empathy in designers to achieve relevant, sensitive, and inspired design (Fulton Suri 2003; McDonagh 2008). Yet Banks and Deuze (2006) equally stress designer's sense of ownership over creativity. Of the nine designers, Dean, Harry, and Irene discussed market research in the web design process but simultaneously stressed the importance of measuring this in design through tacit understanding informed by personal experience. Here, Dean observed that *"we have to rely on our own experiences and be confident that we're making certain decisions that are going to be*

right … sometimes you have to run with a hunch." Brian, Charles, Dean, Ewan, Harry, and Irene all reported that if there were time in a project to conduct research, they tried to do so, but they qualified this in asserting that research can only guide the design process to an extent, with creativity and intuition also being important contributors to design.

In exercising a degree of intellectual legerdemain, some interviewees merge knowledge of the needs, preferences, interests, and situation of the user with the exercise of designer intuition. Harry, for example, linked user-centered design to:

> *"being able to look at something and imagining that I'm my mother or my father or somebody else and thinking 'Well what am I looking at? What are my options here? Does it make any sense? Is there anything I can compare this to in the real world that I've used before that is going to help me use it? What would I do next?'"*

Dean exaggerates the burden of user-centered design in commenting *"If you stopped and tested every single aspect of the site, you would never get anywhere."* He restores authority to the designer when he then states that designers need to exercise intuition to develop designs that do not just satisfy users' needs and preferences but rather push beyond these limits to advance user knowledge and behaviour. These comments suggest Schön's (1983) concept of a reflective approach to practice. For Schön (Ibid., pp. 68-9), where the practitioner "reflects-in-action, they immediately become a researcher in the practice context" to construct new knowledge. Yet it is arguable whether intuitive designing of the type described in the interviews creates added value for the user or more represents a public-private dialogue within graphic design practice based on self-persuasion.

Fairclough (2000, p. 28) argues that discourse has three roles within text and speech; it represents ideologies, enables identification, and authorizes action. Each of these effects is present in our data. The designers instantiate the ideology of user-centered designing by discussing it, grafting it onto their professional identity, showing it to motivate changed practices in some cases and a measure of reflection on the nature of graphic design, its principles and methods, in others. However, equally inscribed in the research findings is evidence of competition for authority and legitimacy between the new discourse of user-centered design and the established one of the role of intuitive creativity in design. The value of designer creativity has given added impetus from sources such as Richard Florida's book *The Rise of the Creative Class* (2002), which champions the importance of creative and knowledgeable workers who generate "economic value through their creativity" (p. 68). Competing with the discourse of user-centered is the influence of the experience of practice which the designers' comments show to revolve around many small, individual problem-solving acts that affirm the professional experience and identity of the designer.

The future of user-centered design in graphic design depends

on its success in moving from the discursive level to the sphere of practice. Fairclough (2003, p. 41) argues that 'dialogicality' in speech and text — the presence of opposing views and qualifying terms — indicates a lack of commitment to any one idea. Counterposed against the 65 explicit comments in the interviews discussing the importance of identifying and fulfilling users' requirements, the designers also discuss incompatibilities between user-centered approaches and established graphic practice. The idea of more inclusive designing, which includes user research and the brokering of alternative perspectives, sees the interviewees discursively balancing the value and ethics of admitting more stakeholders into the design process against the prospect of a loss of creative authority and control.

This dilemma is not restricted to graphic design. It also occurs in other design fields such as industrial design and architecture where Stolterman (2008) notes a discrepancy between practice and theory about the inclusion of user research. Brian, Charles, Dean, Gary, and Harry endorse the omission of the user from the design process on the basis that fulfillment of the user's immediate requirements could limit a designer's creativity and constrain design outcomes. Hosing down arguments for user-centered design, Harry comments *"You can gain insights from … research and feedback around usability issues and communication issues, but I don't believe you should use that sort of work to generate ideas."* Brian also represents the user as a barrier to innovation in the design process stating, *"It's hard when you … put the users at the center … it's very hard to innovate because the average person replicates their knowledge and applies what they already know and things that are common … if you want to change things you can't test everything and put the ordinary user at the center."* Ultimately, the designers interweaving of the discourses of user-centered and intuitive, expert designing constructs a paradoxical rhetorical position that puts graphic designers above audience members, obviating the need for research into actual users. "User testing", for example, is described as often involving colleagues, some of the interviewees arguing that designer's inherent empathy for people's physical, cognitive, and emotional needs allows them to perceive a website from a user's perspective.

For Brian, design evaluation that checks whether a website matches user needs and responses is done within the studio because designers are *"the best users"*. Such inverted identification with the discourse of user-centered design also sees some of the interviewees describe designers as better disposed towards understanding peoples' physical, cognitive, and emotional needs than other stakeholders in the design process, notably clients and marketers. Irene, for example, comments, *"you have to really understand the audience and you can't always rely on the client – it's amazing how many clients don't know their own audience".* Charles similarly states, *"I am still amazed at how some marketing people don't really understand their audience. They're more concerned about their budget, their boss, the share price and how much work they've got to do."* Such comments expose a set of professional

power relations that underlie graphic design practice, seeing the graphic designers seeking to discursively legitimate their authority and value, even if this does not always equate with the expression of power and authority in reality.

Conclusion

Principles of user-centered design reflect changing community attitudes to inclusion, participation, and consultation in diverse aspects of life. However, the references to the user and user research in the comments and drawings provided by the nine designers in this study show that its uptake in graphic design is limited at best. Yet the research also suggests the ambivalent self-persuasion of graphic designers today as they navigate between established ideas of graphic design and the significant changes brought to graphic design practice through the emergence of web design. The research findings indicate that the main priority for graphic designers remains meeting client needs through the application of their creative intuition, a faculty based on the experience of practice. It was not foreseen that the interviews and visualisation exercises would elicit a significant body of comments on the topic of user-centered design, the unsolicited nature of these references suggesting that the discourse of user-centered design has genuinely filtered down to the practice level of graphic design even if the matter of the user is mostly acknowledged in the abstract.

In the graphic design literature, criticism of a lack of attention to the needs and preferences of the user comes from design scholars who contest the efficacy and ethics of how graphic designers practice. Criticism is important to changing intellectual frameworks and practices, but the findings reported here suggest that discussion surrounding user-centered design has had an impact, and the principles governing graphic design practice have been opened up to reconsideration. Criticism can have negative as well as positive effects, its discursive features being shaped by the motivating crisis it seeks to identify and address. It may be that in discussing the place of the user in web design in relation to interactivity, the interviewees were consciously-unconsciously deflecting the need for changes in practice and discursively re-inscribing the authority of the status quo. In advocating for the end-user, the critique of intuitive designing requires a more complex, nuanced, and balanced account of the forces shaping graphic designers' practice.

Given our findings, specific research is needed into the application of user-centered design in various design genres within graphic design practice and its relationship to the identity and actions of graphic designers. Future studies should directly address the duality of thought represented by designers interviewed for this study, exploring whether they perceive the

user-centered design trend as a useful marketing tool or a specific and valuable addition to practice. A future study would include a larger sample of designers, specifically female designers. In addition to specific research into the application of user-centered design in graphic design practice, our findings indicate the need for case studies on the practical benefits and challenges in applying user-centered processes in industry practice. Case studies involving systematic observation and documentation of practice might have more scope to influence practice in facilitating knowledge transfer. In the age of the "prosumer" and user-generated content, the matter of user-centered design will be an ongoing battleground for authority and legitimacy in graphic design. Our article reveals the trace of this new cultural politics as an evident tension in the thinking of the contemporary graphic designer.

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References

Alexander, V. (1994). The Image of Children in Magazine Advertisements from 1905 to 1990. *Communication Research.* 21(6), 742–765.

Banks, J. Deuze, M. (2009). Co-Creative Labour. *International Journal of Cultural Studies*. 12(5), 419–31.

Barnum, A. (2010). These are the days. In G. Grant (Ed.), *BBetween*. Sydney, Australia: Billy Blue College of Design, 3, 79–80.

Barthes, R. (1977). *Image, music, text.* London: Fontana.

Bennett, A. (2002) Interactive aesthetics. *Design Issues*, 18(3), 62–69.

Bennett, A. (2006). The rise of research in graphic design. In A. Bennett (Ed.), *Design studies: Theory and research in graphic design* (pp. 14–23). New York: Princeton Architectural Press.

Blevis, E., Lim, Y. K., & Stolterman, E. (2006). *Regarding software as a material of design*. Paper presented at the Wonderground, Lisbon, Portugal.

Blommaert, J. (2005). *Discourse: A critical introduction*. Cambridge: Cambridge University Press.

Bolton, S. & Green, L. (2007). Getting design off the substitute bench: Reframing and realigning design processes for the business development game. *Emerging Trends in Design Research*. International Association of Societies of Design Research, The Hong Kong Polytechnic University School of Design.

Bonsiepe, G. (1999). *Interface: An approach to design*. The Netherlands: Jan van Eyck Academie.

Buchanan, R. (2000). Good design in the digital age. *AIGA Journal of Design for the Network Economy*, 1(1), 5.

Buchanan, R. (2001). Design research and the new learning. *Design Issues*, 17(4), 3–23.

Buxton, W. (2007). *Sketching user experiences: Getting the design right and the right design*. San Francisco, CA: Morgan Kaufman.

Carroll, J. M. (Ed.). (2002). *Human-Computer Interaction in the New Millennium*. New York: ACM Press.

Chu, S., Paul, N., & Ruel, L. (2009). Using eye tracking technology to examine the effectiveness of design elements on news websites. *Information Design Journal*, 17(1), 31–43.

Cooke, M. (2006). Design methodologies: Toward a systematic approach to design. In A. Bennett (Ed.), *Design studies: Theory and research in graphic design* (pp. 130–146). New York: Princeton Architectural Press.

Crawford, C. (2005). *Chris Crawford on interactive storytelling*. Berkeley, CA: New Riders.

Crilly, N., Blackwell, A.F. and Clarkson, P.J., (2006). Graphic elicitation: using research diagrams as interview stimuli. *Qualitative Research*, 6 (3): 341–366.

Cross, N. (2004). Expertise in Design: An overview. *Design Studies*, 25(5), 427–41.

Cross, N. (2006). *Designerly ways of knowing*. London: Springer.

Davis, M. (2012). *Graphic design theory*. London: Thames and Hudson.

Davis, M. (2008). Toto, I've Got a Feeling We're Not in Kansas Anymore … . *Interactions,* 15(5), 29–34.

De Vries, J. (2010). Stuck for words. In G. Grant (Ed.), *BBetween*. Sydney, Australia: Billy Blue College of Design, 3, 34–35.

Dexel, W. (1999 [1927]). What is new typography? Reprinted in Bierut, M, Helfand, J, Heller, S & Poyner, R (Eds.), *Looking closer 3: Classic writings on graphic design* (pp. 32–34). New York: Allworth Press.

DiNucci, D., Guidice, M., & Stiles, L. (1998). *Elements of web design* (2nd ed.). Berkeley, CA: Peachpit Press.

Downes, E.J., & McMillan, S. (2000). Defining Interactivity: A Qualitative Identification of Key Dimensions. *New Media & Society,* 2(2), 157–179.

Drucker, J., & McVarish, E. (2009). *Graphic design history: A critical guide.* Upper Saddle River, NJ: Pearson Prentice Hall.

Engholm, I. (2002). Digital style history: the development of graphic design on the internet. *Digital Creativity*, 13(4), 193–211.

Fairclough, N. (2000). *New labour, new language?* London: Routledge.

Fairclough, N. (2003). *Analysing Discourse: Textual analysis for social research.* London: Routledge.

Fallman, D. (2008). Triangles of Design Practice, Design Studies, and Design Exploration. *Design Issues*, 24(3), pp.4–18.

Florida, R. (2002). *The rise of the creative class*. New York: Basic Books.

Forlizzi, J., & Lebbon, C. (2002). From formalism to social significance in communication design. *Design Issues*, 18(4), 3–13.

Forlizzi, J., Zimmerman, J., & Evenson, S. (2008). Crafting a place for interaction design research in HCI. *Design Issues*, 24(3), 19–29.

Forty, A. (1986). Design, Designers and the Literature of Design. In A. Forty (Ed.) *Objects of Desire: Design and Society since 1750* (pp.241–245). New York: Thames and Hudson.

Frascara, J. (1995). Graphic design: Fine art or social science? In V. Margolin & R. Buchanan (Eds.), *The idea of design* (pp. 44–55): MIT Press.

Frascara, J. (Ed.). (1997). *User-centeredgraphic design: Mass communications and social change.* London: Taylor & Francis.

Frascara, J. (2004). *Communication design: Principles, methods and practice.* New York: Allworth Press.

Frascara, J. (2007). Hiding lack of knowledge: Bad words in design education. *Design Issues*, 23(4), 62–68.

Frascara, J. & Noël, G. (2012). What's missing in design education today? *Visible Language*, 46:1/2, 37–53.

Fulton Suri, J. (2003). Empathic design: user experience in product design. In I. Koskinen, K. Battarbee, and T. Mattelmäki (Eds.), *Empathic*

design: Informed and inspired by other people's experience (p.52). Helsinki, Finland: IT Press.

Fulton Suri, J. (2008). Informing our intuition design research for radical innovation. *Rotman Magazine*, 52–57.

Fyfe, G., & Law, M. (1988). *Picturing Power: Visual Depiction and Social Relations.* London: Routledge.

Gomez-Palacio, B., & Vit, A. (2009). *Graphic design, referenced: A visual guide to the language, applications, and history of graphic design*. Mass.: Rockport.

Gothelf, J. (2011). *Demystifying design*. A List Apart, 335. Retrieved December 15, 2011, from http://www.alistapart.com/articles/demystifying-design/

Grefé, R. (2000). *(Form + content + context) ÷ time = experience design.* New York: AIGA.

Ha, L., & James, L. (1998). Interactivity reexamined: a baseline analysis of early business web sites. *Journal of Broadcasting & Electronic Media*, 42(4), 457–474.

Hanington, B. (2003). Methods in the making: a perspective on the state of human research in design. *Design Issues*, 19(4), 9–18.

Harper, D. (2002). Talking about Pictures: A Case for Photo Elicitation. *Visual Studies*. 17(1), 13–26.

Helfand, J. (2001). Screen: Essays on graphic design, new media, and visual culture. New York: Princeton Architectural Press.

Heller, S. (2004). *Design Literacy: Understanding graphic design*, (2nd ed), Allworth Press, New York, 2004.

Heller, S. (2006a). Where's the criticism?. In M. Bierut, W. Drenttel & S. Heller (Eds.), *Looking closer five: Critical writings on graphic design* (pp. IX–XI). New York: Allworth Press.

Heller, S. (2006b). Better skills through better research. In A. Bennett (Ed.), *Design studies: Theory and research in graphic design* (pp. 10–13). New York: Princeton Architectural Press.

Hewett, T., Baecker, R., Card, S., Carey, T., Gasen, J., Mantei, M., Verplank, W. (2009). *ACM SIGCHI Curricula for Human-Computer Interaction*. Retrieved 24 October 2011 from http://old.sigchi.org/cdg/

Hewson, R. (1991). Deciding Through Doing: The Role of Sketching in Typographic Design. *ACM SIGCHI Bulletin* 23(4), 39–40.

Hollis, R. (2001). *Graphic design: A concise history*. (2nd ed.). London: Thames and Hudson.

Hollis, R. (2006). *Swiss graphic design: The origins and growth of an international style 1920–1965*. New Haven, CT: Yale University Press.

ICOGRADA. (2008). Leading Creatively. Defining the Profession. Retrieved 21 January 2012, from http://www.icograda.org/about/about.htm

Jensen, J.F. (1996). *Mapping the web: A media typology for information traffic patterns on the internet highway.* Paper presented at the WebNet96, San Francisco.

Jeon, J., White, R., Hunt, R., Cassano-Piché, A. & Easty, A. (2011, March). Optimizing the design of preprinted orders for ambulatory chemotherapy: Combining oncology, human factors, and graphic design. *Journal of Oncology Practice*, 97–103.

Julier, G. (2000). *The culture of design*. London: SAGE Publications.

Kepes, G. (1999 [1949]). Function in modern design. Reprinted in Bierut, M, Helfand, J, Heller, S & Poyner, R (Eds.), *Looking closer 3: Classic writings on graphic design* (pp. 98–103). New York: Allworth Press.

Knowles, C. & Sweetman, P., (2004). Introduction. In Knowles, C. and Sweetman, P. (Eds.), *Picturing the Social Landscape: Visual Methods and the Sociological Imagination* (pp.1–17). London: Routledge.

Kvale, S. (1996). Interviews: *An introduction to qualitative research interviewing.* Thousand Oaks, CA: SAGE.

Laurel, B. (1993). *Computers as theatre.* Reading, Massachusetts: Addison-Wesley.

Locher, P., Overbeeke, K. & Wensveen, S. (2010). Aesthetic interaction: A framework. *Design Issues,* 26(2), pp.70–79

Lupton, E. (1994). Low and high: Design in everyday life. In M. Bierut, W. Drenttel, S. Heller & D.K. Holland, (Eds.), *Looking closer: Critical writings on graphic design* (pp104–108). New York: Allworth Press.

Lupton, E. (2006 [2004]). The Birth of the User. In M. Bierut, W. Drenttel & S. Heller (Eds.), *Looking closer five: Critical writings on graphic design* (pp.23–25). New York: Allworth Press.

Manovich, L. (2001). *The language of new media*. Cambridge, Mass.: MIT Press

McCarthy, J., & Wright, P., (2004). *Technology as experience*. Boston, MA: MIT Press.

McCoy, K. (1995). Graphic Design in a Multicultural Word. In A. Bennett (Ed.), *Design studies: Theory and research in graphic design* (pp. 200–205). New York: Princeton Architectural Press.

McDonagh, D. (2008). Do it until it hurts! Empathic design research. *Design Principles and Practices: An International Journal*, 2 (3), 103–11.

McDermott, C. (2007). *Design: The key concepts*. New York: Routledge.

McGovern, G. (2007, 2009). *Gerry McGovern*. Retrieved 2010–2012, from http://www.gerrymcgovern.com/

McKerlie, D. (2001). Keynote II: User Centered design for the Mobile Web. *Procedia Computer Science,* 5, 36–37

McMillan, S., & Hwang, J.S. (2002). Measures of perceived interactivity: An exploration of the role of direction of communication, user control, and time in shaping perceptions of interactivity. *Journal of Advertising*, 31(3).

Meggs, P., & Purvis, A. (2006). *Megg's history of graphic design* (4th ed.). Hoboken, N.J.: John Wiley & Sons, Inc.

Moggridge, B. (1999). Expressing experiences in design. *Interactions* (July/August), 17–25.

Moggridge, B. (2007). *Designing interactions*. Cambridge, Mass: MIT Press.

Myerson, J. and Vickers, G. (2002). *Rewind 40 years of design and advertising*. London: Phaidon.

Naughton, J. (2012). *Graphic designers are ruining the web.* The Guardian. Retrieved May, 2012 from http://www.theguardian.com/technology/2012/feb/19/john-naughton-webpage-obesity.

Newbury, D. (2011). 34 Making Arguments with Images: Visual Scholarship and Academic Publishing. In Margolis, E. & Pauwels, L. (Eds.), *The SAGE handbook of visual research methods* (pp. 651–677). London: SAGE Publications Ltd.

Nini, P.J. (1996). What graphic designers say they do. *Information Design Journal*, 8, 181–188.

Nini, P.J. (2006). Sharpening one's axe: Making a case for a comprehensive approach to research in the graphic design process. In A. Bennett (Ed.), *Design studies: Theory and research in graphic design* (pp. 117-129). New York: Princeton Architectural Press.

Nielson J., & Rolf, M. (1990). *Heuristic evaluation of user interfaces*. Paper presented at the Proceedings of the SIGCHI conference on Human factors in computing systems: Empowering people, Seattle, Washington, United States. Retrieved April 18, 2009, from http://www.useit.com/papers/heuristic/heuristic_list.html

Nielson, J. (1999). *When Bad Design Elements Become the Standard*. Retrieved 16 September 2011 from http://www.useit.com/alertbox/991114.html

Nielson, J. (2000). *Designing web usability: The practice of simplicity*. Indianapolis: New Riders.

Norman, D., & Draper, S. (Eds.) (1986). *User centered system design: New perspectives on human-computer interaction*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Norman, D.A. (2002). *The Design of Everyday Things.* New York. Basic Books.

Oudshoorn, N., Rommes, E., & Stienstra, M. (2004). Configuring the user as everybody. *Science, Technology, & Human Values*, 29(1), 30–63.

Poggenpohl, S. (2009). Time for change: Building a design discipline. In Poggenpohl, Sharon and Keiichi Sato, *Design Integrations: Research and Collaboration* (pp. 3–22). Bristol, UK: Intellect.

Poyner, R (1991). Type and deconstruction in the digital era. In M. Bierut, W. Drenttel, S. Heller and D.K. Holland (Eds.), *Looking closer: Critical writings on graphic design* (pp. 83–88). New York: Allworth Press.

Rafaeli, S. (Ed.). (1988). *Interactivity: From new media to communication*. Newbury Park, CA: Sage.

Rafaeli, S., & Sudweeks, F. (1997). Networked interactivity. *Journal of Computer Mediated Communications*, 2(4).

Ragin, C. C. (2013). *The comparative method: Moving beyond qualitative and quantitative strategies: with a new introduction*, Oakland, CA: University of California Press.

Raisanen, M. (2012a). To connect with consumers, ditch the focus groups. Try acting instead. *Co.Design Weekly*. Retrieved 19th June, 2012, from http://www.fastcodesign.com/1670049/to-connect-with-consumers-ditch-thefocus-groups-try-acting-instead

Raisanen, M. (2012b). To innovate, you have to stop being a slave to data. *Co.Design* Weekly. Retrieved 19th June, 2012, from http://www.fastcodesign.com/1669090/to-innovate-you-have-to-stop-being-aslave-to-data

Rand, P. (1985). *A designer's art*. New Haven & London: Yale University Press.

Resnick, E. (2003). *Design for Communication: Conceptual graphic design basics.* Hoboken, New Jersey: John Wiley & Sons.

Rock, M. (1996, Spring). The designer as author. *Eye*, 20. Retrieved April, 2012, from http://www.eyemagazine.com/feature/article/the-designer-as-author.

Roth, S. (1999). The State of Design Research. *Design Issues*, 15(2), 18–26.

Saffer, D. (2010). *Designing for interaction: Creating smart applications and clever devices*. Berkeley, CA: New Riders.

Sanders, E. B.N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *CoDesign* 4(1), 5–18.

Schön, D. A. (1983). The Reflective Practitioner, Basic Books, New York.

Shedroff, N. (1994). *Information interaction design: A unified field theory of design.* Retrieved March 23, 2008, from http://www.nathan.com/thoughts/unified/3.html

Shedroff, N. (2001). *Experience design 1*. Indianapolis, Indiana: New Riders.

Shedroff, N. (2007). *Putting people first*. Core 77. Retrieved August 30, 2010, from http://www.experientia.com/blog/nathan-shedroff-on-making-meaning/

Siegel, D. (1996). *Creating killer websites: The art of third-generation site design.* Indianapolis, Indiana: Hayden Books.

Steuer, J. (1992). Defining virtual reality: dimensions determining telepresence. *Journal of Communication*, 42(4), 73–93.

Stolterman, E. (2008). The Nature of Design Practice and Implications for Interaction Design Research. *International Journal of Design,* 2(1), 55–65.

Storkerson, P. (2006). Communication research: Theory, empirical studies, and results. In A. Bennett (Ed.), *Design studies: Theory and research in graphic design* (pp. 158-178). New York: Princeton Architectural Press.

Strauss, A. & Corbin, J. (1998). *Basics of qualitative research*, (2nd ed.). Thousand Oaks, CA: SAGE.

Stromer-Galley, J. (2004). Where interactivity resides. *The Information Society*, 20, 391–394.

Sutcliffe, A. (2002). On the effective use and reuse of HCI knowledge. In J. M. Carroll (Ed.), *Human-computer interaction in the new millennium* (pp.3–29). New York: ACM Press Books.

Taylor, C. (1994). *Multiculturalism: examining the politics of recognition*. Princeton, NJ: Princeton University Press.

Unger, G. (1992). Legible? In M. Bierut, W. Drenttel, S. Heller and D.K. Holland (Eds.), *Looking closer: Critical writings on graphic design* (pp. 108–114). New York: Allworth Press.

Usher, R. (1997). Textuality and Reflexivity in Educational Research in D. Scott and

R. Usher (eds.), Understanding Educational Research, Routledge, London, p. 33-52.

Vaara, E. & Tienari, J. (2010). Critical discourse analysis. In Mills, A.J., Durepos, G. & Wiebe, E. (Eds.), *Encyclopedia of Case Study Research* (pp. 245–248). Thousand Oaks, CA: SAGE Publications.

Veen, J. (2001). *The art and science of web design*. Indianapolis, Indiana: New Riders.

Winograd, T., & Flores, F. (1986). *Understanding computers and cognition*. Norwood, NJ: Ablex Publishing Corporation.

Wodak, R. (2004). Critical discourse analysis. In C. Seale, G. Gobo, J. F. Gubrium and D. Silverman (Eds.), *Qualitative Research Practice* (pp. 197–213). London: Sage.

Young, A.S. (2005). *A genealogy of graphic design in Victoria.* (PhD), RMIT University, Melbourne.

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How Humans Process Visual Information: A focused primer for designing information

Lou Tetlan and Douglas Marschalek

Abstract

Data is presented identifying a major gap between two-dimensional (2D) communication modalities and actual learning of its content. It is proposed that information designers can create formats that are cognitively more effective by incorporating constructs from the cognitive sciences. In order to effectively design information for learning, an understanding of how the brain processes information is important and presented. In addition, application of cognitive constructs have the potential to guide designers in creating cognitive-based information designs (CID). Seven cognitive constructs are discussed that can directly impact the effectiveness of information formats.

Keywords

Communication, Cognitive-based Information Design (CID), information design, information processing, reading

Introduction

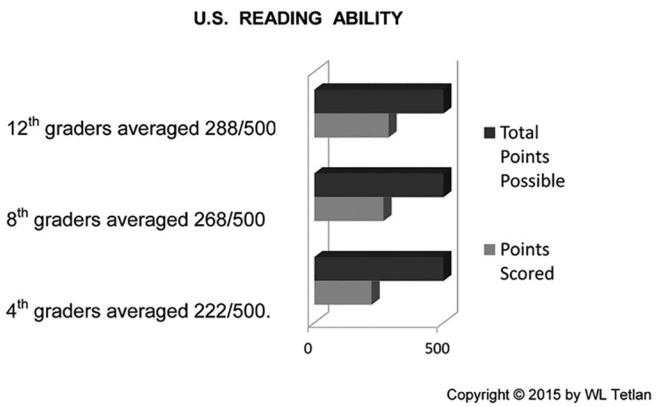
The ability to develop and understand written communication is a hallmark of human ingenuity. Over time Western cultures moved from simple scratches to pictorals and complex symbol systems that emerged as alphabets. As time progressed, written communication in the Western world became more dependent on forming words [text] with alphabets. Apparently word-forming alphabets provided needed clarity to symbol and image-based messages. (Dehaene, 2009)

The Gutenberg press and other tools for mass production of communication made text-based communications easier to create thus providing the vehicles for text to become increasingly dominant. In other words, Western communication became more reliant on text-based presentation of key concepts while images and symbols became less dominate.

At first, only selected populations were taught to read text. Today however, the majority of people in the Western world are taught how to read text. Since reading text is not an innate human ability such as walking or talking, special training is required. Statistics show that some people learn to read text easier than others**.** (See *figure 1*)

Figure 1

NAEP reading scores.



According to the 2013 National Assessment of Educational Progress (NAEP) report many U.S. high school students cannot read above 5th-grade level and 25% of seniors score below basic reading level. As shown in Figure 1, U.S. students scored well below the total 500 points possible within each grade level tested. During a similar period, an international comparison of students using a 1000 point scoring total, showed that U.S. students' average reading score was 498/1000 points, ranking the U.S. 20 out of 21 countries tested. (NAEP, U.S. Department of Education, 2013.) These statistics indicate the U.S. education system has a major communication

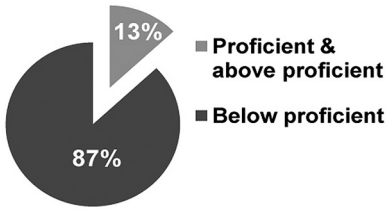
challenge in teaching reading literacy that needs to be further addressed.

Among those who can read text, statistics show that some understand text content better than others. The question is: What percentage of people in the U.S. can both read text and accurately understand its content? In other words, how many people are estimated to be proficient in reading literacy?[1]

Data from the U.S. Department of Education, National Center for Education Statistics' publication *The Condition of Education 2014* (NCES 2014-083) indicate that only 13% of adults were at or above *Proficient* in reading literacy. Conversely stated, 87% of adults rank *Below Proficient* in literacy ability. (See *figure 2*)

Figure 2

Adult literacy percentiles.



In this study literacy was defined as being able to use "… printed and written information to function in society, to achieve one's goals, and to develop one's knowledge and potential." The study identified 4 levels of performance:

"Below *Basic*, *Basic*, *Intermediate*, and *Proficient*…13 percent of adults were at or above *Proficient* (indicating they possess the skills necessary to perform complex and challenging literacy activities) in 2003." (NCES 2014-083)

Therefore, the number of readers in the U.S. who have difficulty reading or correctly interpreting text represents the majority of the adult population. It is a sad irony - at a time when our culture is being inundated with information – that the majority of U.S. citizens may have difficulty or can not properly interpret or correctly understand what they are reading. This poses a pivotal challenge to professionals whose job it is to effectively convey information using text.

Investigating Text Formats

Any number of variables could be contributing to this situation. Upon a review of research addressing this topic, it became apparent that com-

1 In this article 'reading comprehension' is defined as comprehending individual words and units of meaning while 'reading literacy' is the ability to transfer and understand how that knowledge fits into the larger arena of daily life.

paratively few scientific studies have focused on how information is being formatted for authentic, or everyday real-world, materials used for transmitting information.

Existing experimental cognitive research that has been applied to information design is often simplistic in form and not parallel to the complex imagery of learning and daily life. For example, one such stimulus was comprised of tilted T's, L's, X's and sideways T's placed among upright T's (Beck, Jacob 1974). Subjects were observed as to how they discriminated like shapes. This type of format would not normally be seen in authentic formats of reading material. Another such example shows a shape that looks like an upper case H tilting backwards therefore presenting the top end points of the H closer together than the bottom end points (Solso, R. L. 1999). Interpretation of whether the symbol is an A or an H can be dependent on what letters are placed on either side of the tilting H. For example, is the word 'CAT' or 'THE'? This exercise demonstrates how the brain may interpret the same letter in different ways depending upon its context. These examples are both valid but do not reflect the type of materials read in real life situations. Therefore we chose to take a closer look at how the formatting of information in authentic applications might impact reading literacy.

After several years of researching this issue, we posit that the way information is formatted may be as important to literacy, or understanding the content, as the content itself. Additionally, we posit that in order to increase reading literacy, experimental studies are needed focusing on how the formatting of words, images, shapes, space, and symbols affect the processing of information using authentic materials.

We acknowledge the need and importance of reading text-based material and whole-heartedly support continued efforts in improving reading skills. We also acknowledge that there are specific forms of reading materials that require a predominantly text-based format. However, text-based materials are not the only format for presenting information found in manuals, brochures, textbooks, posters, or when the topic addresses such subjects as science, technology, engineering, mathematics, or procedural knowledge. We propose that there is a significant need for a broader range of formats that could enable the other 87% of the population to more readily access and understand written content in two-dimensional (2D) format. Two such formats are: 1) visual-based formats, and 2) cognitive-based formats.

Visual-based formats present information through a fluid reading format that incorporate words, images, shapes, space and symbols. These visual-based design formats are known by a variety of names including but not limited to, information graphics (Lankow, Ritchie & Crooks, 2012), information architecture (Wurman, 1997; Wurman, Whitehouse, Sume & Leifer, 2001) and visual language[2] (Horn, 1998; Tufte, 1997) . For simplicity

2 The terminology 'Visual Language' has varied meanings to different groups. For some, it means comic book and/or graphic novel language, for others manual hand sign language, and yet others use this terminology when describing infants looking at written words.

sake, in this article, we refer to these types of information design as visual language. These formats have become increasingly common in popular culture. However, predominantly text-based formats remain the standard vehicle for transferring information when using 2D formats.

Cognitive-based formats present information using constructs from fields of science. The fields of science and those fields applying experimental scientific research methodologies that we looked at included cognitive psychology, educational psychology, neuroEducation, neuroscience, science of human development, and ophthamaology. Formats based on cognitive constructs from these fields present information in ways that parallel how humans are thought to actually process information, build knowledge, and facilitate recall. Designing these formats entails following specific constructs using words, images, shapes, space, and symbols.

Designs for information constituting visual-based formats may also contain various cognitive constructs – be it a result of intention, good design, or intuition. However, the cognitive-based formats are created solely based on vetted experimental scientific research findings, using only cognitive constructs to guide how each variable (words, images, shapes, space, and symbols) is used. From a reader's viewpoint, the untrained person may not be aware of whether the format being viewed is visual-based or cognitive-based. However, for those trained in cognitive-based formats, the differences between the two types of formats are readily apparent. While researching which cognitive constructs could be valuable tools for designing information, we noted similar principles discussed in graphic design literature. A synopsis of cognitive constructs and the complementary graphic design principles are shown in Table 1. The first column identifies the cognitive trigger each construct influences. The second column identifies the cognitive constructs.[3] The third column identifies complementary principles from graphic design.

Background

The following discussion addresses each of the seven cognitive constructs listed in Table 1, indicating the role each has in designing formats. These constructs affect essential elements for learning that can influence attention, knowledge-building, and recall. These constructs were the first ones we vetted and do not constitute a complete list.

3 The authors associated with each cognitive construct and graphic design principles are representative of a longer list of names associated with each construct and principle. Due to limited space in a Table only a few names could be included.

Table 1

Triggers Affecting	Cognitive Construct	Design Principle
Attention	**Attentional Capacity** is limited. Requiring a reader to combine and process components of information within the same visual unit can lead to shortened engagement and poor reading habits. LaBerge & Samuels (1974).	**Information Design Principles** format content to stay within memory units by using Compositional Semantic Fusion. This fusion focuses on combining words, images and symbols in discrete units. Horn (1998).
	Split Attention – When readers have to visually seek, find and combine information from multiple areas, processing time can double and interfere with learning cores material. Sweller (1994).	**Continuity and Proximity** – When information is not where readers expect to find it, confusion can result. Harris (2007).
	Cognitive Overload occurs when short term memory cannot process information due to too many different pieces of information being presented together. Sweller (1994).	**Overload Amnesia** occurs when too much information tries to infiltrate the memory. Cognitive overload can occur along with loss of arbitrary data. Wurman (2001).
Knowledge Building	**Information Processing Models** identify how the brain takes in sensory information, uses short term memory to build knowledge, stores and recalls long term memory. Siegler and Shipley (1995).	**Percept-Concept Integration** combine percepts (objects shown as visual images) and concepts (mental ideas shown as text) for ease of comprehension, retention, retrieval. Horn (1998).
	Schema Acquisition – Human brains organize information according to meaning. Bartlett (1932), Rumelhart (1980), Sweller (1994).	**Hierarchy** groups and sequences information making it easier to understand relevance, priority and order, helping to establish meaning. Holmes (1984), Shedroff (2001), White (2002).
	Prior Knowledge provides an attachment for new information and cues as to how to transfer and use that knowledge. Bransford, Brown and Cocking (1999).	**Making Connections** – "Failing to make connections between the known and the unknown prevents us from grasping new ideas…" Wurman, 2001, p. 261.
Recall	**Theories of Expertise** suggest that experts chunk information into meaningful units of understanding to facilitate recall. Bereiter and Scardamalia (1993), Dhillon (1998).	**Chunked Information** clusters words, images and symbols into meaningful units of memory-compatible information. Horn (1998), Shedroff (2001).

Attention Factors

Attentional Capacity.

Humans have a limited attention span (Cowan et al,1999; Healey & Miyake, 2009; LaBerge & Samuels,1974; Muller & Rabbitt,1989; Neely, 1977; Pass, 1992; Pomplun et al, 2001; Posner et al,1980; Rosenthal et al, 2006) that varies according to type of activity and working memory capability (McVay & Kane, 2012). In order to understand communication it is necessary to remain engaged long enough with the material in order for the brain to make sense of what it is seeing. Brain imaging studies have shown that the brain works

harder to make sense out of a word it does not know compared to a word it recognizes. The brain takes longer to identify unfamiliar words taxing our limited attention span.

In an effort to encourage readers to stay engaged with the material, using elements that can be interpreted more quickly than text, such as images and symbols, may prolong engagement. (Carney & Levin, 2002; Pelli et al, 2003; Horn 1998; Mayer &. Gallini, 1990; Mayer et al, 1996; Sweller, 2010.) Logic implies that longer engagement with content increases the probability of learning. When trying to teach someone about a new concept or procedure, speed of understanding the material may in turn contribute to further engagement. If new or topic-specific vocabulary is to be introduced in the material, it appears that these words may need to be introduced prior to seeing it in the context of the material in order to present information that is readily digestible; ready to be applied to prior knowledge and added to the readers vault of knowledge.

LaBerge and Samuels (1974) have stated that coordination of learner attention to the component processes of reading is crucial. If, for example, one component, perhaps decoding, requires too much attention, the limits of attentional capacity of the reader may result in poor comprehension or difficult-to-"cure" (non)reading habits.[4] (Chall, 1996) Therefore, the need for instructional material to capture readers' attention and keep them engaged is particularly important for readers who may need to be led into focused learning. Using cognitive constructs that have been scientifically proven to impact information processing may encourage increased engagement with the content presented. (Tetlan, 2013)

To date, text-based learning and information materials have primarily focused on the basic elements of language (e.g. word parts and types, sentence content and structure) with modest attention paid to the format and presentation of that content or the possible effect that format design might have on readers' overall comprehension. Current format of informational materials - e.g., manuals, worksheets, books, pamphlets - are often presented and structured in a primarily linear text format. In these formats lines of text consume the majority of the page and are tightly compact in a linear modality, creating the following:

- difficult to find information;
- the necessity for focusing on maintaining a long linear scanning sequence that disallows time for the brain to process the information;
- difficult to re-locate site of reading when the eyes momentarily shift from the point of reading.

Each of these can discourage continued engagement with the material. Based on what we now understand about the relationship between neural functioning, perception, and comprehension, it has become clear that these

4 According to Pugh et al (1997), 75% of third graders who are poor readers will still be poor readers in high school.

linear run-on formats do not mirror the neural functioning which directly impacts information comprehension, retention, and retrieval. (Dehaene, 2009; Horn 1998; Pelli et al, 2003; Sweller,1994,1989,1988.)

Another weakness of this format can be the placement of the image. Usually, the eye will be drawn to an image before text since the viewing capacity for shapes can be three times the size of capacity for viewing text.[5] (Mims, 2011) Therefore, placing an image to the right of text attracts the eye first to the image at the right, requiring the reader to visually backtrack to the left in order to read the text. This can weaken reader engagement due to limited attention span.

Split Attention

Split Attention refers to the necessity for readers to visually seek, find, and combine information found either on separate pages or in non-sequential areas of a single page that require physical/mental integration of the information in order to accomplish complete knowledge construction. (Ayres & Sweller, 2005; Levie & Lentz, 1982; Mandl & Levin, 1989) An example of this was found in a currently used text book that had images of an aircraft catching a space capsule while the text talked about propulsion, aerodynamics, structural engineering, Midas and Samos rockets, thrust, and military bases in England (Chester, 1960). The information in the visual images did not complement the information in the text of that page. However, the information relating to the images could be found on later pages, requiring the reader to seek out and combine the information.

Cognitive overload

Cognitive overload occurs when the brain cannot process what the eye is seeing due to receiving more cues than it is able to decipher. As discussed in more detail later in this article in the section on Information Processing, the brain can process only a certain amount of information at one time (3-7 items). When the incoming stimuli is more than the brain can process it can be overwhelming, encouraging disengagement with the material. (Sweller 1994; Moreno & Mayer 2000; Plass et al, 2003.) Sweller (1994) noted that the design of materials that considers "both intrinsic and extraneous cognitive load can lead to instructional designs generating spectacular gains in learning efficiency" (p.185). He further states that those designs causing extraneous cognitive load can be fatal to learning. (p. 226).

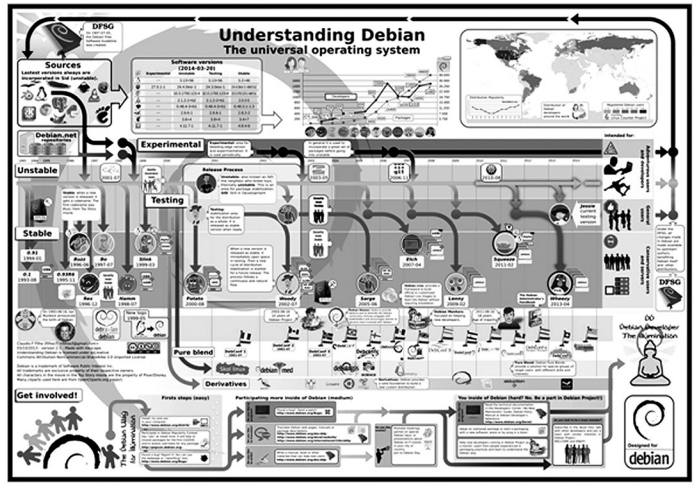
For example, Figure 3 illustrates how cognitive overload can occur when: the spacing of words, images and symbols are too uniformly spaced; there is no clear division of sub-topics (lack of chunking); no definitive hierarchy of information or identification of the 3-5 major points

5 Research into the human visual field indicates that we can clearly indentify shapes within a 30° range while text can only be clearly interpreted within a 5-10° range of the visual field.

to remember; and an overall high level of element interactivity. These are common problems with infographics. The example below is better than many infographics in its ability to guide patient readers through its use of symbols and color. For many viewers, this type of presentation of information contains too much information resulting in a type of brain freeze that discourages attention to the presented information. Attention is necessary in order for the brain to begin piecing the information together to gain understanding and build knowledge.

Figure 3

Example of Cognitive Overload.[6]



Another variable that leads to cognitive overload is Element Interactivity. This is an overuse of visual elements using lines, symbols, and color that are extraneous to the content. Any extraneous visual element, such as shadow boxes, can interfere with processing the intended content. Therefore, interactivity when not intrinsic to the content can impose a cognitive load that conversely interferes with learning. (Sweller, 2010).

The Cognitive Overload construct is important to the design of information. It basically states that the maximum load the human information-processing system can handle dictates the amount of information that can be successfully received. This suggests that designers reduce both the intrinsic and extraneous information in learning formats in order to limit cognitive overload. (Sweller et al, 1990) We can re-shape the design of information materials to reduce cognitive overload by:

- Deleting redundancies & using words concisely
- Grouping units of thought in spaces that the reader can visually take-in as a single unit of information

6 From Understanding Debian by Ferreira, Claudio, 2013 Infographic. http://cfnarede.com.br/infografico-do-debian. (Accessed November 5, 2015). Reprinted with permission.

- Limiting the number of fonts and colors used
- Balancing words with images, symbols and space
- Limiting the amount of lines and shapes used to only those that enhance understanding and flow of information.

Knowledge Building Factors

Information Processing Models

Information Processing Models provide a general framework for how information is processed. Information is perceived through our sensory organs (sight, hearing, touch, taste, smell). In this model, human brains have a capacity to hold 3-7 units of information at a time for a duration of 0.5 to 3 seconds. Those units that are captured and deemed relevant proceed to the brains working memory areas. Working memory can be maintained, in general, for 5 to 15 seconds. It is during this time that the brain is attempting to make sense of the units. In order for that to occur the brain will either attach the units to some form of prior knowledge or deem it irrelevant and proceed to delete the unit/s. Those connections made need to be repeated and rehearsed in order for that information to be encoded for longer-term memory.

Studies looking at the memory aspect of information processing reinforce that the brain spends only limited time in deciding whether the perceived units of information are important enough to pass on to working memory. Therefore, logic implies that units of information that take less time to decipher and provide clarity of relevant meaning are more likely to make it to the coding and recoding stages (working memory). This is one reason why pertinent images facilitate the uptake of information over text which can take longer to decode and recode.[7] Therefore, currently designed instructional materials which emphasize text over visual forms of information, may present information in ways that can create cognitive overload thereby lessening opportunities to learn. (Sweller,1994; Mayer et al,1996; Mayer & Moreno, 2003; Song & Schwarz, 2008)

Research performed by cognitive psychologists on methods of visual instruction suggests the potential for integrating visual-based interventions in learning acquisition. These cognitive psychologists include: Holley and Dansereau (1984) - effects of spatial elements on learning; Waddill, McDaniel and Einstein (1988) - inter-relationships of text and illustrations; Weidenmann (1989) - difference between effective and ineffective illustrations; Winn (1987) - effective use of diagrams, charts and graphs in learning materials; Carney and Levin (2002) - scoured decades of research and concluded that "Pictorial illustrations still improve students' learning

7 See Neuroscience and the Physiology of Reading later in this article for more detail on reading text.

from text" (p. 5); and Mayer and Moreno (2003) - addressed the processing of pictorial materials.

Decades of research by both psychologists Richard E. Mayer and John Sweller, give strong support to the need for materials to be designed for learning and not just for presenting information. Their separate and numerous studies have looked at cognition, working memory, and instructional designs. In research by Sweller pertaining to computer training manuals, one user group was given the traditional manual which required readers to split their attention between the manual, a video screen, and their keyboard while a second group was given modified manuals containing the pictures and image of a keyboard all visually located on one page. The results showed the group with the modified manuals took less time to learn the subject, scored higher on a test about the program, and displayed higher accuracy skills applying the program than the group using the traditional formatted manual.

Sweller summarized the relationship of formats for learning by noting that—

- (a) Schema acquisition is a major learning mechanism when dealing with higher cognitive functions; they are designed to circumvent our limited working memories while encouraging our highly effective long-term memories.
- (b) A limited working memory makes it difficult to assimilate multiple elements of information simultaneously.
- (c) Under conditions where multiple elements of information interact, they must be assimilated simultaneously.
- (d) A heavy cognitive load is imposed when dealing with material that has a high level of element interactivity.
- (e) High levels of element interactivity and resulting cognitive loads may be caused both by the intrinsic nature of the material being learned and by the method of presentation. (Sweller, 1994, 185)

Similar studies have been performed since Sweller's study that reiterate elements of his findings. (Brünken et al, 2003; Clark & Mayer 2003; Mayer 2002; Pollock et al, 2002; Mayer & Moreno, 2003.) These points illustrate the need to design information with cognition in mind. This includes presenting information in smaller chunks, or schemas that the brain can easily assimilate for long term memory.

Schema Acquisition

According to the developmental psychologist Jean Piaget (1958), a schema is a cognitive process whereby humans link incoming information to previously established units of similar information. It can be simple or elaborate. As new information is added to a previous schemata, that schemata becomes more complex. Schemata can be visualized as building blocks of knowledge. They organize information according to meaning, and thereby

chunk the meaning of the information in ways that scaffold, or help build, understanding. Therefore, the redesigning of learning material that incorporates meaningful schemata could be essential to presenting stable chunks[8] of information thereby increasing accuracy of learning.

Also linked to schema acquisition are other elements of design. Mayer and Gallini (1990) noted that theories of mental models (de Kleer & Brown, 1985; Gentner & Stevens, 1983; Kieras & Bovair, 1984; Larkin & Simon, 1987; White & Frederiksen, 1987) support two elements of illustrations, *system topology* and *component behavior*, that enable learners to "build runnable mental models" (p. 715). System topology identifies the components and labels them; component behavior identifies the components and how they change, naming the parts, steps and sequences. According to cognitive psychology then, instructional materials that identify the components being discussed with labels while showing the steps of changes or movement, their names and sequences of the concept being taught, could provide improved learning tools and more effective transfer of information.

Neuroscience and the Physiology of Reading.

Understanding how information is processed through the eye-brain continuum provides a context for why properly designed materials could be a key factor in learning and improving reading literacy. The following section provides a discussion on the eye; how it transports what it sees (stimuli) to the brain; and what the brain does with that data in order to be able to interpret the stimuli. If the way we are designing information is contrary to the processes of the eye – brain continuum, then perhaps knowing this, can influence creating designs that are better aligned with how the brain actually processes information.

This discussion starts at the beginning of perception - with the way we see.[9] Since the mid-1900's neuroscience researchers such as Roger Sperry (1968, 1974, 1986) and S.M. Kosslyn, J. D. Holtzman, M. J. Farah, Gazzaniga, M.S. (1985) have used brain- imaging techniques to examine how adults perceive the world. Research on human perception, especially in areas concerning the functioning of the eye and brain in the perception of information, is quite well understood. (Fanf & He, 2005; Hubel & Wiesel, 1962; Kreiman et al, 2000; Dehaene, 2009; and Batterink & Neville, 2013)

The first level of processing visual information is in the retina. Stimuli from the viewed information travels through the optic nerve via the

8 Stable chunks of information combine elements in ways that leave little room for misinterpretation of meaning. Unstable information allows the reader to arrange meaning according to the reader's discretion and not necessarily according to the intended meaning.

9 This is a literal reference to 'seeing'. Although blind people can read by 'seeing' through touch, 'seeing' in that context is considered to be figurative. However, recent brain research indicates that it is quite plausible that through the sense of touch, blind people actually can see the word in their brain.

lateral geniculate or superior colliculus. The next level of processing occurs within the brain itself. However, "(w)hereas, the eye processes information sequentially, the brain is thought to do so in parallel operation". (Solso, 1999, 26) From the optic nerve, information "…is relayed 1) to the amygdala in the limbic system, for emotional analysis, and 2) to the visual cortex, two credit-card-sized areas in the occipital lobes…" (Sylwester, 1995, p.62)

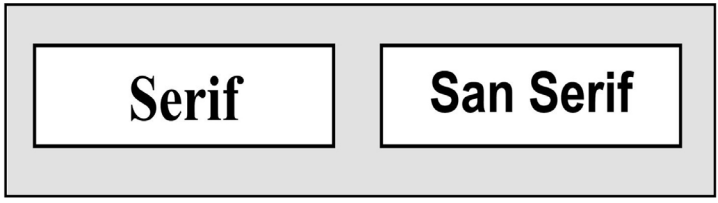
"The visual cortex responds to different stimuli in different areas of the cortex..." (Hubel & Wiesel, 1965, 1979.) In Hubel's (1963) words "Each cell seems to have its own specific duties; it takes care of one restricted part of the retina, responds best to one particular shape of stimulus and to one particular orientation." It processes the neural information into simple forms and shapes (Solso, 1999, 38) which are analyzed

> "…according to primitive features, such as vertical and horizontal elements, angles, and curves (which) are 'recognized' and 'classified' and dispatched to other parts of the brain…" (Solso, 1999, 6). The purpose of this is "…for higher order processing which requires the neuron messaging to be combined with previous knowledge for further interpretation" (Solso, 1999, 30). (McClelland & Rumelhart, 1981; Dehaene, 2009; Friederici, 2011)

One element that needs to be visually deciphered while reading are words and the letters that make up those words. Due to the importance of limited attention span a valid question is, which font type is more efficient for the visual cortex to decode? Serif or san serif?[10] (See *figure 4*)

Figure 4

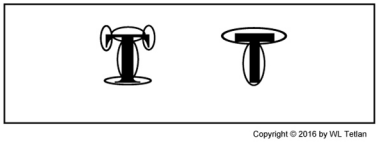
Example of serif and san serif fonts.



Serif fonts have extraneous decorative elements added to the vertical and horizontal structure of the letterform whereas san serif fonts do not. (See Figure 5.) Because the brain needs to tease apart each line of a letter, it therefore reasons that more time and effort are required for the brain

Figure 5

Lines in a font.



to interpret serif fonts than sans serif. (Pelli et al, 2003; Wogalter et al, 2005.) For instance, as seen in Figure 5, a serif 'T' has five lines to decode while a sans serif 'T' has only two. For example, the following sentence is presented first in a serif and then a san serif font:

10 'Serif' comes from the Dutch word schreef meaning 'line'.

The little red fox turned pink when feeling shy.

[serif example]

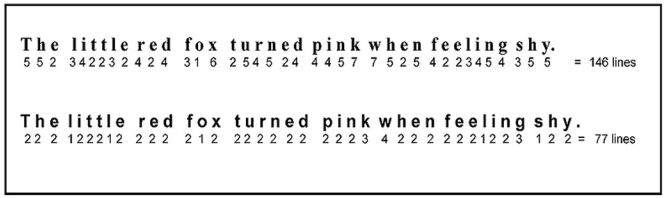
The little red fox turned pink when feeling shy.

[sans serif example]

When each of the letters in the serif font are broken down into individual lines, the sentence is found to contain 146 separate lines that the visual cortex needs to decode. Below is the serif sentence with corresponding numbers beneath each letter representing the number of lines each letter has to decode. In comparison, the same sentence using a sans serif font contains only 77 lines to decode. (See *figure 6*)

Figure 6

Counting letter lines in fonts.

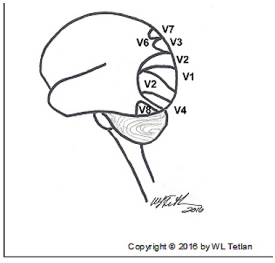


Therefore, in theory reading the sans serif font would be more efficient than reading the serif font thereby consuming less of the readers limited attention span. In this case, the sans serif sentence is nearly twice as efficient to decode than is the sentence using the serif font. These statements are based on logic. Actual text reading performance depends on the interaction of many factors including font familiarity.

When stimuli reaches the visual cortex, the brain sorts the cues into categories. Rita Carter (1999) summarizes the identified areas of the visual cortex as follows (see Figure 7): "... V1 – general scanning; V2 – stereo vision; V3 – depth and distance; V4 – colour; V5 – motion; V6 – determines objective (rather than relative) position of object; 'Where?' path: V1-V2-V3-V5-V6; 'What?' path: V1- V2 - V4." (p.112.)

Figure 7

'V' locations in the brain.[11]



Other studies have focused on the ways in which perceived information is configured in the brain with attempts to document the loci

11 V5 deals with motion and not the processing of 2D reading materials and therefore is not included.

of specific activities. (Kreiman et al, 2000; MIT, 1996; Roska & Werblin, 2001) These studies indicate that there is a difference in loci between reading words and making sense of them. In addition, when viewing a word the brain engages eight different processes in order to understand it's meaning: phonological processing; subvocal articulation; word meaning; color perception; making grammatical judgment about word gender; syntactic (sentence-level) processing; suppression of lexical properties of written words; and word-level orthography (visual word form) processing. This entire visual process, from the time stimuli enters the eye until the brain makes sense of it takes less than 1/3 of a second or c. 300 msec (Solso, 1999, 34). This is an initial perceptual response to visual stimuli that triggers higher order cognitive processes resulting in more complex meaning making. (Hempenstall, 2006; Kamitani & Tong, 2005; Richards, et al 2006)

Prior Knowledge

Prior Knowledge refers to that knowledge already stored in long term memory. In order for new information to obtain meaning, it needs to attach itself to prior knowledge. Therefore, if the new information is to be attached to the correct unit of prior information, designs need to include some trigger that evokes that prior knowledge. Providing links that activate prior knowledge have shown an increase in learning. (Gurlitt & Renkl, 2010; McNamara, 2001) Without triggers, the reader is left to evoke whatever unit of prior knowledge they think the new information should be attached to or deem it irrelevant and be dismissed. Presenting information without a link to the proper unit of prior knowledge is another form of presenting unstable information. This can lead to inaccurate understanding of the information, be it: a process to follow; the purpose of a product; or the place (unit) the information should be grouped with and stored. If the prior knowledge evoked is not compatible with the new information, prior knowledge may override the new information (Alvermann et al,1985; van Loon et al, 2013) resulting in non-effective transfer of information.

Ways to activate prior knowledge include, but are not limited to: discussion of topic prior to seeing new information; visuals that stimulate memory; written questions; and providing worksheets or visuals that require readers to link associated topics or sub-topics. (Schmidt et al, 1989; Pressley et al, 1992)

Recall Factor

Theories of Expertise

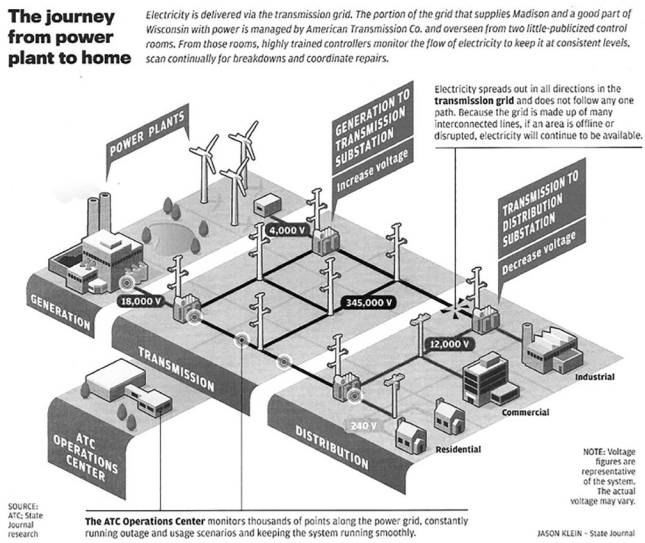
Theories of Expertise note that experts facilitate information retrieval (recall) by grouping, or chunking, information. (Bereiter & Scardamalia,1993)

Formats that visually chunk information scaffold a reader's ability to store information accurately and make long-term retrieval of that information more likely. Chunking information appropriately in a visual format "incorporates two or more elements into a single element, [and thus] reduces extraneous cognitive load and enhances learning" (Sweller, 1994, 193).

Figure 8 is an example of how information can be chunked into meaningful and easily digestible units of information. Notice how the overall visual image has been divided into 3 units. Each of these three major units are further divided into 3-4 units of information. A combination of words, images, symbols and space have been applied unifying the chunks. Lines and shapes were limited to only those that facilitated understanding and flow of information.

Figure 8

Example of chunking information.[12]



Conclusion

There are no templates for using the cognitive constructs discussed in this article. The final design will depend on: the topic; the viewers developmental age and anticipated prior knowledge; which 2D format is being used e.g., print, multimedia; and what the designer is attempting to achieve with the information.

12 From "The journey from power plant to home" by J. Klein, (2012) Wisconsin State Journal, Vol. 172 No.22, page A1. Copyright (2012) by the Wisconsin State Journal. Reprinted with permission.

Also, there are more cognitive constructs that apply to the processing of information than the seven constructs presented in this article. The seven selected have direct implications on how we present information for learning. Decades of research on how humans process information have provided us with insights into how the brain processes such information. Though there is much to be learned yet, we can begin to apply constructs that have been accepted by researchers and their respective fields in order to present information with better stability and clarity.

In this article we have proposed that formats designed using such constructs could be an important key to improving reading literacy and learning with effective transfer and retention of information. Design formats based upon these constructs have the potential to positively influence reading literacy for 87% of adults who rank *Below Proficient* in literacy ability (data from the U.S. Department of Education, National Center for Education Statistics' publication *The Condition of Education*.)

These constructs can serve as guidelines when designing visual information formats. Consciously applying relevant cognitive constructs to create units of graphic content that parallel how we process information may be the paradigm shift that could improve communication and facilitate transfer of stable information across a wider population of readers.

References

Alvermann, D. E., Smith, L. C. & Prior, J. E., 1985. Knowledge Activation and the Comprehension of Compatible and Incompatible Text. *Reading Research Quarterly*, Issue 20.4, 420-436.

Ayres, P. & Sweller, J., 2005. The split-attention principle in multimedia learning. In R. E. Mayer (Ed.), *The Cambridge handbook of multimedia learning*. Cambridge, Eng: Cambridge University Press, 135-167.

Batterink, L & Neville, H. J., 2013. The Human Brain Processes Syntax in the Absence of Conscious Awareness. *The Journal of Neuroscience*, Issue 33.19, 8528-8533.

Beck, Jacob, 1974. Relation between similarity grouping and peripheral discriminability. *Journal of Experimental Psychology*, Issue 102(6), 1145-1147.

Bereiter, C., & Scardamalia, M., 1993. *Surpassing Ourselves: An Inquiry into the Nature and Implications of Expertise*. Chicago: Open Court Publishing Company.

Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds.), 1999. *How people learn: Brain, mind, experience, and school*. Washington, DC: National Research Council.

Brünken, R., Plass, J. L. & Leutner, D., 2003. Direct measurement of cognitive load in multimedia learning. *Educational Psychologist*, Issue 38, 53–61.

Carney, R. N. & Levin, J. R., 2002. Pictorial illustrations still improve students' learning from text. *Educational Psychology Review*, Issue 14.1, 5–26.

Carter, R., 1999. Mapping the Mind. Berkeley and Los Angeles, CA: University of California Press.

Chall, J. S., 1996. *Stages of reading development*. Fort Worth, TX: Harcourt, Brace & Company.

Chester, M. & Kramer, S., 1960. *Discoverer: The Story of a Satellite*. New York: G.P. Putnam's Sons, 111.

Clark, R. C. & Mayer, R. E., 2003. *E-learning and the science of instruction*. San Francisco: Jossey-Bass.

Cowan, N., Nugent, L. D., Elliott, E.M., Ponomarev, I. & Saults, J. S., 1999. The Role of Attention in the Development of Short-Term Memory: Age Differences in the Verbal Span of Apprehension. *Child Development*, Issue 70.5, 1082–1097.

Dehaene, S., 2009. *Reading in the Brain: The new science of how we read*. New York: The Penguin Group.

deKleer, J. & Brown, J.S., 1985. A qualitative physics based on confluences. In D.G. Bobrow (Ed.), *A qualitative physics based on confluences*. Cambridge, MA: MIT Press, 7-83.

Dhillon, A. S., 1998. Individual Differences Within Problem-Solving Strategies Used in Physics. *Science Education*, Issue 82, 379-405.

Fanf, F. & He, S., 2005. Cortical responses to invisible objects in the human dorsal and ventral pathways. *Nature Neuroscience*, Issue 8, 1380-1385.

Friederici, A. D., 2011. The Brain Basis of Language Processing: From Structure to Function. *Physiological Reviews*, Issue 91.4, 1357-1392.

Gentner, D. & Stevens, A. L., 1983. *Mental models*. Hillsdale, NJ: Erlbaum.

Gurlitt, J. & Renkl, A., 2010. Prior knowledge activation: how different concept mapping tasks lead to substantial differences in cognitive processes, learning outcomes, and perceived self-efficacy. *Instructional Science*, Issue 38.4, 417-433.

Harris, R., 2007. *The Elements of Visual Style*. New York: Houghton Mifflin Company.

Healey, K. M. & Miyake, A., 2009. The role of attention during retrieval in working-memory span: A dual-task study. T*he Quarterly Journal of Experimental Psychology*, Issue 62.4, 733-745.

Hempenstall, K., 2006. What brain research can tell us about reading instruction. Learning Difficulties. *Australia Bulletin*, Issue 38.1, 15-16.

Holley, C. D. & Dansereau, D. F. (Eds), 1984. *Spatial learning strategies*. San Diego, CA: Academic Press.

Holmes, Nigel, 1984. *Designer's Guide to Creating Charts and Diagrams*. New York: Watson-Guptill.

Horn, R., 1998. *Visual Language: Global Communication for the 21st Century*. Bainbridge Island, WA: MacroVU, Inc.

Hubel, D. H., 1963. The Visual Cortex of the Brain. *Scientific American*, Issue 209. 5, 54-63.

Hubel, D.H. & Wiesel, T.N., 1962. Receptive Fields, Binocular Interaction and Functional Architecture in the Cat's Visual Cortex. *Journal of Physiology*, Issue 160.

Hubel, D. H. & Weisel, T.N. 1965. Receptive Fields and Functional Architecture in Two Nonstriate Visual Areas (18 and 19) of the Cat. *Journal of Neurophysiology*, Issue 28.2, 229-289.

Hubel, D. H. & Weisel, T. N., 1979. Brain Mechanisms of Vision. *Scientific American*, 150-162.

Kamitani, Y & Tong, F., 2005. Decoding the visual and subjective contents of the human brain. *Nature Neuroscience*, Issue 8, 679 – 685.

Kieras, D. E. & Bovair, S., 1984. The role of a mental model in learning to operate a device. *Cognitive Science*, Issue 8, 255-274.

Kosslyn, S.M., Holtzman, J.D., Farah, M.J. & Gazzaniga, M.S., 1985. A Computational Analysis of Mental Image Generation: Evidence From Functional Dissociations in Split-Brain Patients. *Journal of Experimental Psychology*: General, Issue 114.3, 311-341.

Kreiman, G., Koch, C. & Fried, I., 2000. Imagery neurons in the human brain. *Nature* Issue 408, 357-36.

LaBerge, D. & Samuels, S.J.,1974. Toward a theory of automatic information processing in reading. *Cognitive Psychology*, Issue 6, 293-323.

Lankow, J., Ritchie, J. & Crooks, R., 2012. *Infographics: The power of visual storytelling*. Hoboken, NJ: Wiley & Sons.

Larkin, J. H. & Simon, H.A. 1987. Why a diagram is (sometimes) worth a thousand words. *Cognitive Science*, Issue 11, 65-99.

Levie, W. H. & Lentz, R., 1982. Effects of text illustrations: A review of research. *Educational Communication and Technology Journal*, Issue 30, 195-232.

Mandl, H. & Levin, J. R., (Eds.) 1989. *Knowledge Acquisition from text and pictures*. Amsterdam: Elsevier.

Mayer, R. E., 2002. *Teaching for meaningful learning*. Upper Saddle River, NJ: Prentice Hall.

Mayer, R. E., Bove, W., Bryman, A., Mars, R. & Tapangco, L., 1996. When Less is More: Meaningful Learning from Visual and Verbal Summaries of Science Textbook Lessons. *Journal of Educational Psychology*, Issue 88.1, 64-73.

Mayer, R. E. & Gallini, J. K., 1990. When Is an Illustration Worth 10,000 Words? *Journal of Educational Psychology*, Issue 82.4, 715-726.

Mayer, R. E. & Moreno, R., 2003. Nine Ways to Reduce Cognitive Load in Multimedia Learning. *Educational Psychologist*, Issue 38.1, 43–52.

McClelland, J. L. & Rumelhart, D. E., 1981. An Interactive Activation Model of Context Effects in Letter Perception: I. An account of basic findings. *Psychological Review*, Issue 88, 375-407.

McNamara, D. S., 2001. Reading both high-coherence and low-coherence texts: Effects of text sequence and prior knowledge. Canadian *Journal of Experimental Psychology/Revue*, Issue 55.1, 51-62.

McVay, J.C. & Kane, M.J., 2012. Why Does Working Memory Capacity Predict Variation in Reading Comprehension? On the Influence of Mind Wandering NS Executive Function. J*ournal of Experimental Psychology* Gen, Issue 141.2, 302-320.

Mims, C. 2011. Augmented Reality Interface Exploits Human Nervous System. *MIT Technology Review*. http://www.technologyreview.com/view/423575 (Accessed July, 14, 2015).

Moreno, R., & Mayer, R. E., 2000. A coherence effect in multimedia learning: the case for minimizing irrelevant sounds in the design of multimedia messages. J*ournal of Educational Psychology*, Issue 92, 117–125.

Muller, H. J. & Rabbitt, P. M. A., 1989. Reflexive and Voluntary Orienting of Visual Attention: Time Course of Activation and Resistance to Interruption. J*ournal of Experimental Psychology: Human Perception and Performance*, Issue 15. 2, 315-330.

National Assessment of Educational Progress (NAEP). 2013. U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. https://nces.ed.gov/nationsreportcard/reading (Accessed January, 23, 2015).

Neely, J. H., 1977. Semantic Priming and Retrieval from Lexical Memory: Roles of Inhibitionless Spreading Activation and Limited-Capacity Attention. *Journal of Experimental Psychology*: General, Issue 106.3, 226-254.

Paas, F., 1992. Training strategies for attaining transfer of problem solving skill in statistics: A cognitive-load approach. *Journal of Educational Psychology,* Issue 84, 429-434.

Pelli, D. G., Farell, B. & Moore, D. C., 2003. The remarkable inefficiency of word recognition. *Nature*, Issue 423, 752-756.

Piaget, J., 1958. *Logic and psychology*. New York: Basic Books.

Plass, J. L., Chunb, D. M., Mayer, R. E. & Leutner, D., 2003. Cognitive load in reading a foreign language text with multimedia aids and the influence of verbal and spatial abilities. *Computers in Human Behavior*, Issue 19, 221–243.

Pollock, E., Chandler, P. & Sweller, J., 2002. Assimilating complex information. *Learning and Instruction*, Issue 12, 61–86.

Pomplun, M., Reingold, E. M. & Shen, J., 2001. Investigating the visual span in comparative search: the effects of task difficulty and divided attention. *Cognition*, Issue 81, 57- 67.

Posner, M. I., Snyder, C. R. & Davidson, B. J., 1980. Attention and the detection of signals. *Journal of Experimental Psychology*: General, Issue 109, 160-174.

Pressley, M., Wood, E., Woloshyn, V.E., Martin, V., King, A. & Menke, D., 1992. Encouraging Mindful Use of Prior Knowledge: Attempting to Construct Explanatory Answers Facilitates Learning. *Educational Psychologist*, Issue 27.1, 91-109.

Pugh, K. R., Shaywitz, B. A., Shaywitz, S. E., Shankweiler, D.P., Katz, L., Fletcher, J.M., Skudlarski, P., Fulbright, R.K., Constable, R.T., Bronen, R.A., Lacadie, C., Gore, J. C., 1997. Predicting Reading Performance from Neuroimaging Profiles: The Cerebral Basis of Phonological Effects in Printed Word Identification. *Journal of Experimental Psychology: Human Perception and Performance*, Issue 23.2, 299-318.

Richards, T.L., Aylward E, Berninger V, Field K, Parsons A, Richards A, Nagy W., 2006. Individual fMRI activation in orthographic mapping and morpheme mapping after orthographic or morphological

spelling treatment in child dyslexics. *Journal of Neurolinguistics*, Issue 19.1, 56-86.

Rosenthal, E. N., Riccio, C. A., Gsanger, K. M. & Jarratt K. P., 2006. Digit Span components as predictors of attention problems and executive functioning in children. Clinical Neuropsychology, Issue 21.2, 131–139.

Roska, B. & Werblin, F., 2001. Vertical Interactions across ten parallel, stacked representations in the mammalian retina. *Nature*, Issue 410.6828, 583-588.

Rumelhart, D. E., 1980. Schemata: the building blocks of cognition. In: R.J. Spiro et al. (Eds) T*heoretical Issues in Reading Comprehension*. Hillsdale, NJ: Lawrence Erlbaum.

Schmidt, H. G., De Volder, M. L., De Grave, W. S., Moust, J. H. & Patel, V. L., 1989. Explanatory Models in the Processing of Science Text: The Role of Prior Knowledge Activation Through Small-Group Discussion. *Journal of Educational Psychology*, Issue 81.4, 610-619.

Shedroff, N., 2001. *Experience design*. Indiana: New Riders.

Siegler, R. S. & Shipley, C., 1995. Variation, Selection, and Cognitive Change. In *Developing Cognitive Competence: New Approaches to Process Modeling*. Simon & Halford (Eds). Hillsdale, NJ: Erlbaum.

Solso, R. L., 1999. *Cognition and the Visual Arts*. USA: MIT Press.

Song, H. & Schwarz, N., 2008. If It's Hard to Read, It's Hard to Do: Processing Fluency Affects Effort Prediction and Motivation. *Psychological Science*, Issue 19.10, 986-988.

Sperry, R. W., 1968. Hemisphere disconnection and unity in conscious awareness. *American Psychologist,* Issue 23, 723-33.

Sperry, R.W., 1974. Hemispheric specialization: scope and limits in F.O. Schmitt and Frederic G. Worden (Eds.), *Neuroscience: Third Study Program. Cambridge*, MA: MIT Press.

Sperry, R., 1986. The new mentalist paradigm and ultimate concern. *Perspectives in Biology & Medicine*, Issue 29.3, 413-422.

Sweller, J., 1988. Cognitive load during problem solving: Effects on learning. *Cognitive Science*, Issue 12, 257-285.

Sweller, J., 1989. Cognitive technology: Some procedures for facilitating learning and problem solving in mathematics and science. *Journal of Educational Psychology*, Issue 81, 457-466.

Sweller, J., Chandler, P., Tierney, P. & Cooper, M., 1990. Cognitive load as a factor in the structuring of technical material. *Journal of Experimental Psychology: General, Issue* 119, 176-192.

Sweller, J. & Paul, C., 1994. Why Some Material is Difficult to Learn. *Cognition and Instruction,* Issue 12.3, 185- 233.

Sweller, J., 2010. Element interactivity and intrinsic, extraneous, and germane cognitive load. *Educational Psychology Review*, 22, 123-138.

Sylwester, R., 1995. *A Celebration of Neurons: An Educator's Guide to the Human Brain.* Alexandria, VA: Association for Supervision and Curriculum Development.

Tetlan, W. L., 2013. Applying Design to Learning: Cognitive Science Research Supports Visual Language Principles in the Design of Effective Educational Reading Materials. *DRS//Cumulus 2nd International Conference for Design Education Researchers, Vol. 2*, 829-845.

Tufte, E., 1997. *Visual Explanations: Images and quantities, evidence and narrative.* Cheshire, CT: Graphic Press.

U.S. Department of Education, National Center for Education Statistics, 2014. *The Condition of Education 2014* (NCES 2014-083).

van Loon, M.H. de Bruin, A. B., van Gog, T. & van Merriënboer, J.J., 2013. Activation of inaccurate prior knowledge affects primary-school students' metacognitive judgements and calibration. *Learning and Instruction*, Issue 24, 5-25.

Waddill, P. J., McDaniel, M. A. & Einstein, G. O., 1988. Illustrations as adjuncts to prose: A text-appropriate processing approach. *Journal of Educational Psychology*, Issue 80, 457-464.

Weidenmann, B., 1989. When good pictures fail: An information-processing approach to the effects of illustrations. In H. Mandl & J. R. Levin (Eds), *Knowing acquisition from text and pictures*. Amsterdam: Elsevier, 157-171.

White, A., 2002. *The Elements of Graphic Design.* New York: Allworth Press.

White, B. Y. & Frederiksen, J. R., 1987. Qualitative models and intelligent learning environments. In R. W. Lawler & M. Yazdani (Eds.), *Artificial intelligence and education: Vol. 1. Learning environments and tutoring systems.* Norwood, NJ: Ablex, 281–305.

Winn, B., 1987. Charts, graphs, and diagrams in educational materials. In D. M. Willows & H. A. Houghton (Eds.), *The psychology of illustration: Vol. 1*. New York: Springer-Verlag, 152-198.

Wogalter, M. S., DeJoy, D. M., Laughery, K. R., (Eds.), 2005. *Warnings and Risk Communication*. Philadelphia: Taylor & Francis Inc.

Wurman, R. S., 1997. *Information Architects.* New York: Watson-Guptill Publications Inc.

Wurman, R., Whitehouse, K., Sume, D. & Leifer, L., 2001. *Information anxiety 2*. Hayden, Quebec: Pearson Education.

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Visible Language call for papers:

Visible Language as social commentary

In October 2016 Colombians voted to reject a peace agreement. In response artist Doris Salcedo designed a public typographic project in which volunteers wrote the names of over 2,000 victims of the fighting on large pieces of white cloth spread over the ground of the public square in Bogota. (https://www.theguardian.com/world/2016/oct/12/colombia-war-art-project-bogota-doris-salcedo)

Visual Language is employed constantly in public discourse both by those in official positions and by those offering social commentary. For example, in 2016 communication design advanced the selection a president in the USA and the exit of Britain from the EU. Designers clearly play a role in shaping the discourse, but what responsibility do they have, if any, beyond crafting effective messages for clients? What new roles are designers taking beyond service to clients that contribute social commentary? In crafting messages are there ethical principles that should guide designers' visualization of information to make those visualizations honest by including relevant context for example? Are there visual symbols that should not be used or ways that symbols should be used respectfully, or not used?

The journal *Visible Language* calls for research and papers reporting research to analyze the role communication design plays in public discourse. We seek thoughtful analysis that amounts to a reflection on practice. We invite case studies of individual projects that are analyzed in context or are evaluated as to outcomes.

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Visible Language call for papers:

Hermeneutics, Communication theory, and Visible Language

Semiotics theory has informed communication design for decades while the discourse surrounding communication in other disciplines has shifted from the transmission of information to the formation of meaning. Hermeneutics, the study of how meaning is formed, has engaged in a lively evolution in the past 80 years from Schleiermacher's analysis of historical contexts authorial intent to the displacement of original meaning by the reader's construction or deconstruction of meaning through engagement with a text, as described by Derrida.

Hermeneutics offers both actionable steps and philosophical cognitive models that are significant for communication designers and worthy of more study. "The author is dead" Barthes wrote. If the author is dead, can the designer be far behind? What is the current state of design thinking on communication theories? Is semiotic theory, largely based on linguistics, an apt basis for visible language? How do hermeneutic guidelines relate to design research methods? Which hermeneutic models best inform designers creation of communication objects? What theoretical and practical communication models are currently taught in schools? How are theoretical models employed in practice?

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