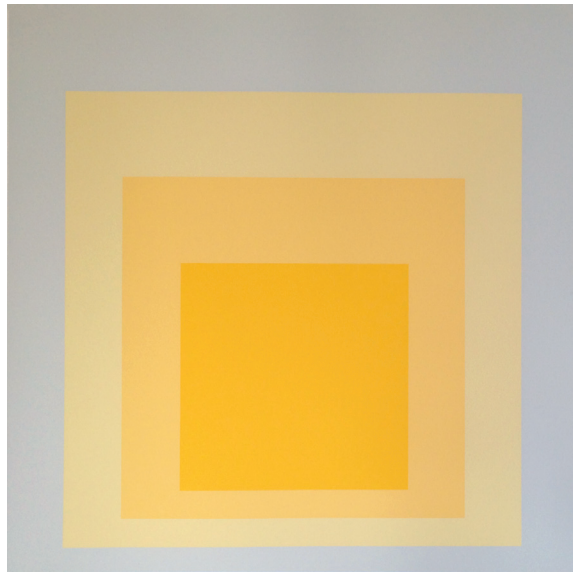
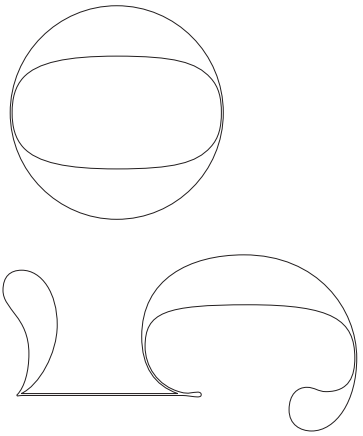


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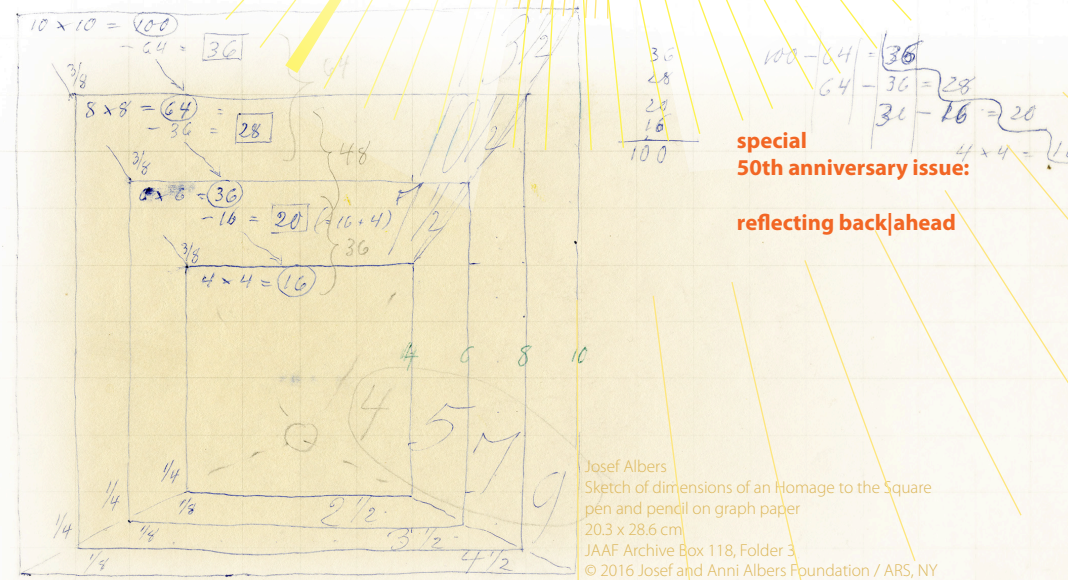
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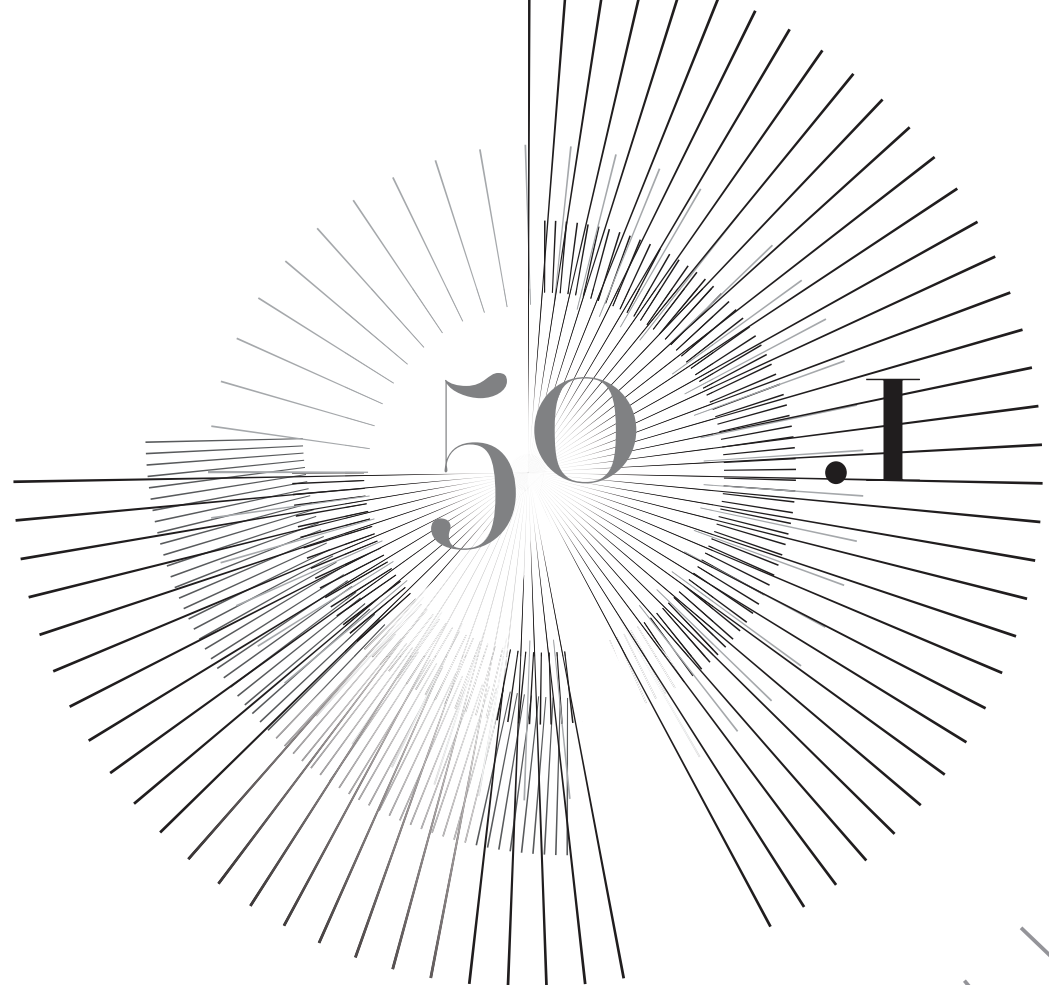


special
50th anniversary issue:

reflecting back|ahead

Josef Albers
Sketch of dimensions of an Homage to the Square
pen and pencil on graph paper
20.3 x 28.6 cm
JAAF Archive Box 118, Folder 3
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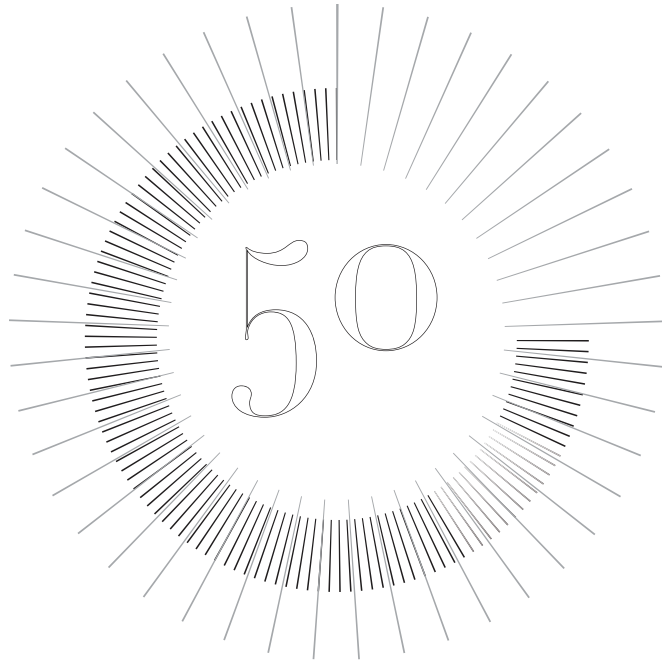
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A lot of design has happened in the 50 years since *Visible Language* was founded: typesetters – gone; desktop publishing – a passing blip; computers – moved from desktop to pocket. The term graphic design had hardly entered the dictionary before the discipline started to consider renaming itself visual communication design or just communication design. Because communication continues to grow in quantity and importance there's no reason to disbelieve in a promising future for a communication design discipline. What the promising design future looks like is, as always, sketchy. A well-known 20th century Danish proverb states that predictions are easy except when they involve the future and George Santayana famously warned of the trouble that awaits failure to examine the past. If we take Santayana's statement less as a warning than as a prescription to guide action, we might reflect thoughtfully on the past in order to plan our steps today to help shape a future the Danes say is so difficult to predict. Reflecting on the past may not make predictions easier, but it might make them more realistic.

To celebrate its 50th year *Visible Language* will revisit themes from the journal's past to help chart the design discipline's future. This issue features articles by Meredith Davis, Sharon Poggenpohl, and myself commenting on design's direction, design journals, and design research. As a special homage to the journal's roots in typographic research issue 50.2 will revisit typography and see what we have learned in the past 50 years and project where typographic study should be going next. Issue 50.3 will look at *Visible Language* in light of design history and theory with a similar aim: to reflect on the past to help guide and inspire the future: reflecting back – reflecting ahead. Reflecting in the sense of thinking deeply or carefully about something and at the same time suggesting the visual nature of much of human cognition and the essential visual nature of design. Reflection is a physical process wherein light or energy is thrown back from a surface. We learn about ourselves through reflection. We see things in a new light, from a new vantage point, and if the mirror is placed properly we can see not just where we've been but where we are going: around the corner we have not yet turned.

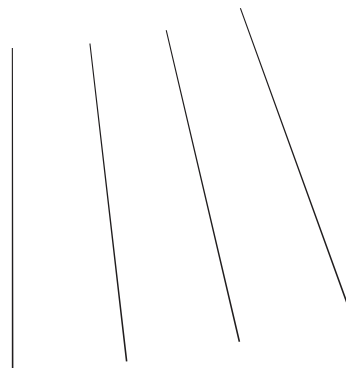
This year we are devoting part of the journal to not predicting the future but to shaping it. We can't wait to see what they'll say about our efforts in 2065!



| | |

“Normal science” and the
changing practices of design
and design education

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Professor Emerita
Department of Graphic and Industrial Design
College of Design / NC State University



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KEYWORDS

design education, design pedagogy, signature pedagogy, community of practice, design practice, future of practice, design problems

Social anthropologist Jean Lave and learning theorist Etienne Wenger described a concept called “communities of practice.” They suggested that learning is not just something we do individually when in school, but socially throughout our lives with people who share a concern or passion for something. These are not mere communities of interest that devote attention to the same subject matter but people who build meaningful relationships through which they learn about their practice from each other. They share experiences, ways of thinking about the work they do, and a network of connections that distinguish them from others. Because they are organized around a domain, they frequently communicate through a common vocabulary and participate in frameworks that have a particular structure (Lave and Wenger, 1991).

This perspective on learning is especially relevant to rapidly changing fields. Communities of practice are typically more agile in responding to new conditions than are formal institutions or established fields of study. Their immersion in concrete situations discourages the abstraction of knowledge often found in academia and the recognized literature of a discipline (Lave and Wenger, 1991). Ideas are judged on the basis of actual performance and are not subject to the constraints of disciplinary or organizational boundaries. Knowledge is co-created and shared through authentic practice.

Science historian and philosopher Thomas Kuhn provided further insight into how knowledge develops through practice. In *The Structure of Scientific Revolutions*, Kuhn described “normal science” as one in which a single paradigm dominates. He warned that paradigms “gain their status because they are more successful than others in solving a few problems that a group of practitioners has come to recognize as being acute” (Kuhn, 1970, p. 23). Practice often extends this knowledge and “matches the paradigm’s predictions by further articulation of the paradigm” (Kuhn, 1970, p. 23). In other words, rather than searching for a new paradigm, the practice simply expands the conceptual territory of the existing paradigm to account for novel problems and outcomes. Kuhn said the aim of normal science is not to call forth new phenomena or theories, especially those that do not fit the paradigm. Instead, normal science relaxes the standards for evaluating work in instances under which the paradigm ceases to be effective. And eventually, the paradigm becomes a criterion for choosing problems that are perceived as having a solution and as appropriate to the practice (Kuhn, 1970, p. 37).

Kuhn argued, however, that science does not progress through the incremental accumulation of knowledge in normal science, but through paradigm shifts (Kuhn, 1970). The failure of something to conform to the dominant paradigm is seen by some as an anomaly, an aberration. As these anomalies build up, they constitute a new paradigm that takes over the old. And the more frequently this happens, the more practitioners recognize potential in inconsistent results. The old paradigm, no matter how elaborated, no longer fits the circumstances.

In this article, I suggest that the current design profession is one composed of very different communities of practice, some challenging the “normal science” of design and operating under new paradigms. By studying these communities of practice, possible futures for the design professions become evident. In the second half of the article, I also raise concerns about the degree to which design education is based almost entirely on the “normal science” of design practice. In this sense, design education is slow to follow paradigm shifts in the field and may have stretched the existing paradigm and knowledge to its limits in addressing the current context for design practice.

Diverse communities of practice

The traditional definition of design focuses on the physical attributes of spaces, objects, and visual messages as supporting function and the emotional experiences of consumers or audiences (Dubberly, 2014). The *artifact-driven* goal of design for most of the twentieth century was to make things work and look better. The designer was an expert who controlled forms that best achieved such results, and the profession placed high value on craftsmanship, surface novelty, and individual authorship. As a community of practice, it rewarded members’ accomplishments and confirmed the “rightness” of such values through professional competitions, glossy publications, and exhibitions.

Young designers entered this community of practice from design school as “apprentices” through technical production, eventually earning the right to control form after demonstrating attention to detail and the ability to execute the creative vision of more experienced practitioners. Consumers acquired particular artifacts as expressions of identity and “good taste.” As founder of Wikihouse (an open-source project for designing and building houses) Alastair Parvin says the traditional definition of design was something done *to* people by experts in the field (Parvin, 2013).

Artifact-driven practices were first challenged by a technological context that favored user access to infinitely malleable and constantly updatable information. Beginning in 1998, a group of forty communication designers and technologists — convened by designer Clement Mok under the aegis of AIGA — met to discuss the emerging practice of interaction design. Called the “Advance for Design” (later, the Experience Design special interest group), participants spent several summers debating the role design would play as public access to the internet expanded communication possibilities beyond data sharing by scientists and the military. Because these meetings started before the dot.com bubble burst in 2000, the majority of participants described buying and selling transactions as the goal of networked communication. However, a small group argued that there was

potential for interaction design in supporting activities in leisure, work, learning, and access to the privileges of democracy.

This was clearly a “community of practice” — its sole purpose was to share what people learned through their work and to publish emerging principles that would guide development of the medium. However, participants were conflicted over what the rapidly evolving networked technologies meant for professional practice in communication design. One meeting was spent mostly in authoring job descriptions for designers in work previously dominated by programmers, hoping to ensure a place at the table in the expansion of the medium.

But as meetings progressed, discussions reflected additional differences among participants regarding a paradigm shift, a departure from the “normal science” of design practice. While acknowledging the need to work with experts in human factors and business when designing for online commerce, some *Advance* participants felt interaction design simply represented a new medium for traditional, artifact-driven methods and principles. For these designers, design was primarily about inventive displays of information, which now employed the digital affordances of sound, motion, and user control of pacing and sequencing. Others felt the development of networked communication represented not only a new tool but also a seismic shift in the relationships among content producers, designers, and users — not another *format* but a totally new communication *environment* with as yet undefined rules of engagement.

After several meetings, the group published principles of experience design. Authors reflected new interest in creating the conditions for user experience but tempered their descriptions through some reluctance to let go of priorities in the design of physical artifacts as central to the practice. At the same time, these principles were evidence of continuing concern for the human dimension of design practice, for the user-centered aspects of the dominant paradigm.

Initially a response to the expansion of graphic design practice in internet technology, the interdisciplinary practice of experience design is now defined as:

Influencing designed user experiences through more than the visual attributes of communication, products, and environments;

Viewing users’ interactions with designed objects, environments, and services across entire lifecycles, from the users’ identification of needs or desires, to when they discard the object, abandon the environment, or discontinue the service;

Creating relationships between experiences and individuals, not mass markets;

Invoking and creating communication, products, and environments that connect with users emotionally and in terms of added value; and

Building upon the traditional design disciplines but also exploring new collaborations with non-designers, such as experts in computer programming, human factors, cognitive science, business, etc.
(Davis et al, 2001)

Hugh Dubberly, who participated in the Advance for Design meetings, describes today’s *design for interaction* as changing the focus of practice from spaces, objects, and messages to the design of simulations, tools, and stories (Dubberly, 2014). In a project supported through the Virtual Center for Innovation at Sun Microsystems and titled, *How do you design?*, Dubberly interviewed developers of interaction design practice and mapped their design processes (Dubberly, 2005). While there were variations among these early adopters, the methods for design in the first years of interaction design practice were significantly different from those in artifact-centered communication design offices. With the goal of shaping user behavior and facilitating active engagement with information, today’s interaction designers now routinely involve users, develop personas and scenarios, and prototype technological solutions for user feedback on interactive strategies.

While the stopping condition in the creation of artifacts is “almost perfect,” Dubberly describes “good enough for now” as a threshold for success in interaction design, acknowledging that the functions and attributes of design will evolve organically through use and that new versions are inevitable (Dubberly, 2008). At the same time, he defines many relationships between users and interactive systems as asymmetrical in that the technology typically does not learn from its users. People adapt to the rules of the system and to conventions established by general practices over time. A goal of interaction design, therefore, is to create a match between the perceptions people have of how systems work and the reality of actual operations, to provide feedback but usually not to give people control over the design of the system itself. Design in this sense is something done *for* people, arising from informed understanding of their motives and behavior.

In a small 2014 meeting — organized by AIGA Director Ric Grefe to articulate the diverse perspectives on design practice — Dubberly described an emerging third type of practice he calls *design for conversation*. He distinguishes this practice from interaction design by its symmetrical, collaborative relationship between the designers of systems and *co-creators* who contribute both content and form to the design of services, platforms, and communities of interest.

The design of service ecologies constitutes an increasing

percentage of professional work. The Bureau of Labor Statistics predicts that the majority of growth in the US economy will be in service providing sectors, reaching almost \$21 trillion by 2022 (Bureau of Labor Statistics, 2013). Gartner, a technology research firm, predicts that cloud-based software-as-a-service will grow to a \$201 billion industry by 2019 (Gartner, 2015). Zipcar has one million users who access a fleet of 12,000 cars in eight countries through an online system, but it makes nothing. Even companies that produce hardware depend on content production and service ecologies as important components of brand loyalty.

Dubberly argues that products haven't necessarily disappeared in the service economy; instead, services have become a way to deliver products and to increase their value (Dubberly, 2016). He quotes former *Wired Magazine* editor Kevin Kelly: "It's not what you sell a customer; it's what you do for them. It's not what something is; it's what it's connected to, what it does. Flow becomes more important than resources. Behavior counts" (Kelly, 1994, p. 27).

Design consultancy Fjord describes new service design challenges facing organizations in the future. "Managing the gaps in consumer experience between the physical and digital channels and across services, devices, and places...reducing the pain of navigating an experience fragmented by specialized services and applications" will be an important trend shaping the evolution of online experiences (Fjord, 2015). In other words, it is no longer enough to have well-designed service components; the design task is to bridge experiences separated by time, place, and sponsor.

Platforms are the systems that support the development of applications and technologies. Dubberly describes platforms as "enabling others to create value" (Dubberly, 2014). At its opening in 2008, Apple's app store offered 800 applications that ran on the Apple platform. Today, there are more than 1.5 million applications, mostly developed by third parties. Because platforms enable or constrain access and the types of applications that can be built, Dubberly cautions that the current concentration of platform development in a few companies (Facebook, Google, Microsoft, Amazon, and Apple, for example) presents opportunities for the design of new systems but also raises concerns over the centralization of content and technology. In a presentation on networked platforms, Dubberly quotes Tim O'Reilly, author of "The State of the Internet Operating System" and open source advocate, as saying, "We are entering a modern version of 'the Great Game,' the rivalry to control the narrowed passes to the promised future of computing" (Dubberly, 2014). It doesn't take much work to find confirmation of O'Reilly's view. An August 2015 article in *Fast Company*, titled, "The Agonizing Slow Decline of Adobe Flash Player," cites a five-year-old essay by Steve Jobs explaining why Flash would never appear on Apple devices (Newman, 2015).

In the design of communities, Dubberly describes design's role as negotiating the rules and frameworks that govern the behavior and

exchange among participants, with provisions for changing rules as the community deems necessary. In a project to reimagine National Geographic as an organization, for example, Dubberly's recommendations encourage returning to its nineteenth-century roots as a membership society interested in geographic expeditions. Under his proposal, technology establishes and supports members as: "citizen scientists" with access to researchers; content generators who develop stories and share photographs; educators who extend the impact of National Geographic resources; and a community of interest in which member profile data enables meaningful connections within and outside the organization (Dubberly, 2013). In other words, this type of design practice brings people together to do something they might not be able to do alone and to share and build insights collectively that move understanding forward; design *with* and *by* people.

Dubberly argues that all three types of practice currently exist: the design of artifacts, design for interaction, and design for conversation. The design of artifacts clearly represents the "normal science" of the profession and there is value in its outcomes. However, it is less likely that artifact-driven practices will produce new knowledge and methods that respond to a changing context of design problems — that is, problems that are increasingly complex and uncertain in their nature, that exist at the level of systems, and that evolve over time. Other than surprising form, therefore, it is difficult to see how the normal science of design can stretch the paradigm much further than current practice.

Donald Norman, now Director of the Design Lab at the University of California/San Diego, provides an alternate view on where the trajectory of design practice can go. Consistent with Dubberly's view, he identifies the historical character of the design professions as arising from the need for a systematic approach to creating products and information for the emerging middle class in Europe and America following the Industrial Revolution. After World War II, says Norman, the focus shifted to appearance, often at the expense of function and performance (Norman et al, 2014). This type of practice depended largely on an arts-based education and individual intuition.

However, the emphasis on appearance often creates problems by complicating the user's perceptions of how technological systems and products work. Norman, once a user experience architect for Apple and Vice President of its Advanced Technology Group, incited the ire of loyal Apple users by an article in *Fast Company* titled, "How Apple is Giving Design a Bad Name."

...when Apple moved to gestural-based interfaces with the first iPhone, followed by its tablets, it deliberately and consciously threw out many of the key Apple principles. No more discoverability, no more recoverability, just the barest remnants of feedback. Why? Not because this was to be a gestural interface, but because Apple simultaneously made a radical move toward

visual simplicity and elegance at the expense of learnability, usability, and productivity. (Norman and Tognazzini, 2015)

Norman and his colleagues in their community of practice identify the misfit between an emphasis on appearance and an emphasis on meeting human needs and abilities, with the latter leading to more satisfying interactions between people and technology. They acknowledge that the methods used by designers in solving problems at this level attract the attention of others who apply them to management and the “large, ambiguous...and fast changing problems facing society” (Norman et al, 2014). But Norman and his colleagues describe design as falling short in its ability to handle problems at this scale of complexity. They list five major principles of modern design that are no longer suited to the nature of contemporary problems:

- 1 Linear causal relationships underpin assumptions that a preferred state can be achieved by fixing a root cause of friction through design.
- 2 Narrowly-defined contexts as problem settings suggest the engagement of relatively few disciplines.
- 3 Independent elements can be addressed one at a time without throwing an entire system out of balance.
- 4 Operating constraints are stable and recurring.
- 5 Relatively few mutually incompatible constraints make it likely that competing priorities can be resolved to some degree of satisfaction.
(Norman, 2015a; Norman, 2016)

Complex problems, however, involve constantly changing relationships among countless interdependent variables that make it impossible to address one at a time in isolation or through a single discipline. Feedback and unforeseen emergent behaviors destabilize constraints and relationships. Norman and his colleagues call for a sociotechnical approach to design based on research and evidence; rapid experimentation and testing of prototypes that lead to superior results through iterations. They argue that the field needs an emphasis upon evidence-based design and a cohesive, collaborative approach to the development of method and knowledge (Norman et al, 2014).

Rick Robinson, an applied researcher in consumer and material culture studies, has pioneered evidence-based approaches to design

practice, recently in his consulting firm Iota Partners and now in his role as faculty at the University of Colorado Boulder. Robinson cites a profound change in the expectation of a return on the investment in research. He says, “By advocating that design be considered a strategic voice in product development, communications, and marketing, the field has been asked to play by the same rules and be measured by the same yardstick as other principal business activities. Research needs to be justified on an ongoing, long-term basis, not purely on a ‘see what we found!’ case-by-case basis” (Robinson, 2016). Robinson describes friction (either overt or discreetly played beneath the surface) between research that focuses on design and traditional market research. He acknowledges that there are instances where the two work as contributing partners. In most cases, however, there is a lag between design advocacy for iteration and interdisciplinarity and the managerial outlook of a vastly larger marketing research ecosystem that espouses mostly linear views of product and communication development.

Although heavy investment in design research heightens expectations for demonstrating the value of design to organizations, increased complexity in the nature of today’s problems and acceleration in the rate of change also argue for innovation approaches being part of what the design field holds as a central value. But like Norman, Robinson pins increased accountability in design research to the sheer scale of problems. He says, “There are very few design issues that are understood as stand-alone problems today. Contexts are connected and dependencies are everywhere. A systems-level view of the world dominates the way organizations understand what needs to be designed. Scaling design research beyond one-off projects means building an ecosystem of providers and processes, of institutionalizing the research work while remaining open to change” (Robinson, 2016). He cites information overload as being more evident and insistent in the need for research than most other domains. In support of such research, Robinson likens the potential of Google and Facebook as new tools for crafting questions about digital life to the roles audio recording, video, and photography once played in the study of language.

When asked about what kind of evidence is compelling, Robinson had one word, “pattern.” He described current work as “data aware” rather than “data driven” — research starts with patterns in data rather than hypotheses. Off-the-shelf technologies, such as smartphones, assist in this effort. Other sensor-based technologies (such as the Nest thermostat that detects patterns of occupancy and movement through rooms in the home) provide traces of human behavior in particular settings. And companies (such as Facebook and Google) make their vast datasets available. So data at scale is no longer hard to get. Robinson says what we really need are “the tools to surface patterns in that data, discipline in exploring it, and suppleness in building or applying frameworks to its interpretation” (Robinson, 2016). With his colleagues, Robinson talks about “faces, places, and traces” – information on people, information on settings and contexts, and traces

that illuminate decision-making, influence, bias, and many more aspects of interaction. (Robinson, 2016)

Design education as “normal science”

So, to what extent do current pedagogical practices in design education address the shifting paradigms that Dubberly, Norman, Robinson, and others demonstrate in their professional work? Does design education chart new pedagogical and curricular territory or merely extend the “normal science” of its traditional artifact-driven, arts-based paradigm? To what degree does the graduate education of design faculty prepare them to address these paradigm shifts and new knowledge in practice? And if the formal preparation of design educators currently fails to acknowledge shifting paradigms, how does the community of practice in design education challenge and re-orient curricular and pedagogical approaches in response to changing conditions?

Educational psychologist Lee Shulman studied *signature pedagogies*: forms of instruction that are characteristic in the preparation of members of particular professions. He suggested that these pedagogies are particularly distinct in professional education because, unlike other academic disciplines, it is accountable for supporting “accomplished and responsible practice in service of others” (Shulman, 2005, p. 53). As president of the Carnegie Foundation, Shulman investigated the essential contradictions inherent in the multiple roles of practitioners in various disciplines and the implications for teaching and learning. He compared two types of classes in engineering. In a classroom on fluid dynamics, all desks faced the blackboard, the professor faced the class to introduce the lesson, and the remaining time was spent with the professor writing on the blackboard and students copying the material for later discussion in their self-organized study groups. There was little connection between knowing and doing, and it was not the “signature” of engineering (Shulman, 2005). In the engineering design studio, students grouped in activity areas with no obvious orientation to the front of the room. They engaged with physical models and computer visualizations, collaborating, building things, and critiquing others’ work. The instructor circulated but was not the only source of information. Architecture, industrial design, and communication design faculty would recognize this model of instruction.

Shulman says signature pedagogies are important because they are pervasive and define how knowledge is “analyzed, criticized, accepted, or discarded” in professional education (Shulman, 2005, p. 54). He further describes signature pedagogies as having three dimensions. The *surface structure* represents the operational aspects of teaching: the teacher-controlled demonstrating, questioning and answering, and interacting with students. The *deep structure* is the locus of theory and how to think like a

professional. It is driven by assumptions about how to pass on knowledge and know-how. The *implicit structure* is a set of beliefs about professional attitudes and values (Shulman, 2005).

With the exception of courses in history and theory, the typical *surface structure* for teaching and learning design is built around faculty-defined studio projects and “making.” Students receive faculty-authored written or oral briefs that define the investigation, much as the design practitioner receives the scope of work from a client. The criteria through which faculty and peers judge design responses are reflected, either explicitly or implicitly, in the brief. Process extends from these expectations. Discussions generally arise from a quest to understand the nature of the assignment, principles expressed in its articulation, and prescribed methods for investigation. Across a four-year professional education, courses generally repeat this pedagogical structure with the goal of reinforcing core principles and building a repertoire of process-oriented approaches for future application in similar contexts.

The *deep structure* of communication design pedagogy is reflected in the content and the organization of curriculum. In some cases, a cafeteria of experiences based on segments of practice or communication formats comprise the course of study — publication design, package design, interaction design, motion graphics, and so forth. The underlying assumption is that formats represent meaningful distinctions in the application of the design process and that understanding of core principles is transferable but not necessarily scaffolded. In other instances, courses defined by medium organize the types of know-how faculty see as essential to practice — typography, photography, or web, for example. While in some programs more integrated problem solving occurs in other courses, the theoretical basis of this division by technology implies that various media have characteristics that are best understood in isolation. In other programs, course titles signal a continuum of some kind — beginning, intermediate, and advanced — typically beginning with abstraction and moving toward more applied work. Under all three strategies, the tendency is to sequester single concepts in beginning work and add complexity and context as students progress toward graduation. The curricular theory is that students learn to manage complexity incrementally, but in the absence of explicit process-oriented instruction or tools for dealing with interdependent variables.

As part of the *implicit structure*, design critiques reinforce the values and general priorities of the field. Lave and Wenger, in their studies of apprenticeship, say, “the purpose is not to learn *from* talk...but to learn *to* talk” as a participant in the work of the domain (Lave and Wenger, 1991, p. 109). Even more than through overt classroom instruction, students learn the values of the profession — and by extension, of its dominant paradigm — through the signature pedagogy of critiques. Faculty can lecture on a range of theories and concepts, but if comments in critiques are inconsistent with lectures, students gravitate to the priorities expressed in the public evaluation of work.

Schulman warns that while pedagogical traditions and habits are good for imparting complex patterns of behavior, they are also “dangerous sources of rigidity” that can encourage repetitive responses and distort learning in some respects (Shulman, 2005, p. 56). He cautions that they often persist “even when they begin to lose their utility, precisely because they are habits with few countervailing forces” (Shulman, 2005, p. 56). Because college-level design faculty rarely receive direct instruction in teaching, they tend to model teaching on the basis of their own education, thus reinforcing established pedagogical traditions.

Although the signature pedagogies of design education receive increasing attention from other fields as effective models for teaching and learning in a variety of subjects, there are associated values and practices that appear somewhat at odds with emerging paradigms in the profession. The prevailing model in the more than 2500 programs that teach communication design in the United States is one overwhelmingly characterized by an art-based, artifact-oriented paradigm, despite an increasing percentage of professional practice that falls outside this perspective. Even when programs add interaction design or service design to the course of study, the experiences leading to them and criteria for evaluating them generally reflect artifact-centered values.

Further, faculty typically frame the problems for students’ design investigation and often strip the assignment of any competing priorities that interfere with foregrounding a particular visual or technical principle. Norman describes the contribution of “design thinking” as “the ability to step back and reconceptualize the issues...as bringing a new framework upon which to view the world” (Norman, 2015b). Students, however, have very little influence over the scale or complexity at which problems are defined and as a result, in practice, often rely on professional problems to be fully articulated by the client. Recent design graduates frequently comment that the assignments at work are less interesting than student projects, not understanding that analyzing the problem — that is, recognizing the challenges and opportunities — is part of their responsibility as professionals. While some college programs require an undergraduate “thesis” or “capstone” project in which students exert some control over scope, instruction in the years leading up to these projects rarely asks them to position investigations within larger social, cultural, technological, or economic systems and settings. Graduate education in design generally follows a fine arts model of studio-based work with opportunities to pursue individual explorations but little instruction in framing researchable problems. Therefore, there are limits to the level of problem complexity, types of research, and diversity of analytical methods and tools through which students prepare for professional practice. In these courses that emphasize independent work, students often begin by identifying an artifact they would like to make or struggle for many weeks in defining a problem territory — typically social or technological — for which they have little knowledge and few skills for addressing systems-level concerns.

Both Dubberly and Norman emphasize the importance of understanding systems. The normal science of design education, however, often interprets “systems” as a set of interrelated physical or virtual artifacts: a visual identity system, an ensemble of publications, the organization of individual displays of website information. Dubberly calls these “nodes” without consideration for the larger networks or ecologies of which they are interdependent parts. In a 2014 presentation in Oslo, he advocated that systems literacy become part of any design education, outlined the vocabulary and content of systems thinking, and reminded the audience that systems theory was a regular part of the curriculum at the Ulm School of Design in the 1960s (Dubberly, 2014).

There is also a general assumption under the signature pedagogy that all students in the class need to be doing the same thing at the same time and that the nature of the class predetermines the format of a problem solution. For example, a web class must produce websites and a publication design class must produce printed publications. As a result, investigations often become solutions in search of problems. Of course, it is important that students learn about various ways through which people encounter information and achieve some technical competency; however, time in these media-centered projects is generally spent in analyzing the nature of the information rather than the nature of the problem.

The traditional design studio environment also tends to reward individual performance over collaborative behavior. When collaboration is present, it is frequently among students in the same discipline and at the same level of education, usually classmates in design. There appears to be little instruction in how to work in interdisciplinary groups and few grading strategies for evaluating the ability of students to collaborate. Group studio projects usually involve a hierarchical division of labor and faculty often evaluate collaborative outcomes by the degree of conflict experienced by the team in executing its work, rather than the effective use of expertise. Rarely is the content of general education coursework incorporated in design activities; study in the social sciences, for example, is *proximate* rather than *integrated* with studies in design.

Under the signature pedagogy, research is something done at the front of the design process and generally focuses on the subject matter of the investigation or technical means of production. Students rarely use technology for more than search engine retrievals and the generation of form. Rick Robinson describes his program in the College of Media, Communication, and Information as looking at recent interest in everything computational — computational biology, computational journalism, computational interaction research — and predicts future computational design research in which analyses of the “digital exhaust” of everyday life play an important role in understanding people and settings for design action (Robinson, 2016). He believes education needs to build on digital natives’ outlooks and skills, producing not only consumers of technology and media

but shapers as well. He sees an explosion of new research and practice as a likely scenario at the graduate level, especially among the schools that accept students with strong programming and computing technology backgrounds.

Norman is clear that the field still needs classically trained designers. In an article titled, *Why Design Education Must Change*, he asserts:

“We must not lose the wonderful, delightful components of design. The artistic side of design is critical: to provide objects, interactions, and services that delight as well as inform, that are joyful... We must not lose the special talents of designers to make our lives more pleasurable.” (Norman, 2010)

He cautions, however, that work on organizational structure and social problems involve complex issues and that designers are under-educated for the application of knowledge and procedures in the social and behavioral sciences. He describes designers as “thinking they know but don’t,” as believing in a “naïve psychology” that comes from observation as plausible explanations of behavior that have little or no basis in fact (Norman, 2010). Robinson concurs and longs for research that “displaces the watered-down ethnography that now dominates professional practice” (Robinson, 2016).

At the same time, Norman cites the dilemma of deciding exactly what courses to teach and what methods are particularly appropriate to design issues. He calls for a new form of design education, rather than a copy of the existing courses in the behavioral sciences, technology, and business. In other words, the problem of matching a design education to the changing world of design problems will not be solved by merely expanding the inventory of general education coursework, but through experimentation with coursework and methods that are particular to design.

This need for a design education that addresses new forms of practice also raises issues about the preparation of the professoriate. Not only does the field continually replicate the signature pedagogy through graduate teaching assistantships but also through communication design master’s curricula that are almost exclusively based on an artifact-driven paradigm. Not all programs need to have the same curricular focus for the field to address emerging paradigms; a few schools, such as Illinois Institute of Technology and Carnegie Mellon University, have defined different agendas with impressive results. But the nascent quality of doctoral study and the MFA as the terminal degree in the United States means that few faculty arrive research ready for their academic positions. And the frequent location of design programs in schools and departments of art make it difficult for faculty to develop alternate approaches to coursework and research in environments where standards are mismatched to emergent practices. These circumstances make it difficult for faculty to participate as equal partners in the interdisciplinary work through which new knowledge and methods

emerge. It will take deliberate efforts to explore new curricular strategies, not only on the part of institutions, but also in collaboration with the field of practice.

Design has much to contribute to the solution of contemporary problems but there is a narrow window of opportunity to demonstrate that the profession is prepared for the challenges presented by a complex world. Other disciplines are anxious to partner in work in projects of scale not easily addressed by single field. There is little evidence, however, that the “normal science” that dominates today’s design education can renew practice through graduates ready for these challenges. It is time to rethink how knowledge develops in design.

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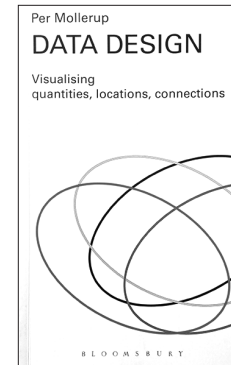
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A u t h o r

Meredith Davis is Professor Emerita of Graphic Design at North Carolina State University, where she chaired the department, directed master's studies, and led the PhD in Design program. She is a recipient of the Alexander Quarels Holladay medal for teaching excellence and AIGA National Medal. Meredith served as the founding president for the Graphic Design Education, president of the American Center for Design, member of the board of directors of the AIGA, and member of the accreditation commission of the National Associate of Schools of Art and Design. She serves on the editorial board of *Design Issues* and *She-Ji, the journal of design, innovation, and economics*. Meredith is a frequent author on design and design education, including *Graphic Design Theory* for Thames and Hudson and upcoming books on design for Bloomsbury and on teaching design for Allworth Press.

Book Review

DATA DESIGN Visualizing quantities, locations, connections
by Per Mollerup



When a book arrives that belongs to a well-populated category on my bookshelf it makes sense to review it in the context of its neighbors. In this case, *DATA DESIGN Visualizing quantities, locations, connections* by Per Mollerup joined 27 books on information design already on my “active books” bookcase, that is, the books not on bookcases in the basement.

Per opens his book explaining foundational concepts in a chapter titled “Basics.” Existing information design books such as *The Wall Street Journal Guide to Information Graphics* by Donna M. Wong open similarly with a first chapter titled “The Basics.” Whereas Wong briefly touches upon various functional components of design such as color, typography, and legibility Mollerup draws in principles from research such as Gestalt psychology. Where Per does discuss color he does so in relation to a color system rather than functional advice. Per’s introduction also introduces the concept of simplicity as well as several historic milestones such as William Playfair’s *The Commercial and Political Atlas* and Isotype. Jenn and Ken Visocky O’Grady also mention Isotype in their “Overview” chapter of *The Information Design Handbook*, but in comparison to these other books *DATA DESIGN* tends to found build arguments more on established findings in other fields than issues particular only to design.

Per’s descriptions of data design are characterized by their simplicity. Simplicity in this case does not mean lacking nuance, sophistication, or insight but rather that he absents explanations of jargon and academic pretension. For example, on page 57 Per writes, “Categorical variables are known by their distinctive difference, by their lack of universal order, and by not being quantifiable. Gender is a categorical variable.” This is as simple, detailed, and clear an explanation as I can remember. However, at times such admirable simplicity provides less help when on one hand it links word to definition while lapsing into circular redundancy such as on page 56 “A variable is a factor that may vary.” Most dictionaries avoid using the root word to define the word and I think both simplicity and comprehension would have been served if the book had more carefully observed this convention.

The bulk of the book is devoted to well organized and amply illustrated examples of data design organized into three broad categories: visualizing quantities, visualizing locations, and visualizing connections. This makes it an easy reference for designers facing a particular kind of task. The clear, simple yet insightful quality of the entire book makes it well worth owning.

Mike Zender

Journal Information

Visible Language is an academic journal focused on research in visual communication. We invite articles from all disciplines that concern visual communication that would be of interest to designers.

READERSHIP

Visible Language, an academic journal, seeks to advance research and scholarship for two types of readers: academics and professionals. The academic is motivated to consume knowledge in order to advance knowledge through research and teaching. The professional is motivated to consume and apply knowledge to improve practice. *Visible Language* seeks to be highly academic without being inaccessible. To the extent possible given your topic, *Visible Language* seeks articles written to be accessible to both our reader types. Anyone interested may request a copy of our editorial guidelines for authors.

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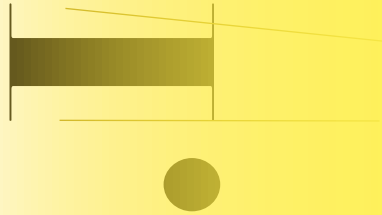
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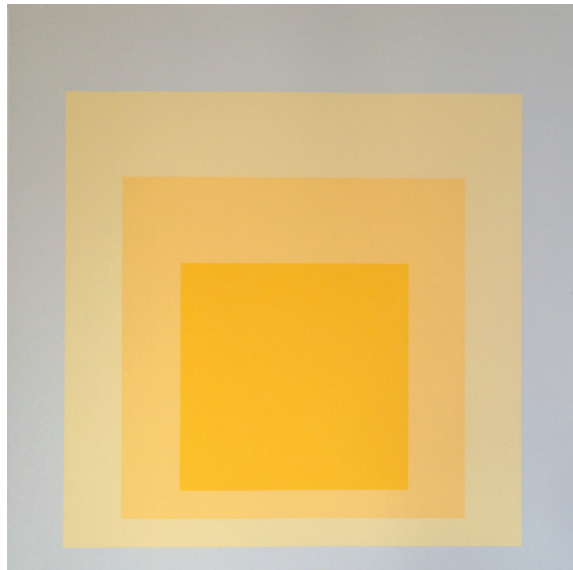
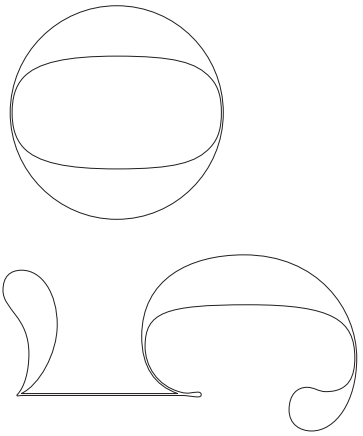
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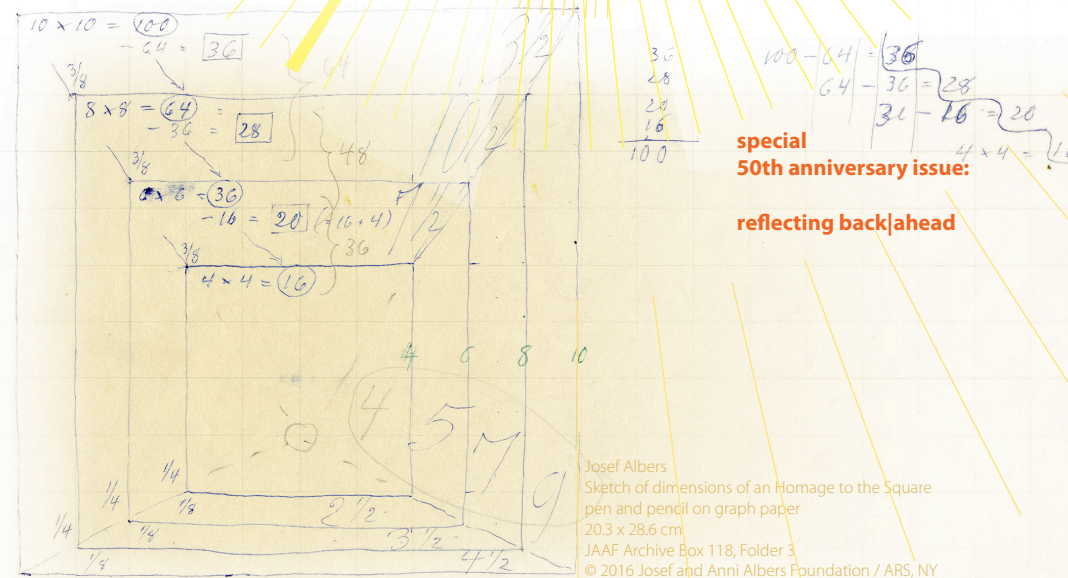
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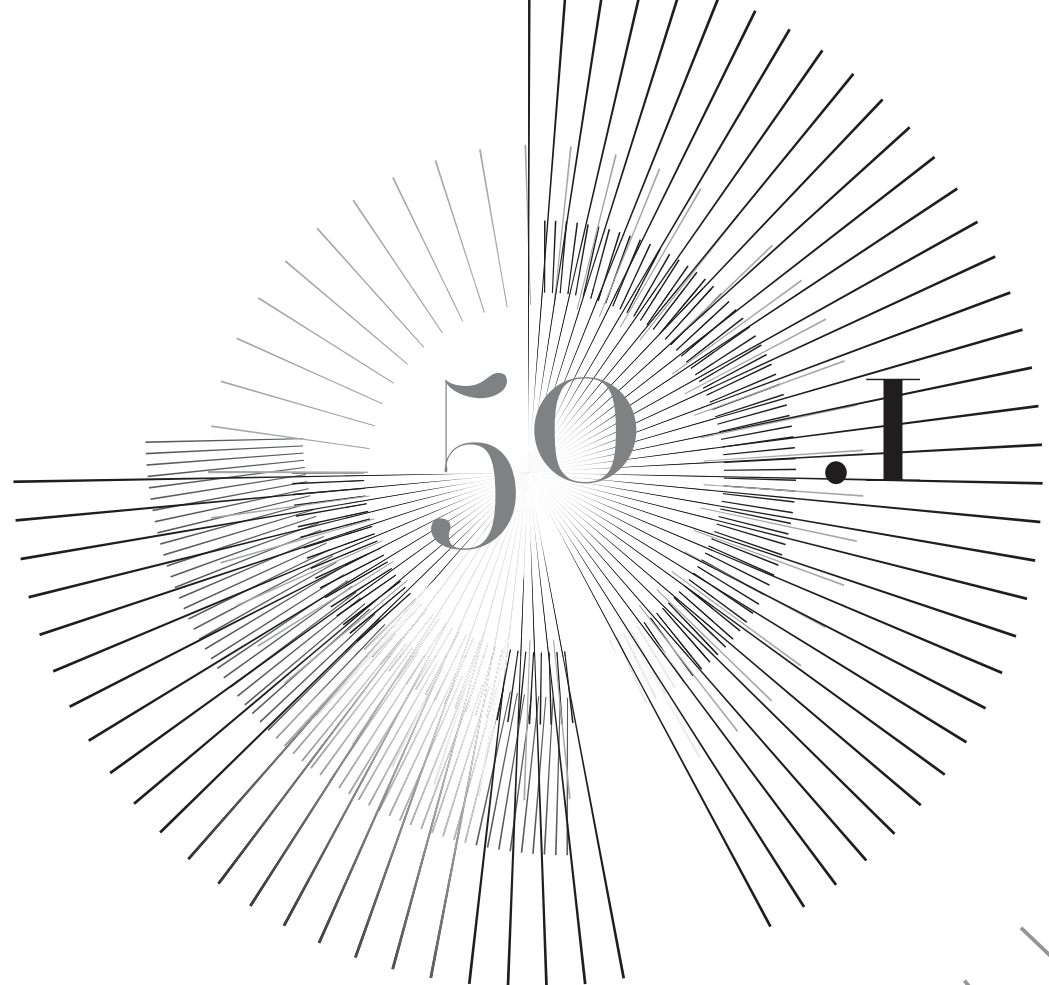


special
50th anniversary issue:

reflecting back|ahead

Josef Albers
Sketch of dimensions of an Homage to the Square
pen and pencil on graph paper
20.3 x 28.6 cm
JAAF Archive Box 118, Folder 3
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BOOK REVIEW: Data Design by Per Mollerup

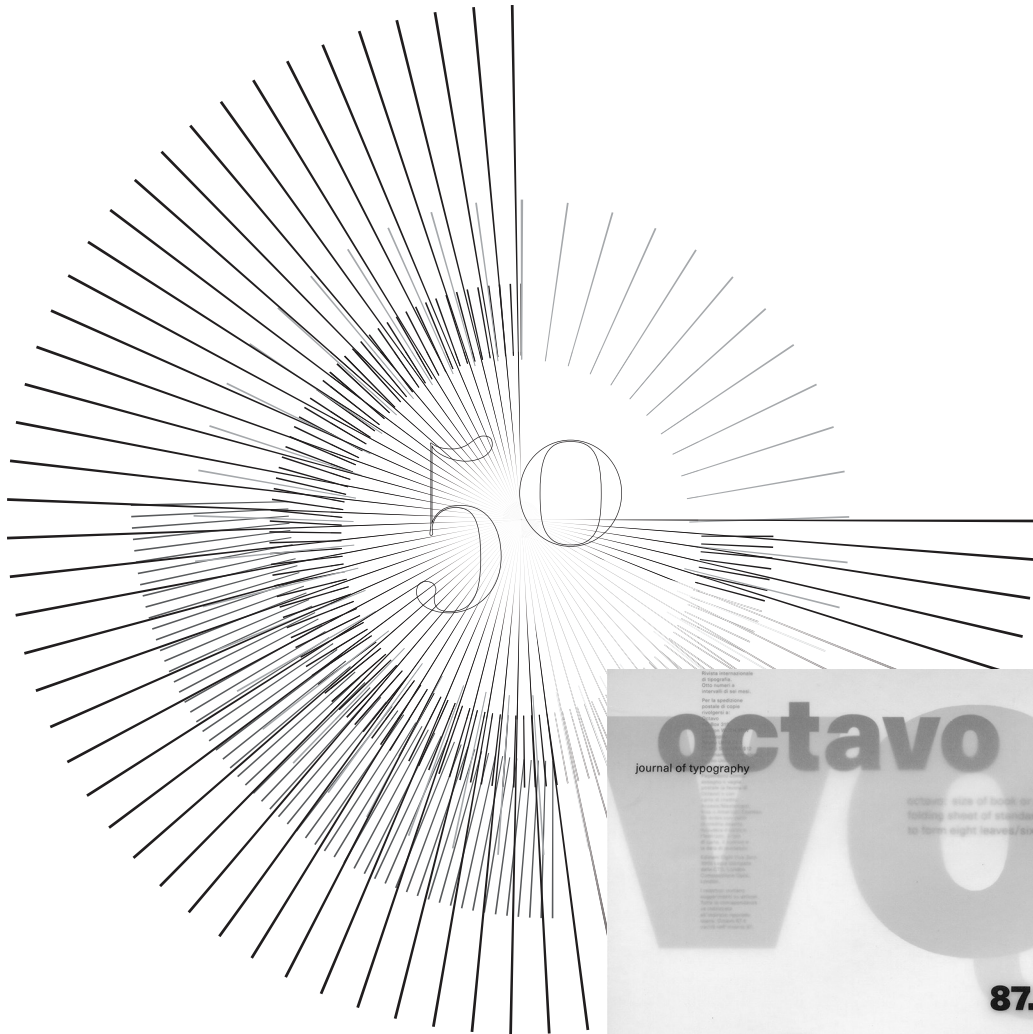
Mike Zender

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A lot of design has happened in the 50 years since *Visible Language* was founded: typesetters – gone; desktop publishing – a passing blip; computers – moved from desktop to pocket. The term graphic design had hardly entered the dictionary before the discipline started to consider renaming itself visual communication design or just communication design. Because communication continues to grow in quantity and importance there's no reason to disbelieve in a promising future for a communication design discipline. What the promising design future looks like is, as always, sketchy. A well-known 20th century Danish proverb states that predictions are easy except when they involve the future and George Santayana famously warned of the trouble that awaits failure to examine the past. If we take Santayana's statement less as a warning than as a prescription to guide action, we might reflect thoughtfully on the past in order to plan our steps today to help shape a future the Danes say is so difficult to predict. Reflecting on the past may not make predictions easier, but it might make them more realistic.

To celebrate its 50th year *Visible Language* will revisit themes from the journal's past to help chart the design discipline's future. This issue features articles by Meredith Davis, Sharon Poggenpohl, and myself commenting on design's direction, design journals, and design research. As a special homage to the journal's roots in typographic research issue 50.2 will revisit typography and see what we have learned in the past 50 years and project where typographic study should be going next. Issue 50.3 will look at *Visible Language* in light of design history and theory with a similar aim: to reflect on the past to help guide and inspire the future: reflecting back – reflecting ahead. Reflecting in the sense of thinking deeply or carefully about something and at the same time suggesting the visual nature of much of human cognition and the essential visual nature of design. Reflection is a physical process wherein light or energy is thrown back from a surface. We learn about ourselves through reflection. We see things in a new light, from a new vantage point, and if the mirror is placed properly we can see not just where we've been but where we are going: around the corner we have not yet turned.

This year we are devoting part of the journal to not predicting the future but to shaping it. We can't wait to see what they'll say about our efforts in 2065!



Design Journals: _____ Context, Serendipity, _____ and Value _____

Sharon Helmer Poggenpohl

Abstract _____

In celebration of *Visible Language's* fifty years of publication, and as its second editor, I examine some journals that have shaped my thinking over many years. I provide a personal journey through some of these journals, some of which have ceased publication long ago. Considering a special issue, an author who influenced me, or the visual stimulation a journal provided, the value of journals becomes apparent. In some cases, a journal anticipates a future that doesn't unfold for decades; while in other cases, an author flags a design or cultural issue with which we still wrestle. An underlying theme is technology and the state of design today. The journals consulted are *Design Quarterly*, *Dot Zero*, *Icographic*, *Information Design Journal*, *Design Issues*, *Octavo*, *International Journal of Design*, and *She Ji*.



KEYWORDS

Design Journals, Journal Values

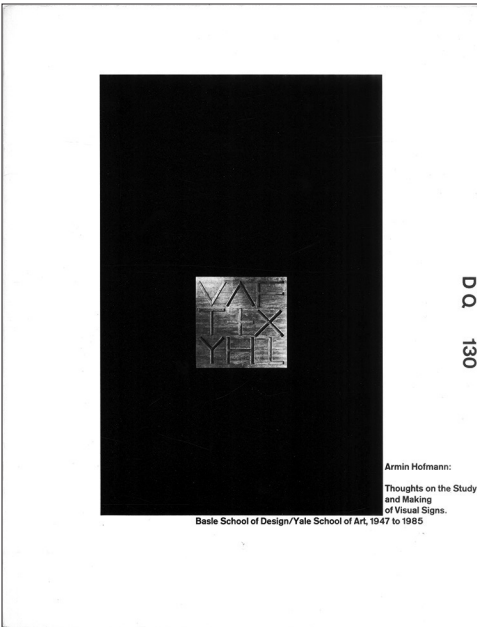


Introduction

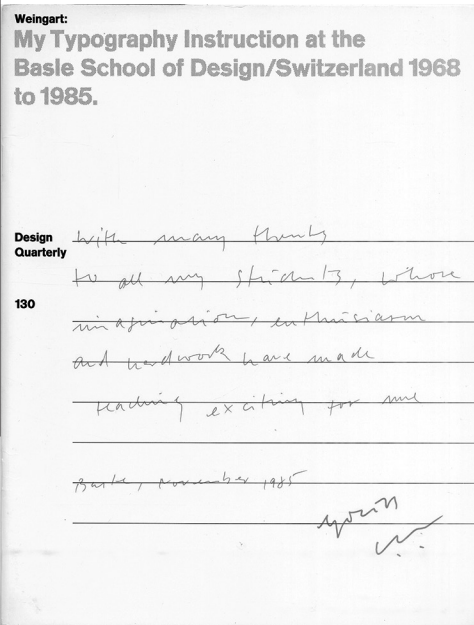
Digging through bookshelves crowded with journals, I sought a particular article I remembered visually but couldn't recall the journal it appeared in. I thumbed through old journals in my search and rediscovered other authors and articles that were important to me over years. This got me thinking about the value journals provide, the pleasure of having them at my fingertips, and the serendipitous discoveries of browsing through them.

But before I sample my journal collection, I want to tell you of my introduction to *Visible Language*. I was a young designer doing a project for a large educational publisher in the Chicago area. The project was to create a thesaurus for third and fourth grade children. To my knowledge a thesaurus had never been done for these grades. I got into an argument with the editor who wanted to use the typographic conventions typically used in dictionaries for older grades and adults. I argued that the children we were designing for wouldn't understand or remember the typographic coding. He was certain it would work. Instead I argued for a special visual position on the page for antonyms and synonyms, for example. We were at a stalemate. Suddenly he reached in his desk and slapped a journal on top. Did I know it? No. It was an early *Visible Language*. I did understand its value as research that could transcend disciplinary lines. I subscribed, and later submitted articles, edited special issues, and met Merald Wrolstad who was the originator and first editor/publisher. If he was alive today, he would celebrate the survival and contribution of *Visible Language* over fifty years!

The journals from my bookshelves cover nearly seventy years of design publication. These journals are just a sample of what was published of importance to me. The journals I mention below were part of a personal journey in design and do not reflect their general acceptance or importance. To get a snapshot of their existence I did a computer search and found varying kinds and amounts of information, particularly with regard to the journals that cease to exist. Some are quite obscure yet they appear robustly on the web. Others that are still published are caught in their publisher's web and don't divulge much information about the journal, perhaps its mission statement, but generally subscription or access to joining something is covered. Because of this I make no attempt to standardize the information found, but deal with the journals somewhat idiosyncratically. Also, my purpose here is not to analyze the journals as I have done previously in *Visible Language* (Poggenpohl, 2008) but to reveal their importance to me. I begin with the oldest journal and move forward, selecting one author or issue that I found interesting.



DQ 130

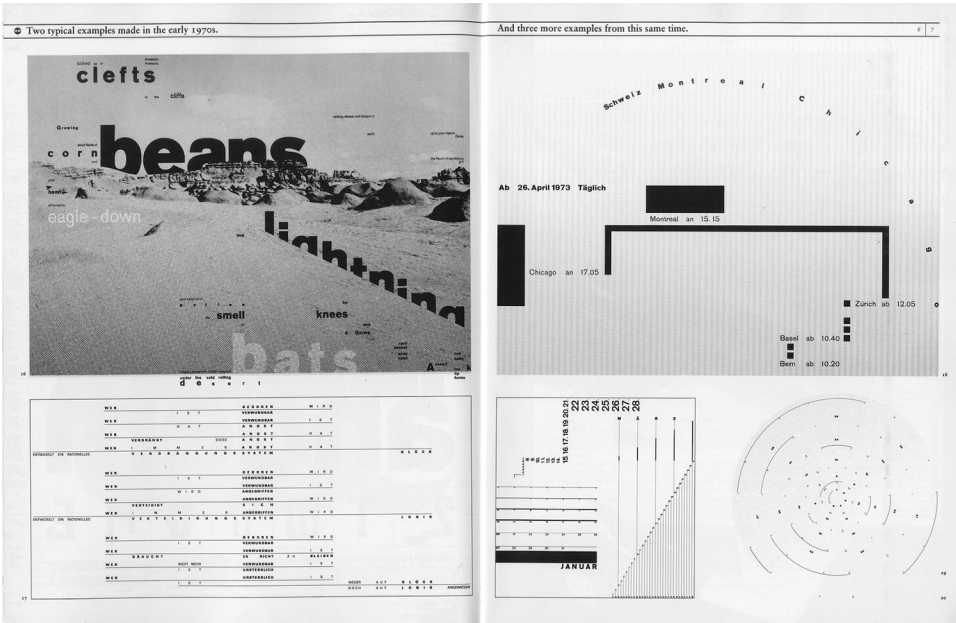


FIGURES 1-3

top - Design Quarterly 130
Cover Armin Hofmann

right - Cover Wolfgang
Weingart

below - Spread from Wolfgang
Weingart's article.



Visible Language
50.1

The Journals

Design Quarterly

Design Quarterly, or DQ as it was informally referred to, began under the title *Everyday Art Quarterly* in 1946. The name changed to *Design Quarterly* in 1954. Issues were numbered consecutively, and it was published by the Walker Art Center in Minneapolis until 1993 with issue 159. I know that there was an attempt to find an angel for the journal, to move it into a new situation in 1993, but this didn't work out. The journal was almost published for fifty years, and it remains a loss to the design community that it didn't continue. Issues appear now and then for sale on the web. I have a long series of DQ.

DQ was interdisciplinary, covering design and sometimes art in an ecumenical fashion; it covered all aspects of design. I had the impression that it dealt too much with architecture and urban planning, but I appreciated the scope of its focus. The size of the journal was consistent, but its number of pages varied a lot. A few issues give the scope of what was covered. In 1974, *DQ 94/95*, *The Design Reality*, *Second Federal Design Assembly*, looked at how design was developed to represent the United States, including architecture, visual communications, landscape design, and interior/industrial design. In 1981, *DQ 116*, *WGBH, Boston, A Design Anatomy*, explored the design vision for this important public television station. In 1984, *DQ 123*, *A Paul Rand Miscellany*, celebrated this American designer's work. In 1983, a special issue on Robots, *DQ 121* was published. Who suspected in 1983 that robots and artificial intelligence would become cultural issues thirty-three years later? In almost every case, legendary designers were the authors, and ideas, people, and design merged and emerged.

It is difficult to select one particular issue to reveal the value DQ imparted. I considered 145, Richard Saul Wurman's *Hats*; it explored hats as a metaphor for units of information; then there was 62, Martin Krampen's issue on *Signs and Symbols in Graphic Communication*. But I settled on 130, the Armin Hoffman-Wolfgang Weingart (1985) exposition double titled respectively: "Thoughts on the Study and Making of Visual Signs" (1-20 rotated) and "My Typography Instruction at the Basle School of Design/Switzerland 1968-1985" (1-20 rotated the other way). While I didn't completely agree with either one of them, their influence on graphic design education was significant. This particular issue focused more on the visual presentation of work with little textual exposition. The issue presented an interesting contrast between Hoffman's more classical and Weingart's more experimental approach to typography; it was a fine demonstration of the power of typographic form and symbolic communication.

DQ's variety of topics made me stop and think about how a country or television station represented itself, what a designer's vision consisted of, or why we have always been fascinated with robots. DQ was pleasing to look at and was surprising in its content. It opened ideas for reflection.

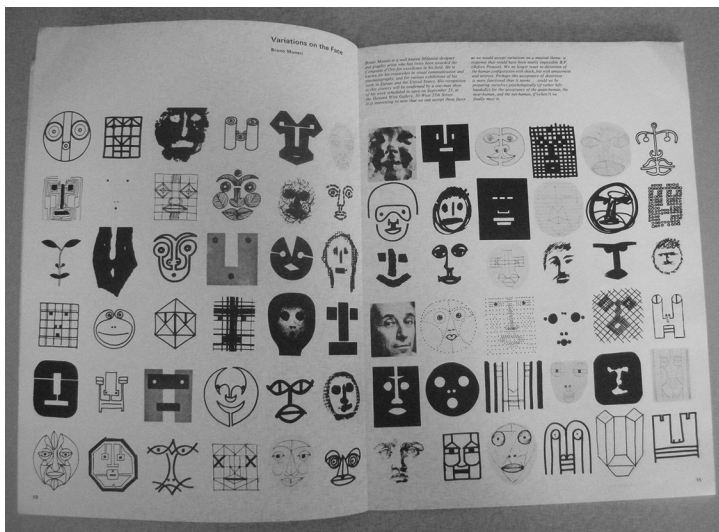
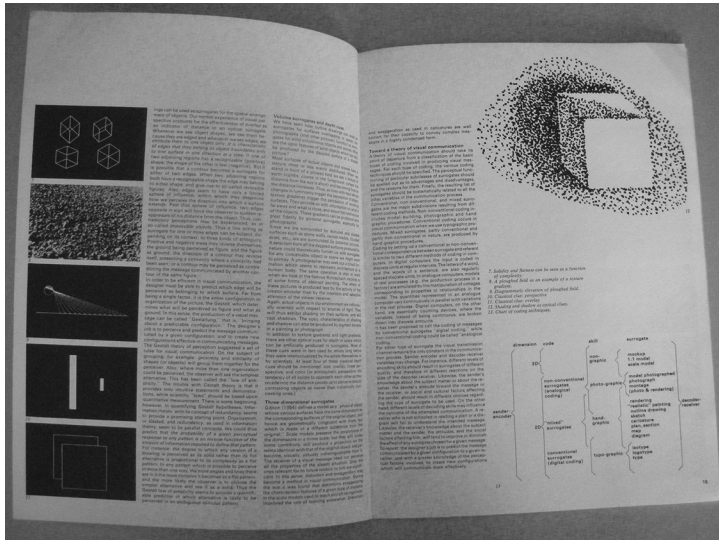


FIGURES 4-6

Dot Zero 1
 top - Logotype (1966). The cover (only the logo detail is shown) has its dot zero embossed on white stock and is embarrassingly dirty from age and use,

middle- Spread from Martin Krampen's article,

bottom - Spread from Bruno Munari's demonstration.



Dot Zero, planned as a quarterly, published 5 issues between 1966 and 1968. It was the house organ for the design firm Unimark in Chicago, and it was produced in partnership with Finch Papers. Its mission was stated in the first issue: "It will deal with the theory and practice of visual communication from varied points of reference, breaking down constantly what used to be thought of as barriers and are now seen to be points of contact." Its goal was to elevate design discourse. Massimo Vignelli (n.d.) was its designer and creative director; he gave an interview regarding *Dot Zero* online (Bierut, n.d).

The first issue of *Dot Zero*, contained Herbert Bayer's explanation of its name (1966, 1). He referenced the western Colorado town Dotsero and the survey that began with .0 before going on to explain the meaning of "0" as presenting an unbiased point of view. Further, the 0 (now a circle with a dot in the middle) is visually satisfying with image and meaning supporting each other. The first issue contained articles by Arthur Drexler "Alternative to Architecture," Marshall McLuhan "The Decline of the Visual," and Martin Krampen "Psychology of the Visual." Visual demonstrations like "Variations on the Face" by Bruno Munari were also present. The content, like *DQ*, covered big ideas, content that related to design itself. There was also an article on computer graphics. Who knew in the mid-sixties that computers would become such a revolutionary cultural force in everyday life and particularly in design?

Dot Zero lived briefly, it lost its sponsor, and (I imagine) its position provided some conflict between a house organ for Unimark and a design journal. Unfortunately, it ended while its goal to elevate design discourse had just begun.



FIGURE 7
Icographic 9 (1977)
 Cover with AIGA transportation symbols.

Icographic

Icographic, founded by John Halas in 1971, was released quarterly for the first year and thereafter came out twice a year. Its sponsor was Icoqrada, the International Council of Graphic Design Associations. It covered perception, semiotics, ergonomics, and communication theory. The 1970s were fixated on sign systems for travel and international events; this is reflected in many of the journal issues. The idea was that representations of an iconic nature could transcend people’s language limitations to deliver information quickly and effectively. One issue (14/15) covered an article about Bliss Symbols, designed to function in combinations much like a language, although a language with icons rather than words (Finke, 1979). Typography was also a

focus going beyond western languages to present Arabic, Chinese, Russian, Farsi, and others. *Icographic* was an international journal with an international focus even though it came out of London and was in English. The issues favored visual images over explanation or text.

In contrast to its visual focus, *Icographic 9* contains a very critical article by Victor Papenak (1977, 2-3) titled “Edugraphology—the myths of design and the design of myths.” In it he charges professional designers and design educators with elitism regarding whom they worked for and obfuscation in relabeling ordinary objects and activities in design. He outlines ten myths and their remedies. I paraphrase the remedies and hope the reader reflects on whether the remedy has come to pass in the past forty years and to what degree.

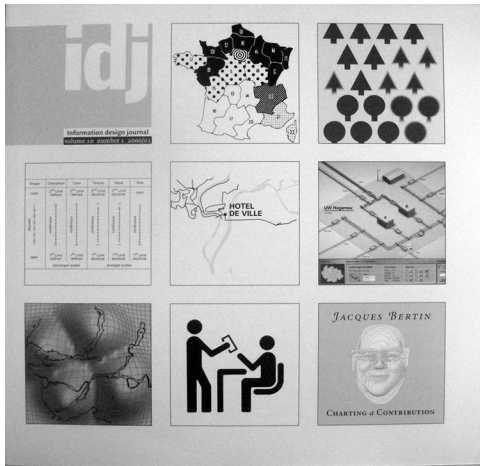
1. Designers work for industry, seldom for the social good whether for cancer clinics or bicyclists.
2. Designers do not concern themselves with the difference between renewable and non-renewable resources.
3. People should participate in design development; cross-disciplinary teams need to include both makers and users.
4. Designers should form new coalitions of makers and users.
5. Technology should be simple, small in scale, and respect ecological, social, and political consequences.
6. Design should cure people of product addiction through demythologizing both design and objects.
7. Students should be brought into contact with real people and their needs rather than manufacturing needs for them.
8. Tools should not “eliminate or diminish human labor, participation, and ability” to use human skills.
9. People should be enabled to create their own experiences, tools, and artifacts.
10. Technology can create tools to “move design from myth to participation...to personal fulfillment.”

My own reaction to Papenak’s ten observations for design relates to shortcomings regarding the application of technology in everyday life (Papenak’s 5 and 8 above). Too often people are replaced by technology. For example, I recently returned to the United States through the Dallas airport, and instead of seeing an immigration agent asking questions and welcoming me home, I was confronted by technology to scan my passport and asked questions via screen text. Besides eliminating jobs, I wonder if anyone considered how easy it is to lie to a machine. Papenak’s article from 1977 still resonates today as his 9 and 10 above are just now appearing as “maker spaces” with a book, *Open Design Now* (van Abel et al, 2011) detailing the ideas and possibilities of anyone being a designer. It is technology that makes this possible.

The cover of *Icographic 9*, the AIGA transportation icons, is in keeping with the journal’s strong focus. Other issues explored the extensive iconic work of Otl Aicher, the generation of sign systems, the translation of signs to low fidelity grids, and other cultural approaches to iconic representation.

FIGURE 8

Information Design Journal
(*idj*) 10, number 1 (2001)
Cover.



DQ and *Dot Zero* were American journals—*Icographic* was for me a window on the world—but its publication ended. In 2014, *Icographic* transitioned into a new name International Council of Design (*ico-D*). It now publishes *Communication Design: Interdisciplinary and Graphic Design Research* (2015 and continuing). This journal was formerly called *Iridescent* (2011-2014). This demonstrates the changing relationship between a parent organization and its sense of itself requiring necessary changes to its journal.

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i d j

idj (Information Design Journal) began in 1979 to bridge the gap between research and practice in information design; it was another international journal. Its mission was to provide a platform for discussing and improving design usability shaped to user needs in terms of visual and verbal messages, putting overall content into form. It focused on evidence-based articles and their implications for practice. In comparison to the previous three journals that were highly visual, *idj* was wordy and followed a more scholarly approach to its exposition. The visual material complemented or expanded upon the text; it required a critical reader and viewer.

Volume 10, number 1 (2001) followed a theme: Jacques Bertin's theories. Bertin wrote the *Semiology of Graphics* in 1967 and *Graphics and Graphic Information Processing* in 1977. He was a cartographer and geographer who developed what may be the earliest theory of visual information processing. At this current time of big data and data mining his demonstrations of technique, while originally created physically, can be applied digitally and expanded dynamically. It is the logic of his ideas and demonstrations that are important; it is about transforming data into patterns that more easily reveal useful information. Bertin himself created the first article with visual demonstrations for this issue of *idj*. "Matrix Theory of Graphics" (2001, 5-19) was a distillation of his ideas but not a primer as some familiarity with his work was essential. Subsequent authors dug further into his work in this issue and/or further expanded on visual data transformation. I selected this particular issue because I value Bertin's work and think few designers are aware of it.

Idj has had a challenging journey to remain in print. It is published in association with the International Institute for Information Design (IIID) in Vienna. While it has reinvented itself, it continues to be international and remains true to its earlier mission.

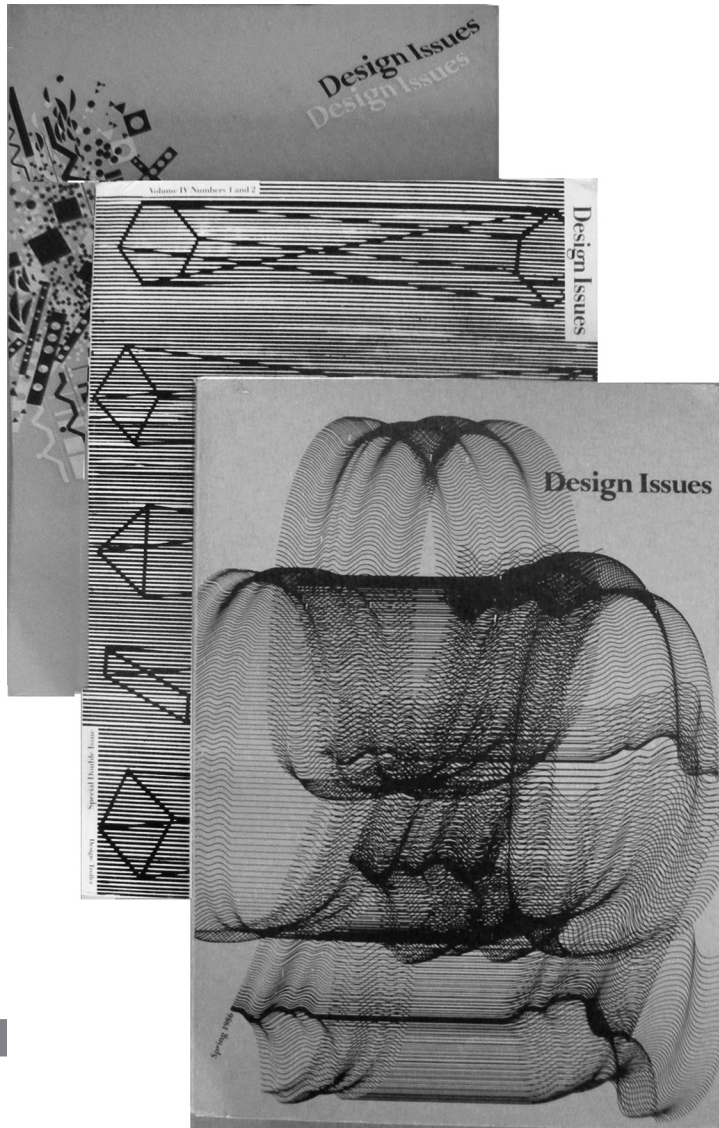


FIGURE 9
Design Issues II, number 1 (1985), IV Numbers 1 and 2 (1988), and III, number 1 (1986) Covers in descending order.

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 Design Issues

Design Issues began in 1984; it focuses on history, theory, and criticism and it is scholarly in nature with international contributors. In this case, rather than focus on a particular issue, *Design Issues* introduced me to an author I probably would not have otherwise run into: Abraham Moles. He has been described as a French sociologist, engineer, and/or information theorist who critically thought about contemporary life; this included design. In the first of his *Design Issues* offerings, "The Comprehensive Guarantee: A New Consumer Value," Moles (1985) examined planned obsolescence in terms of the demand on the consumer's behavioral costs and the micro-anxieties that emerged from interaction with the object: learning to use the purchased object, finding storage or a place in one's daily routine for it, experiencing difficulty if it fails to work or wears out, finding a repair agent, recycling it, purchasing a new one with the cycle of concern beginning again. Time, energy, and mental effort for choice or decision are part of the behavioral cost. I hardly need to point to contemporary technology in this regard. The guarantee Moles envisioned related to parts, labor, compensation for failure to function, and reimbursement for uncertainty regarding how the object should be used. Obviously the guarantee had both design and business implications. I congratulate Moles for taking planned obsolescence head-on.

In his second *Design Issues* offering, "The Legibility of the World: A Project of Graphic Design," Moles offered another perspective on graphic design as viewed through "...analysis of micro-anxieties, micro-pleasures, micro-structures, micro-events, or micro-decisions: the entire web of life" (1986, 43). Again the focus was on the individual's project or immediate goal and how design assists or impedes the individual. This article continued on from the earlier one and had some fundamental ideas for human-centered design.

His third offering, "Design and Immateriality: What of it in a Post Industrial Society?" was prescient, dealing with the "age of telepresence" and "communicational opulence." He reflected on our increasingly immaterial culture based on highly developed infrastructure subject to the law of entropy, the unavoidable tendency to disorder. Moles understood how design process was changing based on its reliance on software programs that contained obvious or hidden limitations. The act of designing became "initial form plus variations" called "variational creativity." He concluded the article with: "The role of the designer, then, is not so much to create 'new' objects to serve as structural supports of an immaterial culture, as to insist on an environment of implacable stability. Before introducing something new, the designer must protect the status quo, which permits individuals to participate spontaneously and with little effort in the seductive immateriality of today's world" (1988, 31).

Without stating his position directly, he criticized planned obsolescence and offered a remedy; he took a human-centered perspective and offered new analytical insight; and he challenged the "new"—our current

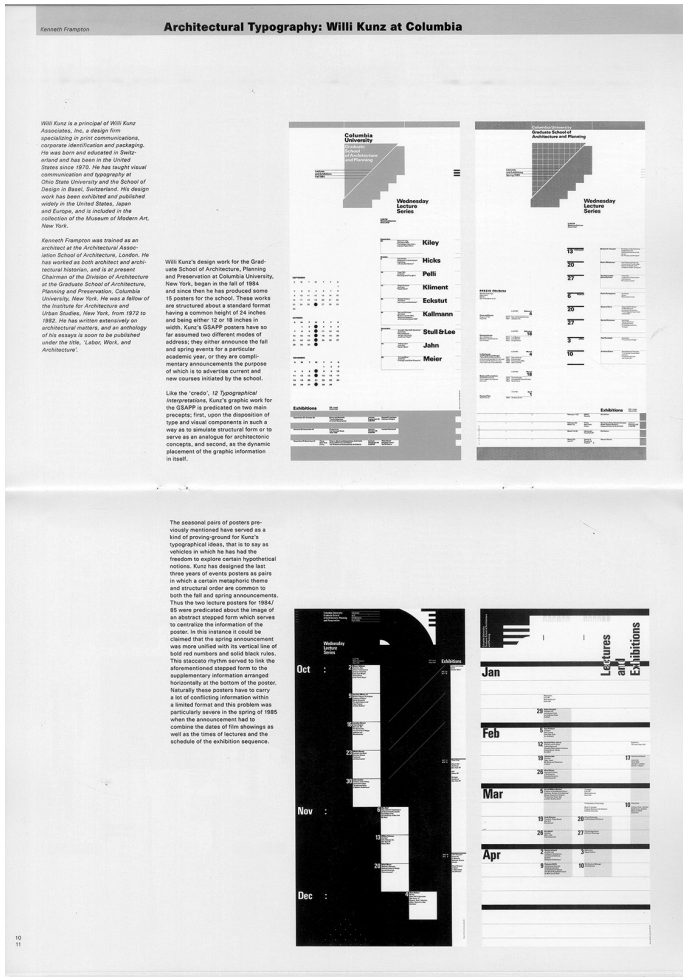
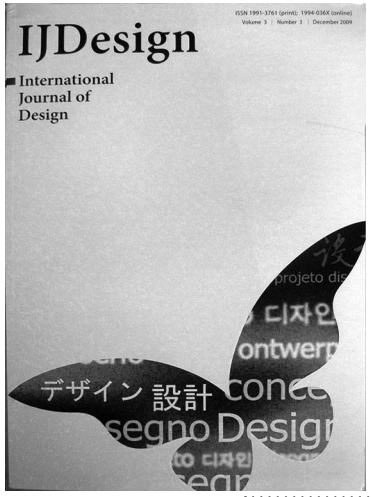


FIGURE 14
International Journal of Design (IJDesign) 3, number 3 (2009)
Cover.



Visible Language
50.1

and planned to be only 8 issues. The goal was to push against then current London design trends. In a sense, with a more limited goal, it was like *Dot Zero*. What was remarkable about *Octavo* was its aesthetic and that it was produced by hand before digital publishing. In comparison with most of the other journals mentioned here, this was a visual feast. It was not scholarly and had modest content goals. Whether it reached its goal to challenge London trends, I have no idea. The final issue was an interactive CD-ROM, as the late 1980s were technologically a transitional time for design.

Issue 87.3 was sixteen pages with articles about Ian Hamilton Findlay (Fulcher, 1987) and Willi Kunz (Frampton, 1987) among others. I have long appreciated the sculptural typography of Findlay, his concrete poetry and the paradoxical character of some of his work that causes me to stop and think, to experience more deeply. Posters for the Columbia University Graduate School of Architecture, Planning and Preservation were the focus of Willi Kunz's work. His Basle origins were evident in the structural use of space and typography with strong content organization and visual gestalt. Both Findlay and Kunz provided quality design experiences, aesthetic delights framed by the sensitivity of *Octavo* itself. *Octavo* had total control and presented whatever caught its fancy.

International Journal of Design

International Journal of Design (IJDesign) began in 2007, located at the National Taiwan University of Science and Technology. It published research papers in all fields of design and aimed to provide an international forum for exchange of ideas regarding cultural factors and their impact on design. Further, it desired to transfer ideas between design academics and professionals through research that was applicable to design performance. It followed a fairly typical academic research report format, covering research methods, analysis, findings, and conclusion. Content heavy, it provided images, tables, and diagrams to complement the text. Despite its location in Taiwan, this was an English language journal.

"Design Patterns for Cross-cultural Collaboration" by Nicole Schadewitz (2009) is a distillation from her doctoral dissertation. I was particularly interested to read this article because I knew Nicole in Hong Kong where she did her Ph.D. It is always interesting to see how students develop their professional skills further and continue to contribute to design research. As designers work in more collaborative cross-disciplinary projects, they also may work in cross-cultural collaborations. This article detailed communication breakdowns and offered remedies. I recall that Nicole used many qualitative analytical approaches to her data; this was evident in her article and its tables and diagrams.

FIGURE 15

She Ji (2015)
 Web site in English version.
 For open access see <http://www.journals.elsevier.com/she-ji-the-journal-of-design-economics-and-innovation>



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 She Ji

She Ji, The Journal of Design, Economics, and Innovation began in 2015 at Tongji University in Shanghai. This newly minted journal is open access and established its scope of interest clearly: design, economics, and innovation. It is bilingual in Mandarin and English but in separate editions. So far only the English version has appeared online. Some in China recognize the importance of moving the culture of design from imitation to innovation, along with recognition of the economics of such a move in terms of both monetary gain and social improvement. It is only in recent decades that a few design thinkers (Richard Buchanan, John Heskett, and Patrick Whitney among others) have puzzled over the economic contributions of design. *She Ji* expects to move such research forward in a cross-cultural context.

Starting a new journal is an optimistic event. It will be interesting to observe whether the research and ideas move equitably back and forth across eastern and western cultures. Buchanan and Whitney book-end the issue. Buchanan (2015, 5-20) explores design thinking for innovation within organizations, while Whitney (2015, 57-78) argues that the economy of choice is superseding the economy of scale, and he offers design capabilities as a way to tune innovation. Kees Dorst (2015, 21-32) proposes a model of frame reflection in design, based on abduction. He explores how other professions can use this model to escape the trap of dead-end definition and redefine problems for a more innovative look. He shares with Victor Margolin (2015, 33-42) the observation that designers are transcending the traditional roles that characterized design and are moving into areas that deal with significant large-scale problems such as sustainability in cities for Margolin and bottom-up stakeholder response and planning for a large-scale interruption in transportation and community character for Dorst. My own contribution to this issue deals with design research, its importance in

cross-disciplinary collaborative work, and a suggestion for how to scaffold its learning across design curricula (Poggenpohl, 2015, 43-56).

It will be interesting to follow subsequent *She Ji* issues under Ken Friedman's editorial direction (2015, 2) with the essential bilingual sophistication of Jin Ma. This will not be design as usual, but will no doubt push the envelope intellectually and practically, to say nothing of culturally. It takes focus and determination to launch a journal and maintain it. But to live, a journal must create its mission and find its contributors and audience. This is not easy. (As an open access publication, the reader is encouraged to consult *She Ji* online.)

Conclusion

The small sample I present shows the uncertainty of journals even those with a long history of quality publication. Sponsors or parent organizations sometimes change and alter their journal mission or the journal disappears altogether. Nevertheless, it is heartening that new journals appear. This demonstration is idiosyncratic. It supports my belief that design is more than making something; design is a cultural statement that either fits or challenges the current state of things. It is also a critic of what is and a harbinger of what will be.

FIGURE 16

The journals selected for this review are positioned based on the author's experience with them and the lasting impression they left.

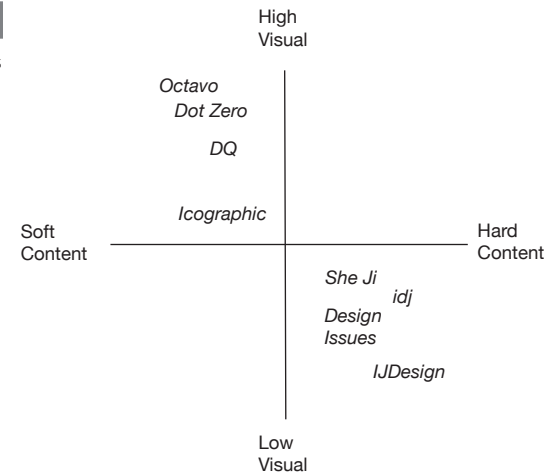


Figure 17 crudely locates the journals presented based on whether they are very consciously visual in a designerly sense or focused on content presented in a standardized fashion and whether their content is "soft" i.e., ideas and exposition that extend thinking (hopefully like this paper) or "hard" i.e., scholarly, substantiated with much reference or research

based with qualitative or quantitative back up. The difference between the two occupied quadrants in Figure 17 might be characterized as stimulation and pleasure (upper left) or research/scholarly content that is useful to improve performance (lower right). Both expand the designer's understanding and repertory for action. The act of design is not turned on and off: it is a way to live a life, to appreciate order, surprise, aesthetic delight, human behavior, the natural world and the artificial, craft, other's insights, and a way to envision a future.

Another analytical dimension is whether a journal is focused on some sub-variety of design or takes a more holistic approach to its offerings. *DQ*, *Design Issues*, *IDJ*, and *She Ji* take the broader view. In the past such an interdisciplinary view within design was a survival mechanism, as getting a necessary core group of subscribers was a problem. Now there is greater understanding of interdisciplinary work and that information (whether critical, historical, theoretical, or research based) can feed active makers more broadly.

As designers work on more significant interdisciplinary projects, access to historical information regarding previous design failures or limited successes can provide context for newer work. Anticipating future developments and thinking about them critically is especially important as technology alters cultural dimensions of life and even human relationships. It would be interesting to see a history of technology criticism from post World War II to the present day. I think of Jacques Ellul (1964), Ivan Illich (1973), Lewis Mumford, (1970) and Neil Postman (1992) as early critics, and Evgeny Morozov (2013) and Sherry Turkle (2015, 2011) as present day critics among others.

Design in the broadest sense has always been dependent on technology, and now this is even more the case. Design and technology are partners—with others—in changing the world. The question is what is gained and what is lost. What are the hidden consequences of a change? Critical articles and a more inclusive sense of the role of design from an intellectual standpoint are needed.

Why are journals important? They provide current information that is reviewed before acceptance. As an editor sending out papers for review, I have been impressed by the care, insight, suggested resources and revisions reviewers bring to their reviews. Their generosity in sharing information and ideas help authors to improve their work and help the journal to maintain its standards. Published articles are ways to find like-minded people to partner with; sometimes an article will test its ideas and later develop into a book.

Of course journals expand knowledge in the field of design. Without them there are only occasional conferences, books, and colleagues for stimulation. We form our identity as a designer in many ways, including thinking broadly about what we do, the culture in which we live, its contemporary challenges, and how the structure of life is changing. Abraham Moles opened my mind to the individual's investment in an object, not as a

monetary issue, but as a support for the individual's life. Victor Papanek put technology into a human context, one we continue to wrestle with. Journals surprise us; they provide intellectual serendipity; some few are visual delights; and in all cases they help shape our understanding and identity as designers.

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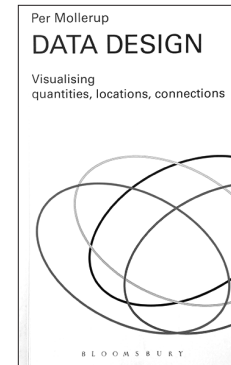
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A u t h o r

Sharon Helmer Poggenpohl has taught in notable design programs: The Hong Kong Polytechnic University, the Institute of Design at the Illinois Institute of Technology in Chicago, and the Rhode Island School of Design. Her focus over a long career has been post-graduate design education, both master and Ph.D., as well as design research. Taking a human-centered position with regard to design, she teaches to help students humanize technology, to learn to work creatively and collaboratively with each other, and to prepare them to contribute to building a body of design knowledge. For twenty-six years, she edited and published the international scholarly journal *Visible Language*. She co-edited with Keiichi Sato *Design Integrations, Research and Collaboration* (Intellect Books, 2009). Currently, she is working on a book tentatively titled *Design Theory-to-go*, while teaching occasionally in Hong Kong.

Book Review

DATA DESIGN Visualizing quantities, locations, connections
by Per Mollerup



When a book arrives that belongs to a well-populated category on my bookshelf it makes sense to review it in the context of its neighbors. In this case, *DATA DESIGN Visualizing quantities, locations, connections* by Per Mollerup joined 27 books on information design already on my “active books” bookcase, that is, the books not on bookcases in the basement.

Per opens his book explaining foundational concepts in a chapter titled “Basics.” Existing information design books such as *The Wall Street Journal Guide to Information Graphics* by Donna M. Wong open similarly with a first chapter titled “The Basics.” Whereas Wong briefly touches upon various functional components of design such as color, typography, and legibility Mollerup draws in principles from research such as Gestalt psychology.

Where Per does discuss color he does so in relation to a color system rather than functional advice. Per’s introduction also introduces the concept of simplicity as well as several historic milestones such as William Playfair’s *The Commercial and Political Atlas* and Isotype. Jenn and Ken Visocky O’Grady also mention Isotype in their “Overview” chapter of *The Information Design Handbook*, but in comparison to these other books *DATA DESIGN* tends to found build arguments more on established findings in other fields than issues particular only to design.

Per’s descriptions of data design are characterized by their simplicity. Simplicity in this case does not mean lacking nuance, sophistication, or insight but rather that he absents explanations of jargon and academic pretension. For example, on page 57 Per writes, “Categorical variables are known by their distinctive difference, by their lack of universal order, and by not being quantifiable. Gender is a categorical variable.” This is as simple, detailed, and clear an explanation as I can remember. However, at times such admirable simplicity provides less help when on one hand it links word to definition while lapsing into circular redundancy such as on page 56 “A variable is a factor that may vary.” Most dictionaries avoid using the root word to define the word and I think both simplicity and comprehension would have been served if the book had more carefully observed this convention.

The bulk of the book is devoted to well organized and amply illustrated examples of data design organized into three broad categories: visualizing quantities, visualizing locations, and visualizing connections. This makes it an easy reference for designers facing a particular kind of task. The clear, simple yet insightful quality of the entire book makes it well worth owning.

Mike Zender

Journal Information

Visible Language is an academic journal focused on research in visual communication. We invite articles from all disciplines that concern visual communication that would be of interest to designers.

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Visible Language, an academic journal, seeks to advance research and scholarship for two types of readers: academics and professionals. The academic is motivated to consume knowledge in order to advance knowledge through research and teaching. The professional is motivated to consume and apply knowledge to improve practice. *Visible Language* seeks to be highly academic without being inaccessible. To the extent possible given your topic, *Visible Language* seeks articles written to be accessible to both our reader types. Anyone interested may request a copy of our editorial guidelines for authors.

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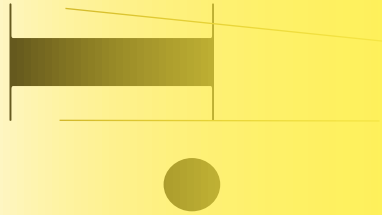
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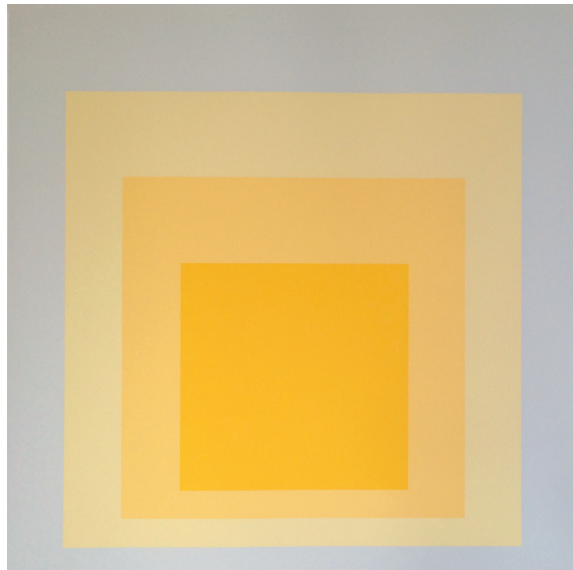
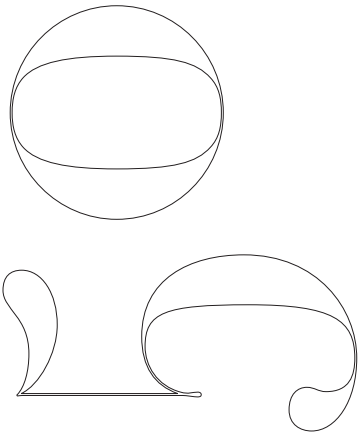
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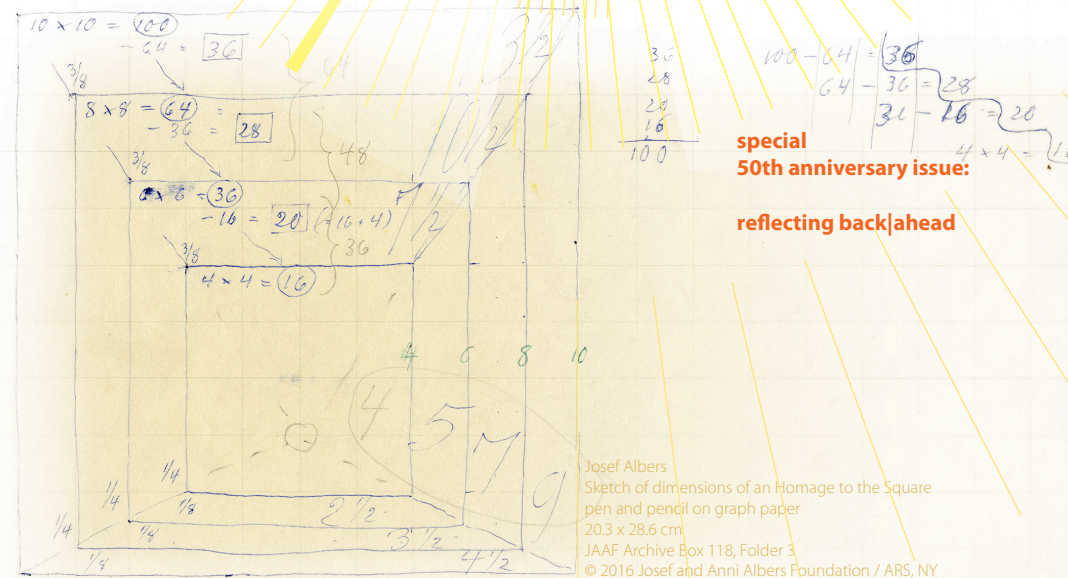
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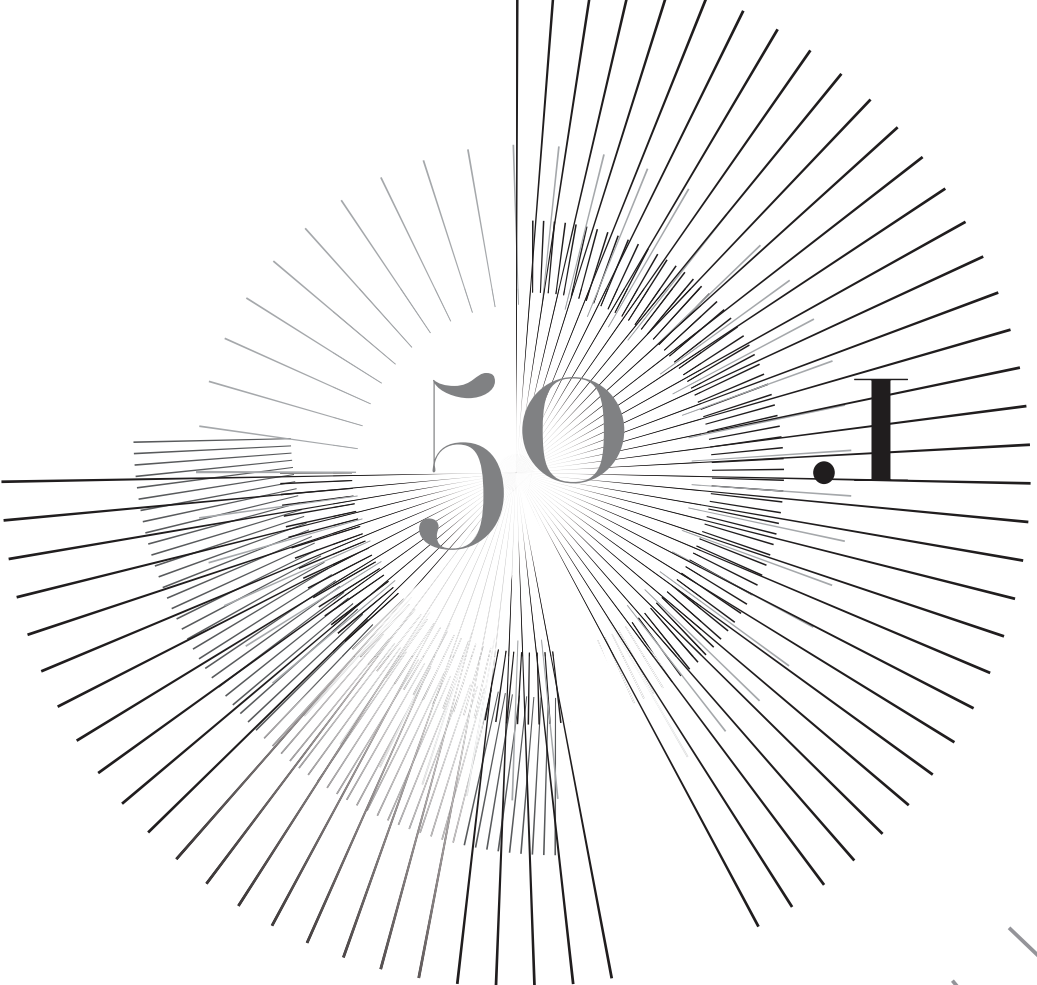


special
50th anniversary issue:

reflecting back|ahead

Josef Albers
Sketch of dimensions of an Homage to the Square
pen and pencil on graph paper
20.3 x 28.6 cm
JAAF Archive Box 118, Folder 3
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**50th anniversary issue:
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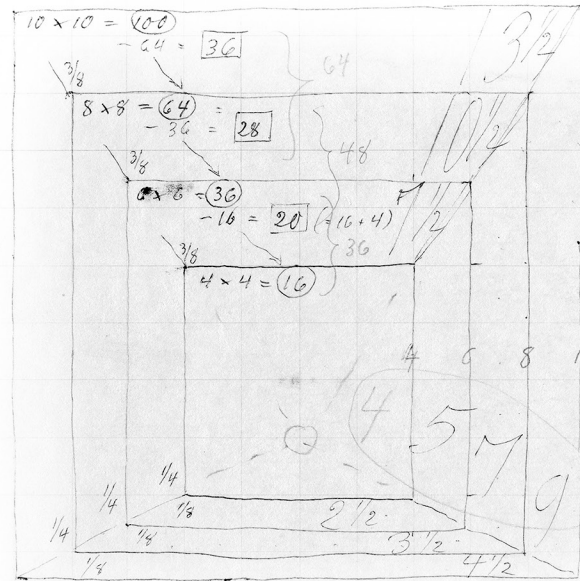
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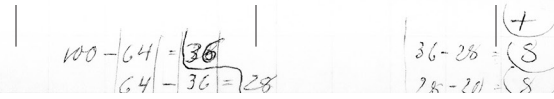
A lot of design has happened in the 50 years since *Visible Language* was founded: typesetters – gone; desktop publishing – a passing blip; computers – moved from desktop to pocket. The term graphic design had hardly entered the dictionary before the discipline started to consider renaming itself visual communication design or just communication design. Because communication continues to grow in quantity and importance there's no reason to disbelieve in a promising future for a communication design discipline. What the promising design future looks like is, as always, sketchy. A well-known 20th century Danish proverb states that predictions are easy except when they involve the future and George Santayana famously warned of the trouble that awaits failure to examine the past. If we take Santayana's statement less as a warning than as a prescription to guide action, we might reflect thoughtfully on the past in order to plan our steps today to help shape a future the Danes say is so difficult to predict. Reflecting on the past may not make predictions easier, but it might make them more realistic.

To celebrate its 50th year *Visible Language* will revisit themes from the journal's past to help chart the design discipline's future. This issue features articles by Meredith Davis, Sharon Poggenpohl, and myself commenting on design's direction, design journals, and design research. As a special homage to the journal's roots in typographic research issue 50.2 will revisit typography and see what we have learned in the past 50 years and project where typographic study should be going next. Issue 50.3 will look at *Visible Language* in light of design history and theory with a similar aim: to reflect on the past to help guide and inspire the future: reflecting back – reflecting ahead. Reflecting in the sense of thinking deeply or carefully about something and at the same time suggesting the visual nature of much of human cognition and the essential visual nature of design. Reflection is a physical process wherein light or energy is thrown back from a surface. We learn about ourselves through reflection. We see things in a new light, from a new vantage point, and if the mirror is placed properly we can see not just where we've been but where we are going: around the corner we have not yet turned.

This year we are devoting part of the journal to not predicting the future but to shaping it. We can't wait to see what they'll say about our efforts in 2065!



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Design Research Pioneer

Josef Albers:

a case for design research

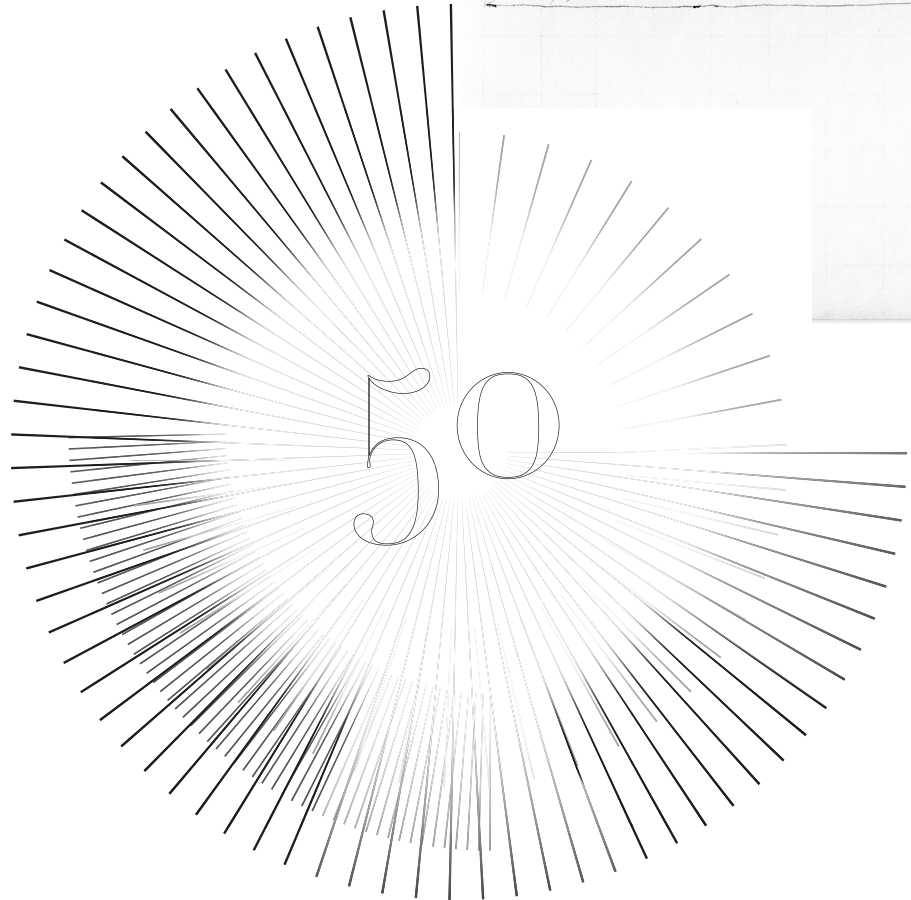
Mike Zender

Abstract

A lot of design has happened since Josef Albers produced his massive work *Interaction of Color* in 1963 (Albers, 1963). Communication design has grown from a toddling discipline full of confidence to an adolescent exploring new territory. Albers' color teaching in design school, articulated 52 years ago just as Graphic Design was emerging as a professional discipline, had a formative influence that has been as widespread as it continues to be lasting. Today, as design research is becoming normative in practice, this article revisits Albers not for his teaching, which is well understood, nor for his art, which is famous, but for his research. Josef Albers can be viewed as a pioneering design researcher of the first order and *Interaction of Color* can be read as the one of the earliest published records of a body of design research and principles derived from it. In this light, Albers' work might be worthy of emulation in its focus on a key topic explored through sustained, systematic, empirical study that produced generalizable knowledge and kept practice before theory. The article observes that design, far from building on Albers' research legacy, has largely failed to produce works of similar quality or influence to his groundbreaking work 50 years ago.

KEYWORDS

design research, visual perception, color, design foundations, science, scientific method, design teaching, communication design, graphic design



Mere distribution and accumulation of facts,
 and many more so-called facts,
 I consider possessive teaching and learning,
 challenging memory more than imagination,
 placing theory before practice,
 and retrospection before creation,
 and thus “re-search” before search.

Josef Albers, *Search Versus Re-Search*
 (Albers, 1969, p. 13)

**J o s e f A l b e r s -
 d e s i g n s e a r c h e r / r e - s e a r c h e r ?**

To make a vast understatement, Josef Albers was a talented individual. His art is world renown. But far from being a narrow specialist, he succeeded in multiple roles: teacher, artist, designer, and as this paper will argue - researcher.

When viewed from a career perspective, Albers’ CV would say he was foremost a teacher. Indeed, most of his life was spent teaching first in elementary school, then art and design at the Bauhaus, at Black Mountain College, and finally at Yale University (Horowitz & Danilowitz, 2006). *Interaction of Color* (abbreviated here *IC*) was his most comprehensive record of his teaching. More than a history, it is clearly a teaching manual, a primer for how to teach color. In it he wrote about classroom activities, “On the blackboard and in our notebooks we write... then the class is invited to produce similar effects but is not given the reasons...

Soon, these first trials are collected and separated into groups...

The class will become aware...

A second class exhibition of more advanced results should clarify...” (Albers, 2009, p. 11). Note how many times on a single page (p. 11) the word “class” was used. Albers described *IC* as “a report on a logical sequence of class exercises aiming at the development of color-sensitive eyes” (Holloway & Weil, 1970). *IC* offered instructions from a master teacher to instruct other teachers in his methods. In the last chapter of *IC*, Albers wrote, “This book presents the results of search, not what is academically called research. As it is not a compilation from books, it does not end with a list of books – either books read, or books not read.” Although Albers called it search rather than re-search, from within *IC*’s descriptions of teaching emerge the methods of a researcher,

“It starts on a trial and error basis... Because of the laboratory character of these studies... successful studies present a demonstration.” (Albers, 2009, p. 11). The research orientation of Albers’ teaching is clear from the very first line of the *IC* Introduction, “The book “Interaction of Color” is a record of an experimental way of studying color and of teaching color.”

Albers made clear in his lecture series titled “Search Versus Re-Search” that when he spoke against re-search he had in mind students’ “memorization and redistribution” of theories that others had previously discovered (RE-search). Albers was not opposed to research. In fact he vocally advocated an experimental teaching method using trial and error and doing laboratory studies. What Albers opposed was students’ learning by reading about experiences rather than having experiences of their own. This is clear because Albers used the language of the research laboratory to prescribe his classroom activity.

It’s not at all novel to use the classroom as a laboratory as multitudes of good professors know. That Albers primary laboratory space was the classroom does not disqualify Albers’ work from being scientifically valid; otherwise, much of past and current science across many fields would be removed from the corpus. Yet it would be an injustice to the truth to say that science was Albers primary aim. He made his aim unmistakably clear, “The aim of such study is to develop—through experience –by trial and error—an eye for color.”

Yet even this clearly stated aim integrates teaching and research, theory and practice, but in a reversed order.

“This book therefore does not follow the academic conception of “theory and practice.”

It reverses this order and places practice before theory, which, after all, is the conclusion of practice.”

(Albers, 2009, p. 1)

While Albers principal aim was not to do re-search, he at times certainly acted like a researcher. “This way of searching will lead from... to...” (*IC* p. 2) are words that describe an empirical process founded on a cause and effect epistemology that is the foundation of scientific inquiry. Others took note of the degree to which Albers used scientific methods in his teaching. In 1969 two scientists interviewed Albers for the art and science journal *Leonardo* and asked (I – interviewers; A – Albers),

I. It has occurred to us that in your work there appears to be considerable application of scientific method.

A. I do not know. I should tell you that recently I received articles on my work which are related to your question. One from Paris has the title ‘Three important mathematical steps in Albers’ work’. And another article from Rome saying ‘Albers works scientifically.’ Whether this is right or wrong, I enjoy mak-

ing line constructions and color instrumentations which seem to work, that is, by inviting the spectator to attain an aesthetic experience and/or a new visual insight (cf. Fig. 1). My main concern is to remain a student looking for further problems to be solved and working for my own development.
(Holloway & Weil, 1970)

In his response Albers did not reject the label “scientific” while being careful to qualify or add to it the concept of aesthetic insights. The descriptions of Albers’ methods as “scientific” were made at a time when a single scientific method was more commonly envisioned than today. Today’s scholars would be more nuanced. The National Academy of Sciences has recognized that there is not a single “scientific method” but a “body of methods” particular to scientists’ work such as formation of a hypothesis, careful and thorough examination of the hypothesis using relevant data, and reporting of results (Committee on Science & Public, 2009). The Stanford Encyclopedia of Philosophy entry on “Scientific Method”, while obviously philosophical in orientation, has also noted the devolution of a clearly defined, single scientific method while at the same time observing that science education at all levels continues to teach a scientific method of roughly five steps: observation, hypothesis formation, examination of evidence to test the hypothesis, analysis of test results, and presentation of findings (Anderson & Hepburn, 2015). Lately, some have noted that in their most general form scientific methods are the methods used to formulate knowledge of any kind. What the Stanford Encyclopedia entry concludes is that what distinguishes methods as scientific is the rigor and care with which knowledge is formed: the systematic examination of relevant data, the care in excluding alternative explanations, the rigor in reducing error, and the reasoned connections to other data. Thus scientific methods may be seen as a subset of epistemology that focuses on answering questions through methodical study. For purpose of this paper, methods will be considered scientific which include systematic exploration, examination, and demonstration of a hypothesis through empirical data with reported results. This paper will argue that over time Albers developed and used scientific methods in his teaching and in his personal work to do research.

Albers search/re-search impact on design

Albers integration of scientific methodology into his classes was not pioneering, but he was a pioneer in bringing a scientific approach to teaching Graphic Design while it was still in its infancy as a discipline. Many identify the Bauhaus (1919-1933) as a guiding influence for Graphic Design as a twentieth century discipline (Meggs, 1991, p. 288). While the Bauhaus started as an integration of art and crafts, it quickly embraced the scientific methods that were part of the spirit of the age. There were numerous lectures on Gestalt theory at the Bauhaus “typical of the tendency that dominated the

Bauhaus from 1928 on, to introduce system and scientific methods into the curriculum.” (Wingler & Stein, 1976, p. 159). Scientific methods are defined above as being characterized by reliance on empirical data, and empirical is defined in the Oxford English Dictionary as based on observation and experience often involving experimentation. Albers applied scientific methods early in his Bauhaus teaching through his emphasis on students’ direct experience with data. For the Sixth International for Drawing, Art Education, and Applied Art in Prague in 1928, Albers wrote, “The best education is one’s own experience.” (Wingler & Stein, 1976, p. 142). Albers advanced the use of scientific methods at the Bauhaus when he turned the fundamentals course away from the artistic direction of his predecessor Itten and toward a more empirical approach.

When Albers himself began teaching what became known as the Bauhaus *Vorkurs* (Preliminary Course) in 1923, he build on Itten’s course, stripping away its more esoteric and expressionist aspects and concentrating on the concrete experience of the investigation of materials and visual training.... Rooted in a fascination with how seeing occurs, Albers believed it was an outwardly directed endeavor (Horowitz & Danilowitz, 2006, p. 20). (underline added)

Albers fascination with seeing was fed by findings in vision science. His exact links to vision science will be detailed below, and it will show he was deeply engaged. He not only employed scientific findings in the design of his course content, but he also applied scientific methods in students’ activities that used direct observations to build empirical evidence. His faculty position at the Bauhaus placed his methods at the center of the emergence of the Graphic Design discipline.

It was natural for Albers to teach design, as Albers was himself an occasional graphic designer. In his Introduction to the 2009 edition of *Interaction of Color*, Nicholas Fox Weber wrote, “In 1921 his (Albers) first project at the Weimar Bauhaus had been to make a speculative binding for a portfolio of artists prints, and a few years later when Gropius’s pioneering art school had moved to Dessau, Albers made alphabets; graphic design was one of his passions” (Albers, 2009, p. xi). Noted art historian T. G. Rosenthal concludes simply, “Albers like other Bauhaus masters was a superb and innovative designer.” (Albers & Rosenthal, 2006). Albers design orientation certainly found a receptive audience in design students who embraced his scientific methods. Albers teaching using scientific methods certainly helped train designers whose subsequent practice distinguished Graphic Design from craft and commercial art in part due to the scientific approach those designers utilized. It could be argued that it was Albers’ research approach that helped distinguish Graphic Design from Fine Art.

Albers honed his teaching methods at the Bauhaus, and after a brief interruption for the war he brought them in a more advanced form to teach at Yale from 1950-1960. At this time Yale was at the forefront of

the impulse to establish Graphic Design as a discipline distinct from Fine or Commercial Art. Then-dean Charles Sawyer had just reorganized the Yale Division of the Arts “into three Departments: Architecture (which included city planning), Design (which combined painting, sculpture, and graphic arts), and somewhat incongruously, Drama” (Horowitz & Danilowitz, 2006, p. 46). The change raised a furor among painting and sculpture faculties “who resented, sometimes vocally and vociferously, the about-turn their hallowed art school was taking” (ibid. p. 49). When in 1950 Sawyer invited Albers to be the Chairman of the newly formed Department of Design where Albers was to introduce his research-oriented teaching methods, Albers faced the opposition deftly. “Albers strategy was simply to ignore the old guard and allow them to continue their classes, which attracted increasingly dwindling student numbers” (ibid. p. 49). Design historian Lorraine Wild in noting the impact that Bauhaus emigrés had on the creation and growth of design curricula in the U.S.A., credits Albers with establishing “one of the nation’s first formal graphic design programs” at Yale (Giovannini & Walker Art, 1989). Though priority is important, it is not the same as prominence. In this case however, Yale was not only one of the first, but one of the most influential Graphic Design programs. Beginning at the time of Albers arrival, the Graphic Design Program at Yale was to become for nearly 30 years, under Alvin Eisenman’s leadership, one of the premier Graphic Design programs in the world with a deep and far ranging impact on both academic study - with many alumni becoming future faculty in Graphic Design - and the profession - with many alumni such as Chermayeff and Geismar becoming principals in prominent Graphic Design firms. Since Albers’ color course was required for Graphic Design majors at Yale, it is hardly surprising that the students who produced the studies that formed the core of *Interaction of Color* were graphic designers. Indeed, T. Geismar, of Chermayeff and Geismar mentioned above, is credited as author of Plate VII-4(L) in *Interaction of Color*. This book, first published in 1963, was almost immediately adopted into Graphic Design education well beyond Yale. Color studies from *Interaction of Color* were used to teach graphic design starting in 1969 at the University of Cincinnati’s newly re-named Graphic Design Department headed by Yale alumnus Gordon Salchow. UC remains a leading design school and continues to teach Albers’ color studies. In 1974 *IC* was published as a paperback book which, as Brenda Danilowitz reported in “A Brief history of Josef Albers *Interaction of Color*,”

...(IC) was used frequently as a textbook in schools, where students often had access to the original publication in their libraries, and sales soared. Editions in Japanese, French, Spanish, Swedish, and Italian followed German and Finnish paperback editions. With the exception of the Japanese and Swedish editions, all remain in print (Malloy, 2015).

Albers’ color studies became a staple of foundation and similar courses in Graphic Design in the U.S.A. and have remained a staple of foundational

design education all over the world until today.

Perhaps because Graphic Design began to emerge from a craft into a discipline during a century reaping the fruit of scientific methodology it was inevitable that scientific methods would help form Graphic Design. Or it may be that Albers and a few others particularly interested in science at the Bauhaus skewed Design into a more scientific mindset than it might otherwise have had. Whether it was Albers’ interests or the irresistible sweep of technology or perhaps some of both, as a result of this teaching Graphic Design had scientific methodologies integrated into its core teaching from the start; there is little doubt this foundation helped shape the subsequent nature of Design toward science and research.

But was Albers’ use of scientific methods research? There is a difference between borrowing a method and using a method to produce research. If Albers did research, then Albers’ work can be seen as one of the earliest, most extensive, most repeated, and most influential design research programs yet recorded. If it was research, it was a research-orientation that helped define the Graphic Design discipline and that still informs it today. Without perverting Albers’ instructional intent or taking away from his many artistic accomplishments, this paper examines Albers work as research and if found to be so, to draw from his research important qualities to inform the future of Graphic Design research.

Research

The definition of research that will be used here to examine Albers’ work is a simple one: systematic investigation that aims to produce generalizable knowledge. This research definition is used by The University of Cincinnati (UC) and 1,400 other institutions across the USA who utilize the CITI training website to prepare researchers to conduct government funded research studies. The definition’s core tenets are exploration or examination in a rigorous way that includes carefully controlled observation, collection, and analysis of data (in short, scientific methods defined above) the aim of which is broadly applicable principles that others can employ to reliably address problems or on which to construct new knowledge. Emphasis is on empirical study rather than pure logic with public reporting of findings so that others can verify them, refute them, and when suitable build on them. Based on the CITI definition, this paper defines research as

a hypothesis,
systematically explored, examined, and/or demonstrated using empirical data,
with links to other knowledge (scientific methods),
and reported results.

Many have argued that design research is different from other research, or that it should be. Herb Simon is often quoted in this regard

describing design as the science of the artificial (Simon, 1996) as opposed to the science of the natural. The key distinction many make is that science seeks to explain the nature of things that exist like physical phenomena while design involves the human creation of the not yet and that this significant difference necessarily affects not just the aims of inquiry but also the methods of inquiry. Others suggest that design involves aesthetics and connects beauty to intangible qualities not considered the purview of science. Donald Norman has written convincingly on the critical role of aesthetics and emotion in *Emotional Design: why we love or hate everyday things* (Norman, 2004). Citing research findings, on page 19 Norman wrote, “attractive things make people feel good, which in turn makes them think more creatively... making it easier to find solutions to problems they encounter.” Still others point to the practice-based practical nature of design as distinguishing it from scientific research. Yet even allowing for these differences, design research still shares many features of the general research definition. Most design research employs observation or experience, the definition of empirical study. Most design researchers report their findings for others to consider. Both design and general research hope to identify principles and knowledge that others can use, and certainly many branches of science such as medicine are extremely practice focused.

This paper suggests that Albers’ work fulfills this definition of research, as will be detailed below. Albers investigated a hypothesis he called the interaction of color. He studied this for more than 40 years. Albers investigated systematically. He produced and supervised the production of numerous systematic, carefully controlled, and rigorously supervised studies. The data Albers collected was carefully analyzed, annotated, and stored. Conclusions reached were based on empirical observation. Albers’ results produced generalizable knowledge. The results were categorized and formulated into a structured framework. They were published and adopted broadly making them subject to scrutiny and repeated examination for verification and amplification.

In addition to Albers’ work fitting the definition of research, two contemporary witnesses described Albers as a researcher. To publish the book *Interaction of Color* Albers sought and was awarded a \$6,000 grant from the Rockefeller Foundation Division of Humanities. In his April 11, 1956 letter requesting the grant, Yale Provost E. S. Furniss wrote that the grant was “...to enable Josef Albers, Professor of Art and Chairman of the Department of Design at Yale University, to complete his research and prepare for publication of a manuscript of his color studies and their application to the field of design.” The receipt for one of the \$1,500 quarterly payments was labeled simply “research” (letter and receipt Albers Foundation, Box 73, Folder 14). Albers clearly acted like a researcher, was funded as a researcher, and was recognized as a researcher by knowledgeable peers.

One measure of authentic research is the impact it has on others working in the same field. The fact that Albers’ experiments have

been reproduced widely and influenced the development of Design was noted above. Yet the impact of Albers’ research went well beyond his students. Albers’ work laid a foundation for others’ work in color. Karl Gerstner worked initially as a graphic designer and founder of a design agency Gerstner+Kutter and later as an artist deeply interested in color. Grace Glueck in her essay “Perceiving Karl Gerstner” in the book *The Spirit of Colors: The Art of Karl Gerstner* wrote that as Gerstner’s interest in the phenomena of color grew, he contacted Albers to learn of Albers’ work and made it “a departure point for his own work.” (Sterlin, 1981, p. 15). Glueck quotes Gerstner as saying, “Albers was one of the first to explore colors in a precise and rational way, describing them as phenomena with an intriguing life of interactions” (Sterlin, 1981). Gerstner recognized in Albers a scientific approach “precise and rational” and a novel research hypothesis “intriguing life of interactions.” Clearly this is the description of Albers as a researcher made by a colleague building upon his work.

At first look Albers’ work certainly seems to fit the general definition of research. Gerstner’s observation suggests that Albers was indeed a design research pioneer, and the lasting effect of *Interaction of Color* suggests Albers was a pioneer of the first order that others continue to follow. If Albers was a researcher with significant influence, then we might benefit from a look at the characteristics of his research: what he did, how he did it.

Characteristics of Albers’ Search / Re - Search

Albers’ work was based on findings in vision science, particularly color. This is evident from the chapter titles of *Interaction of Color*. Chapter XIII is titled “The Bezold Effect” and chapter XX “The Weber-Fechner Law.”¹ Albers’ foundation in vision science is also evident in his notes for *IC*,

The physio-psychological phenomena of the so-called after-image is the reason why we don’t see neighboring colors as what they actually are, that is, physically. (HANDWRITTEN NOTE “wavelengths”) ¶14 “This effect can be understood two ways. First-(HAND STRIKETHROUGH) One, as it is usually, in an additive direction as any outspoken hue adds its complementary hue to its neighbor. But it is just as important to see this as a subtractive influence in absorbing from its neighbor its own hue, or (HAND ADDED its own) light.

Albers Archive, Box 74, Folder 12.2

Albers had significant work to build upon. Vanja Malloy wrote recently in the “Introduction” to *Intersecting Colors*,

It is not a coincidence that Albers’s concern with the deceptiveness of visual perception developed during a momentous period in vision science. During his lifetime great advances were

¹ The Weber-Fechner Law is about perception generally not just visual perception, but it was applied by Albers to visual perception.

made in improving our knowledge of how the brain interprets the information it receives from the eye. The American physiologist Ida Henrietta Hyde (1857–1945) invented the microelectrode in the 1930s, enabling scientists to record the activity of single cells in the brain (Malloy, 2015).

Vision science had been developing for 100s of years from Newton's discoveries of the properties of the spectrum through Chevreul in the 19th century, and as Malloy notes this science got a boost from the use of single neuron probes. However, the most important results of electron probe visual research largely came after Albers had completed his work. About 1950 Stephen Kuffler began to identify the important center-surround structure of the cat eye using such probes, followed in the 1958 by discoveries from David Hubel's lab about the functional structure of the visual cortex in the cat brain (Hubel, 1988, p. 69). The published results of these groundbreaking discoveries did not appear for some time after Albers had largely finished his teaching career. Knowledge of the process of visual perception would develop even more rapidly at the end of the 20th century with the development of non-invasive forms of brain imaging to monitor physiological brain activity in response to visual stimuli in humans.

While Malloy may have overstated the influence of the single electrode probe on Albers, the essential point is correct: vision science certainly was advancing during the time Albers was exploring color in his classes, and there is ample evidence he was aware of it. Albers had in his library the 1868 English translation of M. E. Chevreul, *The Laws of Contrast of Colour*; indeed, Albers cited page 5, paragraph 11 of Chevreul's book on page 51 of *Interaction of Color*. He also owned Carrie van Biema's *Farben und Formen als Liebendige Krafte* 1930, Bruno Petermann's *Das Gestaltproblem in der Psychologie*, and Goethes' *Natur wissenschaftliche schriften band I and II*, Verlag, Leipzig, 1925, and other similar books.

Albers stayed current with his knowledge of vision science as is evident from his personal interaction and communication with vision scientists. During Albers's tenure at Yale Dr. Walter Miles, noted international researcher doing night vision research, and Dr. Thomas Cornsweat, a widely recognized expert in vision science and definer of the Cornsweat Illusion, were serving as faculty in the Psychology Department at Yale. Albers apparently discussed particular problems in vision science with those in the Psychology Department at Yale. In a November 20 typewritten note on Department of Psychology letterhead either Tom Cornsweat or his predecessor Walter Miles wrote,

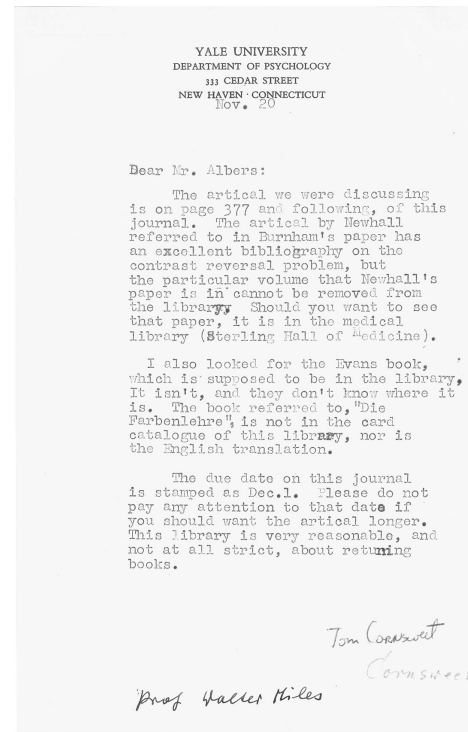
The article we were discussing is on page 377 and following, of this journal. The article by Newhall referred to in Burnham's paper has an excellent bibliography on the contrast reversal problem, but the particular volume that Newhall's paper is in cannot be removed from the library. Should you want to see that paper, it is in the medical library (Sterling Hall of Medicine). (Albers Archive, Box 73, Folder 9)

FIGURE 1

Note from Psychology Department colleagues. Note Albers' annotations of "Cornsweet" and "Prof. Walter Miles" at the bottom.

JAAF Archive Box 73, Folder 9

Courtesy of the Josef and Anni Albers Foundation



As Albers was preparing *IC* for publication he sent a draft of the manuscript to Dr. Walter Miles noted above for review for technical accuracy. In Albers' letter of April 20, 1958 to Dr. Miles, Albers wrote:

I remember with pleasure meeting you in my office in Street Hall about 2 years ago when you gave me a reprint on the Bezold effect. I probably mentioned at the time I was planning a book on color... Now, I am looking for someone competent who could check my formulations, particularly in regard to psychology, I thought of you and was repeatedly referred to you. Thus I dare to ask you whether you would be willing to read and check my manuscript.

The reprint Albers mentioned may have been the one described in the Psychology Department note in Figure 1 suggesting that this note was from Miles. Regardless, the correspondence shows Albers was aware of the Bezold effect, discussed it in a cross-disciplinary way with relevant colleague(s), and took steps to insure that vision science was accurately represented in *Interaction of Color*. Albers likewise communicated with noted psychologist of art, Rudolf Arnheim, and invited Arnheim to come to Yale to make a presentation (Horowitz & Danilowitz, 2006, p. 262).

Albers' dialogue with vision scientists continued after publication of *Interaction of Color*. In a December 11, 1964 letter, Leo M. Hurvich,

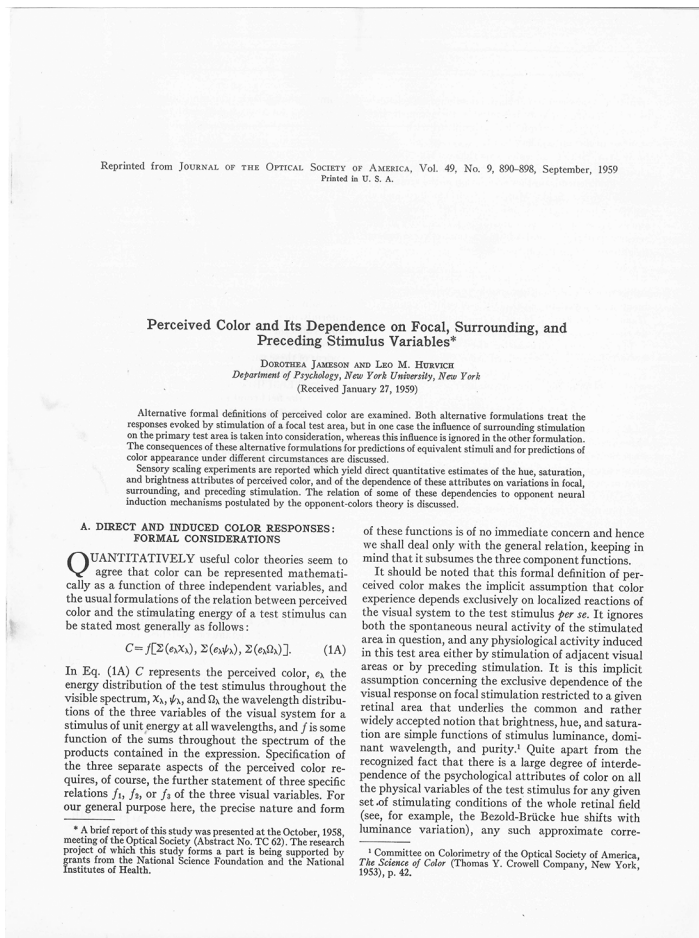
a perceptual scientist, noted having seen and read *Interaction of Color* and observed great similarities between his research interests and Albers' work. Attached to the letter was an article reprint (See *Figure 2*) that he had co-written with Dorothea Jameson titled "Perceived Color and Its Dependence on Focal, Surrounding, and Preceding Stimulus Variables," vol 49 No 9, 1959, *Journal of the Optical Society of America*. The article builds a mathematical formula to describe the "relation between perceived color and the stimulating energy of a test stimulus" (Jameson & Hurvich, 1959, p. 890). Hurvich observed that existing formulae ignored adjacent visual areas, and proposed a way to accommodate the Bezold effect. Jameson and Hurvich asked in their article, "Can we validly ignore the influence of adjacent stimulation on perceived color, or dismiss it as 'purely subjective effect'...?" (correspondence and article Albers Archive, Box 73, Folder 9). Albers who had long preached the difference between "physical fact and psychic effect" must have nodded

FIGURE 2.

Essay on perceived color by Dorothea Jameson and Leo M. Hurvich, 1959 sent to Albers after publication of *Interaction of Color*.

JAAF Archive Box 73, Folder 9

Courtesy of the Josef and Anni Albers Foundation



in agreement and satisfaction even if Hurvich's mathematical formulae were not part of his vocabulary. However, Albers response to another scientist's comment on *Interaction of Color* was decidedly unappreciative. Writing in response to a letter from Mr. Robert Allen Mitchell correcting Albers' use of primaries "red, yellow, and blue" Albers wrote,

As any understanding of acoustics has nothing to do with the production or appreciation of music, so, similarly no knowledge of wavelength of color or theories or rules about color will lead to imagining or seeing meaningful color – or art. Because (to quote myself) the source of art is the discrepancy of physical fact on psychic effect. (Albers Archive, Box 73, Folder 9)

Albers' response to Mr. Mitchell reveals Albers peculiar relationship to science: on the one hand he built his work upon it; on the other hand he looked beyond scientific definitions of color and focused instead on people's experience. Due to his commitment to giving students experience before forming theory Albers would not generally explain the scientific basis of classroom experience until after the students' work on a project was finished (Horowitz & Danilowitz, 2006, p. 203). This suited Albers' prioritization of direct experience over theory as a starting point.

.....
Empirical: experiential, based
on observation

Albers' work was built on findings in vision science as noted above, but Albers did not just build on others' knowledge: he extended their empirical methods. Albers' entire focus was on direct observation. In the "Introduction" to *Interaction of Color* he wrote, "The aim of such study is to develop—through experience—by trial and error," that is, by observation. Albers' students performed experimental studies under his supervision, they observed the data they collected through class critiques, and they analyzed the results. The instrument of measure was the human eye because the purpose of the experiments was ultimately to open the eyes of students to see color, to appreciate it, and as professionals to use it effectively. Horowitz affirmed the empirical quality of these methods writing that "Albers course built on earlier empirical attempts to understand the nature of color" observing that "even though Albers was more narrowly concerned with color as it is observed in normal conditions, the experiments (of Goethe) provided a model for systematic investigation" (Horowitz & Danilowitz, 2006, p. 195). Albers whole process placed practice/experience before theory, as quoted previously.

.....
Integration of science and imagination

Though empirically grounded, Albers' laboratory was not a sterile scientific lab disconnected from reality but united observation with imagination. In the "Introduction" to *Interaction of Color* Albers wrote "Seeing here... is coupled with fantasy, with imagination. This way of searching will lead from a visual realization... to an awareness... ." In Albers' use, "realization" was

word for making objects or physical demonstrations; hence he is speaking of converting the experience of making things into explicit knowledge through imagination. He seemed delighted to note that the Weber-Fechner Law “demonstrates that, perceptually, multiplication appears as addition” (Albers, 2009, p. 111). Albers’ students appreciated Albers’ statement that you can do in art what you can’t do in banking. One plus one could add up to three or more. Albers distinguished between “factual facts” such as data on wavelength and “actual facts” of perceptual experience where 2 colors look like 3 or 4 colors can look like 3. He reveled in exploring the experience of reality and sharing this exploration with his students. They were fascinated. Horowitz quotes one student as saying “You were always looking forward to the next wonderful surprise, it was like going to a magic show” (P. 200). A magic show founded on science.

Albers’ laboratories

Albers explored color using empirical research methods in two different laboratories: the classroom and the studio.

Classroom laboratory

Productive research inquiry is well focused, and Albers focused his research effort on an essential topic: color. This was strategic choice. Color is experienced everywhere and is used everywhere in design. Color was a foundation or core course topic everywhere Albers taught. While color had and still has near universal applicability, it was nevertheless a narrowly focused field with clearly defined properties: value, hue, and saturation are the key features of color from a designer/artist perspective, wavelengths of light are key from a physicists perspective, cones and color opponent pairs are key from a perceptual scientist’s perspective.

Because Albers was primarily a teacher, he explored his chosen topic largely in the classroom. In reality, there was little choice since none of his study was funded because design had few if any funding sources at that time. If the classroom required that Albers’ primary aim was helping students see, we might say his secondary aim was to conduct “an experimental way of studying color” (p. 2). As noted above, in 1963 Albers gathered and recorded his teaching methods and results in *Interaction of Color* (Albers, 1963). Albers designed and produced *IC* with the help of two of his former students and fellow faculty at Yale, Norman Ives and Sewell Sillman. *IC* was a massive (22 lb) and massively expensive (\$200 in 1963) boxed set, the largest and most expensive book then undertaken by Yale University Press. It included Text, color Plates mostly screen printed to precisely control color, and Commentary on the color Plates. Due to *IC*’s size, expense, limited number of copies, and the fame of its author, *IC* soon found its way into the rare book archives of many libraries with corresponding carefully controlled access. *IC* was subsequently reproduced in English in paperback with a very limited

number of color Plates in 1971, 2006, and a 50th anniversary edition in 2013. In 2009 *IC* was also reproduced as an oversized book with all the color Plates reproduced offset rather than silkscreen, providing the most complete and accurate facsimile of the original to date (Albers, 2009). To facilitate reference and examination, this paper references the 2009 re-publication of *IC* in the following analysis.

IC was overwhelmingly visual. The 2009 edition was split into two oversized hardbound volumes. One had over 150 pages of color Plates showing over 170 color studies and demonstrations; the other contained 118 written pages: 72 pages of Text and 46 pages of Commentary on the Plates. Pages showing color studies contained no written copy other than Plate numbers. The Text, Plates, and Commentary shared a system of Roman numerals (I through XXVII) to link them. The Text was divided into 27 brief topics or chapters, each presented in poetic format with individual typographic lines carefully broken by Albers in the manuscript. Despite the oversized page there were only about 350 words per page due to the font size and hand-broken lines. Each Text topic, the equivalent of a chapter, occupied just 1 to 5 pages. The color Plates dominated the book numerically, visually, and conceptually.

IC color studies were chosen from student projects completed in the classroom whose authors are credited on Text page 71, the last chapter titled “In lieu of a bibliography – my first collaborators.” The Text makes clear that these student color studies were driven by research questions: “The question is, What color relatedness makes 3 colors look like 2” (2009, p. 85)? They were directed: “The task: one and the same color, placed equally on 2 grounds of different colors, is to lose its identity entirely...” (2009, p. 84). They were systematic: “these first trials are collected and separated into groups,” and they were repetitious, “a second class exhibition of more advanced results” (2009, p. 11). In some cases “the laboratory character of these studies” (2009, p.11) required a level of repetition that tested student researchers’ patience, “for a number of Albers’s former students the mention of the Weber-Fechner project summoned up memories of drudgery, prompting laughs or groans.” Even so, careful data collection and analysis were required: “To illustrate the difference between the mathematical and geometric progressions, students graphed both systems” (Horowitz & Danilowitz, 2006, p. 209). As Brenda Danilowitz wrote in her contribution to *Intersecting Colors*, “The goal of the exercises was not to elicit a single correct answer but to engage students in active experimentation that would yield many and varying solutions—that would extend the question or investigation at hand and suggest new ones” (Malloy, 2015, p. 19).

Reliability is a characteristic of research, and Albers observed this by repeating classroom exercises year after year, always collecting, analyzing, and critiquing the results. Yet it was an evolving inquiry “in which solutions were not conclusions but steps on an endless path. Those who repeated the course—and many did—reported that it (the course) was never

the same twice” (Horowitz & Danilowitz, 2006, p. 195).

Students were not only co-PIs with Albers in his study, they were subjects also. “We have students test themselves,” Albers wrote (Albers 2009, p. 14). Albers recorded that only a minority of students “can distinguish the lighter from the darker within close intervals” (2009, p. 13). Whereas current standards call for a “n” number when reporting this kind of finding, Albers was content to summarize roughly, suggesting his interest was on color phenomena rather than sociology.

As a result of this study, color principles were identified and verified. Albers reported that “one is able to push light and / or hue, by use of contrasts, away from their first appearance... any ground subtracts its own hue from colors which it carries...” (Albers, 2009, p. 20). Some effects, such as making different colors look alike, were apparently discovered by Albers and his students “in order to present these unusual and little-known effects...” (Albers, 2009, p. 86). Functional properties of principles were identified: “Hue mattered—mixtures could be changed more easily than purer colors. Intensity mattered—dull colors could be changed more easily than brighter colors. Amount mattered... Shape mattered... Placement mattered...” (Horowitz & Danilowitz, 2006, p. 203). Although Albers wrote of his resistance to color theory, it is clear that *IC* conveyed at least numerous related principles of color interaction, if not a well-formulated theory. Albers’ opposition to theory may be partly a matter of semantics. What Albers called color theory we would today call “color systems” as he himself suggested with the title of *IC* chapter XXIV “Color theories—color systems.” It may also be partly a matter of sequence, as Albers was interested in theory so long as it came from practice. Art historian T. G. Rosenthal regarding *IC* stated, “the book has become a key work of color theory” (Rosenthal 2006, p. 21). This shows that even if Albers did not intend theory, that at least some thought theory was the result. These operational principles, or this theory, of color interaction could be used to make engaging color relationships in color compositions, which was what Albers did in his personal work.

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Studio laboratory

In addition to the classroom laboratory, Albers continued his research in his studio where his production of paintings and graphic constructions has been well documented. *Homage to the Square* is perhaps the best known of these with scores of examples in museums around the world. Toward the end of his career Albers published the full range of his work spanning 40 years as a series of two silkscreened portfolios titled *Formulation : Articulation* (here simply *F:A*). Designed and produced with the help of the same two collaborators that helped with *IC*, Norman Ives and Sewell Sillman, the portfolios were not a retrospective, which Albers disdained, but in Albers own words “These are visual realizations here presented outspoken in silkscreen” (Albers & Rosenthal, 2006, p. 20). *F:A* was a re-articulation of Albers’ work in many media: painting, drawing, sandblasting, re-realized in a new media –

silkscreen print. As such it provided a convenient and consistent summary of his studio work and thus provides for this article a focal point and easy reference source for discussion of Albers’ studio work. Specifically, this paper cites the 2006 re-publication of *Formulation : Articulation* by Thames and Hudson. Numbers separated by a colon (I:1 for example) refer to portfolio prints in *F:A*.

The first thing apparent in *F:A* is that when Albers entered his studio, he seldom lacked a starting point because he nearly always worked in series. In addition to the *Homage* paintings, he produced a number of compositions using short thick lines for sandblast technique (*F:A* I:8 for example), a number of compositions with thin concentric lines he called the *Graphic Tectonic* series (*F:A* I:31 for example), and a number of drawings that implied 3D shapes in often perplexing ways that he would call simply “constructions” (*F:A* I:8 through I:10 and I:12 for example). Albers noted in *F:A* I:17 commentary that he had made “nearly twenty” of these on the same underlying grid. Rosenthal noted in *F:A* that Albers produced more than 1,000 *Homage to a Square* paintings (Albers & Rosenthal, 2006, p. 24), at least 38 of which are represented in the two *F:A* portfolios. *F:A* is the chronicle of Albers’ serial focus on visual interaction that unified many hundreds of studio projects over 40 years.

The title of one of his series, *Variants* (*F:A* I:11 for example), suggests the reason for this sustained repetition. Albers was using repetition to show the variation possible within a limited number of broadly applicable principles. As Norman Ives and Sewell Sillman wrote in “Preface” to *F:A*,

We have tried to show how he continually worked in series, for example in one folder the same image will be developed several times, the only difference being that the same color (or similar colors) is distributed in different quantities and therefore assumes new characteristics (Albers & Rosenthal, 2006).

Albers’ repetition was not due to lack of imagination or for commercial gain but again quoting Ives and Sillman, “the artist has placed the folders in a sequential order so that they may be seen and examined for their visual interaction” (ibid, 2006). The sequence and organization of work in *F:A* were designed to make interactive relationships apparent and make the overall principles evident. Albers said in the Preface to *F:A* that the aim was not a retrospective report but “visual realizations.” I take this to mean that *F:A* was not organized as a typical chronological retrospective, nor was its aim to glorify the development of the artist but rather that the aim was to arrange the work so that the principles that they “realized”—Albers code word for “made manifest”— would be made clear for the viewer. As *Interaction of Color* was the record of his students’ exploration, *F:A* was the record of Albers’ search of the same visual interactivity using his own hands.

Albers worked in series in order to make apparent subtle variations on his favorite theme, color interactivity. Many of Albers color projects in the *F:A* portfolio share the same colors used different ways. The

two *Homages* in I:5 use the same four blue/green colors but in reverse order: small square to large, large square to small. Then those same four blue/green colors form the background of four new compositions I:6 which have thick gray bars from the sandblast series to demonstrate the value change in the blues/greens and their impact on the apparent value of the gray. Others used similar colors in different arrangements and quantities such as the eight *Homages* in I:27 and I:28, “all only in reds” as Albers said. Ives and Sillman called attention to desired impact of this in the “Preface” to *F:A* writing that “we will consider the visual dialogue between versions of the same painting in the same hue: reds, greens, grays” (Albers & Rosenthal, 2006). The repetition and organization of these works are designed to show the interaction of color and how color changes in changing contexts.

Like an experiment designed to control variables to make the intervention effects obvious, Albers designed formats for his series to control changes across the multiple variations he made. *Variants* used a “checkerboard” grid “in order to measure the exact quantity of each color used” (Albers notes to *F:A* I:11 and I:17). After noting that the underlying unit of the two *Variants* in *F:A* I:11 was one half-inch square, 32 X 23 units, a total of 736 units per *Variant*, Albers noted the precise quantities of each of the five colors in *Variants* I:11 as 92, 92, 93, 91 equaling 368 units or half of the composition area, leaving the other half of the composition to the remaining color. Not all *Variants* were the same proportion. *Variants* I:17 were a 30 X 15 double-square proportion totaling 450 units for example, but all used the same checkerboard grid and similar layout. *Homage to the Square* works were all produced from the same grid of four nested squares. While some *Homages* only used 3 of the 4 squares, this grid was strictly followed no matter the number of colors (see *Figure 4*). The square grid was not strictly symmetric but was designed to create 3 distinctly different sized bands of each different color. Format measurement was not always mathematical. Albers constructed I:27 *Biconjugate* on a horizontal axis with an even-width unit in a 2-3-2/3-3-2 pattern. Of a similar even-unit pattern for I:8 *Fugue*, Albers said it “recalls a beat (as measured by a metronome) in its vertical, static order...”. Together these reveal a man working with thoughtful consistency determined to control variables to better clarify his purpose.

Though consistent in purpose, Albers was rigorous in exploration of alternatives. Many developmental sketches for the *Variants* and *Homage to the Square* paintings exist showing how Albers tried first one color combination then another, seeking the most intriguing demonstration of color effect. Around 70 of these exploratory sketches, many containing Albers’ handwritten notations, were the focus of the 2011 exhibition *Painting on Paper – Josef Albers in America* at the Kunstmuseum Basel, in Basel, Switzerland. The notes and numerous sketched alternatives were often all on one piece of paper and exhibited Albers’ rigorous process. The website artdaily.org reported on the Basel exhibition and described why Albers worked on paper: “He worked on sheets of highly absorbent blotting paper;

FIGURE 3.

Josef Albers

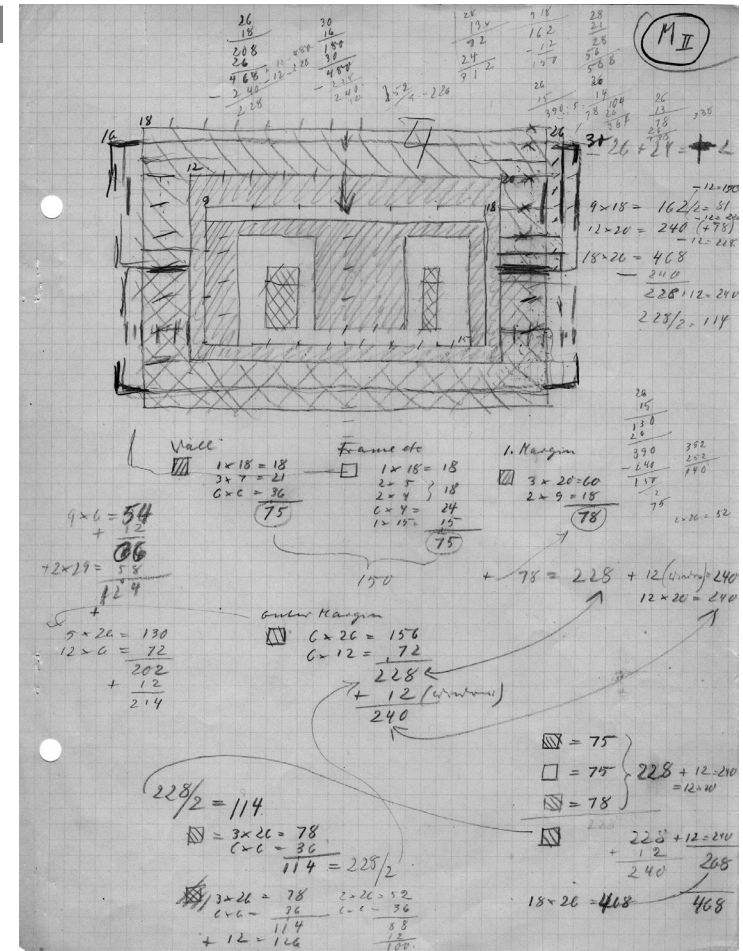
Sketch of an Adobe/Variant, Scheme M II, ca. 1947

graphite and colored pencil on graph paper

26.7 x 20.3 cm

JAAF 1976.40.95; Archive Box 118, Folder 4

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their limited size encouraged his penchant for experimentation and accommodated his serial method, which had been a defining feature of Albers’ art from the very outset” (from <http://artdaily.com/news/52759/Painting-on-Paper--Josef-Albers-in-America-exhibition-on-view-at-Kunstmuseum-Basel#.Vqfgsd-nAU>, accessed 01.26.2016). The absorbent paper made for rapid drying and rapid iteration. An image for a sketch of a *Variant* that accompanied the website showed Albers’ notation of both the colors explored and the half-inch grid (noted above) used to explore them. It’s been reported that Albers generally used only paint colors straight out of tube, no mixtures, to increase his level of control and that he also wrote the names of the individual paint colors used on the backs of his completed *Homage to the Square* paintings.

There is no doubt about his purpose in producing so many variants of the same painting, as Albers said in *F:A* I:15, “in my paintings *Homage to the Square* the interaction of color caused by juxtaposition is one of my

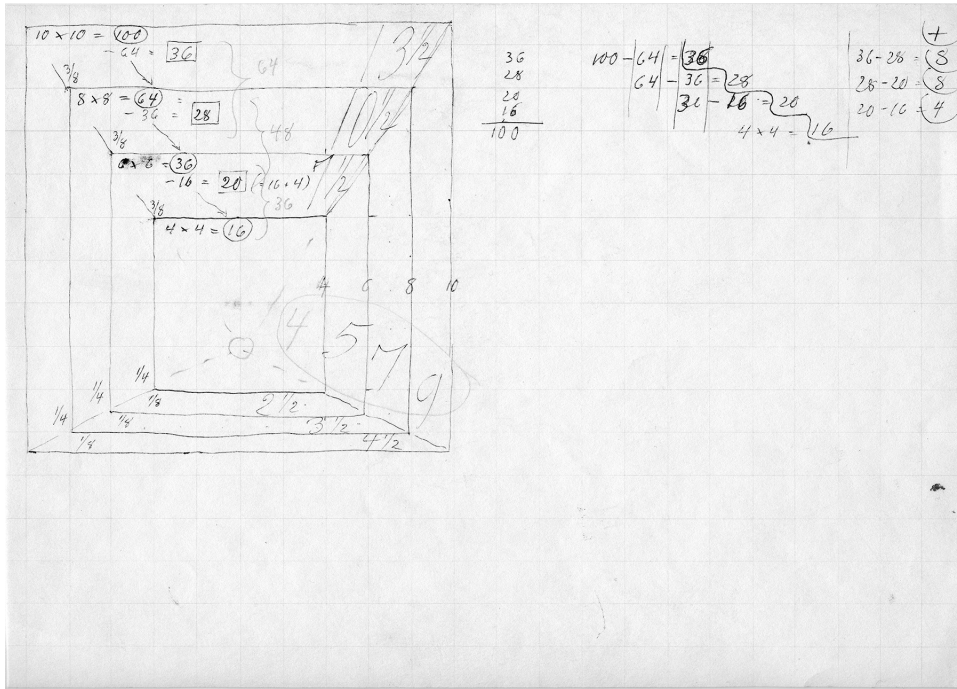


FIGURE 4.

Josef Albers
 Sketch of dimensions of an
Homage to the Square
 pen and pencil on graph
 paper
 20.3 x 28.6 cm
 JAAF Archive Box 118, Folder 3
 © 2016 Josef and Anni Albers
 Foundation / ARS, NY.

main concerns." As Albers noted in *F:A*, some *Homage* paintings and prints demonstrate transparency – the principle in *IC XI*; some *Homage* sequences are designed to make the same color look different – the principle in *IC VI*; or different colors look alike – the principle in *IC VII* (see Albers notes in *F:A II:32* for example). Thus Albers himself demonstrated the principles he articulated in *IC*. He said in his *Search Versus Re-Search* lecture, "We have no right to demand from our students what we are unable or unwilling to do ourselves." The same purpose driving students' explorations presented in *Interaction of Color* were represented in Albers' *Formulation: Articulation* portfolio showing how perfectly aligned were Albers' studio and classroom work.

Without taking anything away from Albers as an artist, from a compositional point of view *Homage* was one composition painted more than 1,000 times. Except for the number of paintings produced, the same could be said of *Variants*. While such extreme repetition may be unusual in art, it is not unusual in research. Without taking anything away from *Homage* and *Variants* as art, their repetition is more easily understood when viewed from a research perspective. This apparently also occurred to the two *Leonardo* interviewers who asked Albers about this.

I. May we talk specifically about your 'Homage to a Square' series, where you seem to have removed every kind of obvious symbolism and you have simplified things so that it seems almost that you are looking for effect from color only-this is like

a scientific treatment. One would concentrate on the single aim with everything else removed. We wondered whether you were doing this consciously so that you could investigate color alone or whether you were doing it intuitively and emotionally or, in the way you were just suggesting, for fun without conscious intellectual effort. What is the history of the squares you make? How did you begin? Was it by deciding to take some simple forms to see what they will do or did you begin with something less tangible?

A. I know my interest in color comes from handling color for years. I know when and where I painted my first 'Homage to the Square', but how I got into it I do not remember. I like to believe that in playing with color combinations I came across a promising accident (as happens sometimes) and I did not overlook it but tried to articulate it.

(Holloway & Weil, 1970, p. 462)

It seems clear from this that Albers was not self-consciously trying to conduct a new kind of research program in his studio. But that does not mean that he did not. His work speaks for itself, in 2016 as loudly as in 1969, of research work done for the simple joy of discovery. The fact that intuition and play inspired the work does not disqualify it as research. In fact, intuition as a source for hypothesis exploration has more in common with current conceptions of how scientists work than it did in Albers day.

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 In Comparison

To reveal the sparkle of a particular diamond cut a wise jeweler often places the gem on black velvet because the contrast highlights differences. In a similar way, the particular characteristics of Albers' research approaches may become clearer if we place them in the context of similar research in a different domain. In the preceding description of Albers' foundations in vision science I noted the quite similar work done by perceptual scientist Leo M. Hurvich (Jameson & Hurvich, 1959) who, like Albers, was interested in the effect of one color surrounded by another. Jameson and Hurvich's paper for the *Journal of the Optical Society of America* provides an interesting point of comparison with Albers' *Interaction of Color* and *Formulation: Articulation* because Hurvich's paper covers the same topic, explored in the same timeframe, but in the context of optical science.

Hurvich and Albers shared more than just subject matter. Hurvich and Albers were both concerned with subjective experience, as Hurvich argued, "Can we validly ignore the influence of adjacent stimulation on perceived color, or dismiss it as a 'purely subjective effect' not amenable to systematic treatment in the psychophysical analysis of color phenomena" (Jameson & Hurvich, 1959, p. 891)? Hurvich and Albers each tested his own hypothesis using the subjective observations of human research subjects as Hurvich reported "the observer is asked to report, in numerical terms, on

a particular attribute of perceived color” (p. 893). Hurvich and Albers both conducted research in conjunction with students, as Hurvich noted on page 893, “A preliminary evaluation of the saturation scaling technique was made by Mr. Robert Kestenbaum in an undergraduate research project.” But Hurvich and Albers also differed significantly. Albers’ first English words about teaching expressed the abiding purpose of his color research: “to open eyes.” By comparison, the first words in Hurvich’s article are “Quantitatively useful color theories...”. A glance at the Jamison/Hurvich paper in Figure 2 shows that they used algebra to express their hypothesis of what was happening physiologically whereas Albers made color demonstrations. In the quote above Hurvich noted that subjects reported “in numerical terms” while Albers required his students to report almost exclusively in color terms. In the Rosenthal quote above he went on to say “The plates in this book are, for the most part, works of art (and design)...”. If *F:A* was a demonstration of theory expressed in the language of art, Hurvich’s article was a work of theory expressed in the language of math. Where Albers used color Plates, Hurvich used Greek letters as mathematical signs; where Albers used lines to suggest ambiguous 3D space, Hurvich used graphs with plot lines to illustrate specific data. Hurvich analyzed in a mathematical language to form or refute a theory whereas Albers through line and color formed and informed his students. He explored perception in order to arouse emotion, saying in *F:A* II 11-12 art is “constant in its task to reveal and arouse emotion.” He wrote of his graphic compositions in *F:A* I:31, “They oppose the belief... that mechanical construction is antigraphic or unable to arouse emotion.” That same note reveals that Albers enjoyed “inducing several interpretations” or “multiple readings” and directions that “are imaginary” rather than offering definitive explanations. Rather than define and quantify nature, Albers wanted to demonstrate color experience. In fact, Albers showed delight in producing work that defied nature saying of *F:A* I:32 that light seemed to be simultaneously coming from opposite sides of a Graphic Tectonic: “Thus art is trying anew to do more than nature: two polar lighting directions at the same time.” Albers traded in ambiguity and fantasy while Hurvich described with precision our reality. Albers made clear he was not creating “a report on nature...” (*F:A* II:17) but was opening eyes, hearts, and minds.

Whereas Hurvich wrote up his work in the specialized language of science, writing, “wavelength distributions of the metametric stimuli e and ϵ remain unchanged but the stimulus energies are uniformly increased or decreased at all wavelengths by some constant factor q throughout the “normal” photopic luminance range...”, Albers described the experienced effect of his work using common metaphors, “they move forth and back, in and out, and grow up and down and near and far, enlarged and diminished”.

²The shift from referring to the discipline as Communication Design here, whereas it has been called Graphic Design previously, reflects the historic evolution of what the discipline calls itself. What was Graphic Design in Albers’ day is with increasing frequency being called Communication Design today.

Albers also described his work with imaginative narratives as in his description of *F:A* I:22: “we then follow a few small steps of the same light red as it leads up a colossal building of many stories which ends broader than high at the top” (see *Figure 9. I:22*), and through poetry as he wrote in poetic form breaking each line of type in *IC* by hand (see the quotes at the beginning and end of this article). Albers often described color in terms of human relationships: “Color in my opinion behaves like man – in two distinctive ways: first in self-realization and then in realizations of relationships with others” in *F:A* II:17. By this I believe Albers meant that a specific red is first itself; then in combination with other colors it both changes itself and changes others and thus it forms relationships of sympathy with some colors and opposition to others. Albers cultivated some of his own specialized language. He used “constellation” to mean a group of related elements (following Gestalt laws); he used “constructed” to indicate forms created by mechanical means (rulers) (*F:A* I:31); “instrumentation” to mean the color collection or palette used to create an effect (*F:A* II:8); “climate” to describe the environmental effects of a color composition (*F:A* II:8). While specialized like Hurvich, Albers’ language is poetic

The conclusion Jamison and Hurvich reached in their paper was that “Surrounds of given hues reduce the perceived saturations of test wavelengths that evoke similar hues when the surrounds are not present” (Jameson & Hurvich, 1959, p. 897). In short, a green surround makes a small greenish patch look less green. Thus they independently confirmed Albers’ color subtraction principle. Hurvich and Albers differed not in outcome but in the language used to describe the phenomena observed: math and graph versus paper and ink; the nature of their purpose: explanatory theory versus experienced life; and the scope of their discovery: specialized precision versus relational expansion. A description of Albers the man by T. G. Rosenthal, who wrote the text for the 2006 edition of *F:A*, also summarizes Albers’ research well: “deeply cerebral, highly intellectualized... also sensual” (p. 20).

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 Summary Characteristics of
 Albers’ Research

Albers’ research demonstrated. It did not explain, and it did not discover, at least not much. He made some slight claim to discovery of principles like 3 colors looking like 2 for example, but his work mostly demonstrated the interaction of color and identified principles related to that, color subtraction for example. Albers’ work employed scientific methods to produce generalizable knowledge. His hypothesis was the interaction of color, his systematic exploration occurred through repeated class exercises and serial artistic works that empirically described color phenomena, his work was well connected to other knowledge, and he reported his results. Thus his work fulfills the definition of research offered here.

Just as use of scientific method does not make an activity research, so all research is not scientific. Albers demonstrated this. Albers’

research employed visual language rather than math and embraced, even focused on, poetic and aesthetic features not normally considered scientific.

Based on the above, this paper asserts that, without diminishing him as a teacher, artist, or designer, Josef Albers was a pioneering design researcher of the first order who had a lasting impact on Graphic Design.

Albers' Search / Research for Today

Assuming the view of Albers' work presented here is an accurate picture effectively drawn, thoughtful readers can draw their own inferences. Of course there are limitations to what can be concluded from one example no matter how outstanding. And we are wise to be cautious drawing lessons from the past because many things have changed.

Yet not everything has changed. Vision still works just the same today as in 1950, and it still plays at least as important a role in human interpretation of the world. Empiricism still remains the dominant way of generating new knowledge despite reasonable challenges from postmodernism's recognition of the inescapability of personal experience when making observations. The enduring influence of Albers' work suggests that it was more than a passing fad. Emboldened by these lasting features, there are at least four qualities from Albers research that stand out as instructive and worthy of emulation in Communication Design² research today:

- Key Topic,
- Sustained, Systematic, Empirical study,
- Generalizable Principles,
- and
- Practice Before Theory.

Key Topic

Albers' research built upon findings in a related field—vision science—and on a topic within that field—color—that was central to Communication Design. Communication Design is a synthetic operation that includes topics that connect to multiple disciplines: anthropology and user-centeredness; form-making and visual perception; typography and readability; symbols and perceptual cognition. A lot of design scholars have little interest in math or science topics and thus don't appreciate the creative and intuitive aspects of science; they think it is all cut and dried. Only a little design research has built on these connections between science and Communication Design, a recent *Visible Language* article "Brainy Type" described the use of EEG to study how letterforms are processed in the brain is one recent example. But much more is possible because so much has been learned in fields like neuroscience since Albers' time. In recent years design has embraced humani-

2 The shift from referring to the discipline as Communication Design here, whereas it has been called Graphic Design previously, reflects the historic evolution of what the discipline calls itself. What was Graphic Design in Albers' day is with increasing frequency being called Communication Design today.

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Visible Language

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ties-informed work and methods such as those in sociology and anthropology. This is wonderful but strategic focus on findings in fields that apply universally, like visual perception, might yield even more broadly applicable principles. A focus on visual perception and cognition might help cultivate a language native to design: visual language. Communication Design would benefit from research on a few foundational research topics informed by findings in other disciplines strategically selected for their universal applicability: research like Albers'.

Sustained, Systematic, Empirical study

Albers studied a single topic in a sustained, systematic, empirical way and then published it in design-friendly visual format that integrated fact with poetry and beauty. This is a unique and powerful combination. Yet too many scholarly design papers are opinion masquerading as fact and too many others look and read like science papers done without math or rigor. Scholars openly bemoan the poor quality of design research papers, even those in the most prestigious venues. It is not a question of the use of visual language versus math but of systematic rigor or the lack of it. Systematic study is the essential component of scientific methods described above and also key to the advancement of Communication Design. Repeated calls for more evidence-based design practice cry-out for sustained empirical design research programs. Albers proved that sustained research is possible even in the absence of funding and that empirical does not mean absence of emotion, aesthetics, poetry, and visual form. Communication Design needs many more sustained research programs systematically conducted, empirically grounded, and aesthetically expressed.

Generalizable Results

Albers work has been used and repeated for over 50 years. This will be commented on below.

Putting Practice Before Theory

When Albers so often said practice should come before theory, he probably did not mean design "practice" as we know it today but something simpler like practicing an instrument comes before making musical art. In that sense it is true that time spent practicing temporally precedes performing well: one before the other. But precedence is not just temporal; there is precedence of priority as well. Design is a practice-oriented discipline focused on creating interventions to make things better. With that in mind, Communication Design would be wise to adapt what Albers may have intended as temporal and apply it as priority in putting practice before theory. Albers avoided systems and laws of color; the growing Communication Design discipline should also be careful to avoid purely theoretical pursuits that

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Albers' Research

Zender

are disconnected from practical outcomes. What works for and with people should be the measure of design research programs and choice of topic areas. Albers' research was human-centered; ours should be too. Albers' research produced generalizable principles that others could use; ours should too.

There's a fifth quality from Albers research that stands out as instructive for today as something Communication Design should *not* emulate. Albers' research explored:

Basic Exercises.

Building on Basics

Albers taught color ABC's. Albers color ABC's are still taught today because they are still relevant, but they probably shouldn't be. Imagine 21st century physicists still primarily learning Newton's color spectrum. Communication Design should have added to Albers' lessons by now. Vision science has learned a tremendous amount since Albers drew upon their findings, but Communication Design has not kept up. Design should not just replicate Albers lessons but should build on them, advance them, and move beyond them using the same empirical research methods he used. I believe Albers would be appalled that we are still replicating his work, mindlessly repeating what he so adventurously discovered. Communication Design desperately needs to build new basic insights.

Observations

In the quote at the head of this article, Albers placed search before research. It should now be clear this formulation was Albers' way of saying he preferred carefully constructing direct experiences to gathering facts from others. He was not opposed to research, quite the opposite. His whole work was what he called search, here given the more familiar word research, that is the systematic exploration, examination, and demonstration of a hypothesis through empirical data with generalizable reported results.

Why hasn't anyone studied Albers as a researcher before? The sciences have been quick to identify pioneers like Newton and build on their work. Was there something about Albers' work that has made design slow to study his example, or was there something about the discipline that put a pause in Albers' field study? Did design exhaust color knowledge? In conversation with a colleague from the School of Art about this paper, she rightly said, "Albers was a great artist." To which I responded, "That's true, from your point of view. He was also a designer who taught at the Bauhaus, and he was a researcher." Perhaps Josef Albers was too many things for his own good, or perhaps design was too immature to claim a great pioneer or is just awakening to its roots, but clearly Josef Albers was a pioneering design researcher of the first order who had a lasting impact on Communication Design. Albers' methods were insightful, prescient, and appropriate for today.

Looking at Albers' work as researcher and *Interaction of Color* as his research report raises the question of whether similar work has been produced in and for Communication Design in the 52 years since *Interaction of Color's* publication. As I scan my library, I find that Communication Design, far from building on Albers' research legacy, has largely failed to produce works of equivalent quality or influence. Emil Ruder's book *Typographie* is considered seminal work on typography in many designer's libraries as are Robert Bringhurst's *The Elements of Typographic Style* and Jan Tschichold's *DIE NEUE TYPOGRAPHIE (The New Typography)*. Karl Gerstner, mentioned earlier, did research and wrote *Compendium for Literates* in 1974, but he did not continue in this line of research for long. None of these typographers are as widely taught as Albers' work. Wolfgang Weingart, Zuzano Licko, and David Carson each shook up the design status quo in the 1980's even as Paul Rand and Massimo Vignelli variously defined and defended it. None of these had the empirical basis of Albers. Paul Rand's reflections may have been well-informed personal opinion but they were never founded on an empirical research and years of patiently collected data like Albers. Nor have any of these had as much lasting influence as Albers' work continues to have. With a growing number of calls for evidence-based design, Albers' model research deserves emulation in areas strategic to Communication Design such as cognition and creativity, design of systems, the way symbols work, evaluation and outcome measurement, aesthetics and perceptual, empathy and emotion, and all of this designed with clear connections to practice. Practice first, then theory, but get to theory. Communication Design is not there yet.

Maybe Albers was fortunate to be in the right place at the right time, looking at something Communication Design needed just as the discipline was emerging. If so, he was looking in the right area, based on well-founded phenomena, conducting rigorously controlled repeated experiments, and reporting his findings vigorously in multiple forms. Maybe Albers was just lucky. I doubt it. But he was definitely fortunate to have done this work, and we are fortunate to have had him do it. I am bold enough to hope for more work like Albers' in the future.

Albers wrote,

In my own work

I am content to compete

with myself

and to search with simple palette

and with simple color

for manifold instrumentation

So I dare further variants

Albers, *F:A II*:18

Final note

This paper hopes to make the case that Josef Albers was a pioneering design researcher despite Albers' own statement that *Interaction of Color* was not an academic research report. I concede *IC* was not a typically structured academic research report. I wish that it had been. If Albers had included a Bibliography, "books read, or books not read," it would have saved me time at the Albers Archive identifying the books in his personal library that bore his personal mark or notation inside them trying to winnow what he had read from what he had not. Odd as it sounded to me some years ago when I read it, knowledge is a decidedly communal activity. It is undeniable that we, all of us, stand on the shoulders of those who have gone before as we each reach out to make our particular contribution to those around us and those who will surely follow us. As design finds its way from craft to discipline supported by a body of knowledge, my hope is that in just this one thing, the desire to do rigorous *academic* research, we will differ from the otherwise exemplary work of Josef Albers. We'll include a Bibliography.

Acknowledgements

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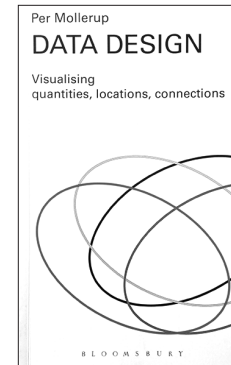
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Albers' Research

Zender

Book Review

DATA DESIGN Visualizing quantities, locations, connections
by Per Mollerup



When a book arrives that belongs to a well-populated category on my bookshelf it makes sense to review it in the context of its neighbors. In this case, *DATA DESIGN Visualizing quantities, locations, connections* by Per Mollerup joined 27 books on information design already on my “active books” bookcase, that is, the books not on bookcases in the basement.

Per opens his book explaining foundational concepts in a chapter titled “Basics.” Existing information design books such as *The Wall Street Journal Guide to Information Graphics* by Donna M. Wong open similarly with a first chapter titled “The Basics.” Whereas Wong briefly touches upon various functional components of design such as color, typography, and legibility Mollerup draws in principles from research such as Gestalt psychology.

Where Per does discuss color he does so in relation to a color system rather than functional advice. Per’s introduction also introduces the concept of simplicity as well as several historic milestones such as William Playfair’s *The Commercial and Political Atlas* and Isotype. Jenn and Ken Visocky O’Grady also mention Isotype in their “Overview” chapter of *The Information Design Handbook*, but in comparison to these other books *DATA DESIGN* tends to found build arguments more on established findings in other fields than issues particular only to design.

Per’s descriptions of data design are characterized by their simplicity. Simplicity in this case does not mean lacking nuance, sophistication, or insight but rather that he absents explanations of jargon and academic pretension. For example, on page 57 Per writes, “Categorical variables are known by their distinctive difference, by their lack of universal order, and by not being quantifiable. Gender is a categorical variable.” This is as simple, detailed, and clear an explanation as I can remember. However, at times such admirable simplicity provides less help when on one hand it links word to definition while lapsing into circular redundancy such as on page 56 “A variable is a factor that may vary.” Most dictionaries avoid using the root word to define the word and I think both simplicity and comprehension would have been served if the book had more carefully observed this convention.

The bulk of the book is devoted to well organized and amply illustrated examples of data design organized into three broad categories: visualizing quantities, visualizing locations, and visualizing connections. This makes it an easy reference for designers facing a particular kind of task. The clear, simple yet insightful quality of the entire book makes it well worth owning.

Mike Zender

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Visible Language is an academic journal focused on research in visual communication. We invite articles from all disciplines that concern visual communication that would be of interest to designers.

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Visible Language, an academic journal, seeks to advance research and scholarship for two types of readers: academics and professionals. The academic is motivated to consume knowledge in order to advance knowledge through research and teaching. The professional is motivated to consume and apply knowledge to improve practice. *Visible Language* seeks to be highly academic without being inaccessible. To the extent possible given your topic, *Visible Language* seeks articles written to be accessible to both our reader types. Anyone interested may request a copy of our editorial guidelines for authors.

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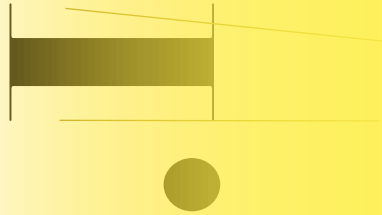
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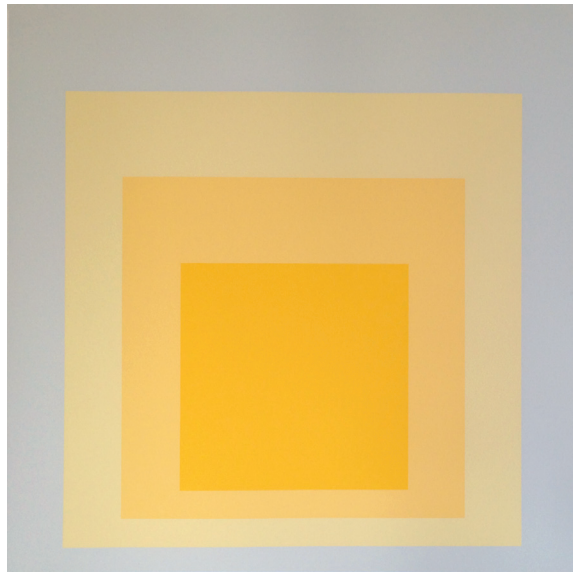
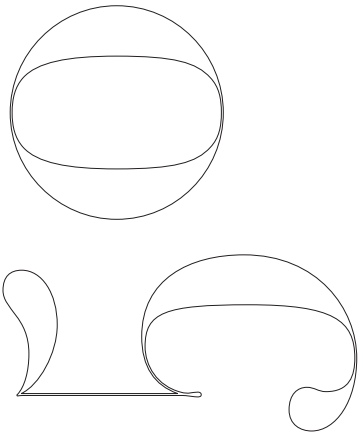
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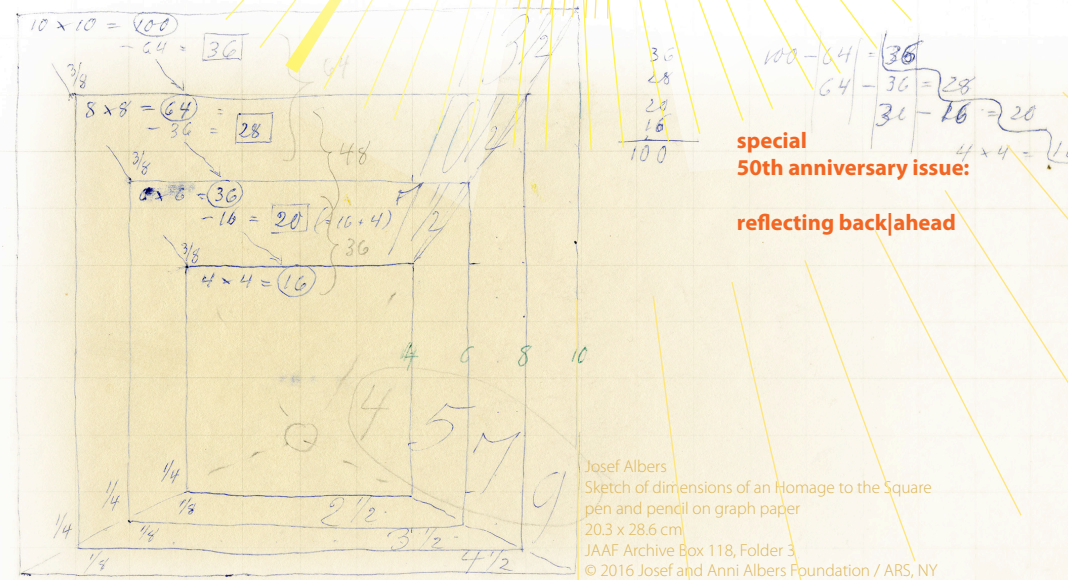
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special
50th anniversary issue:

reflecting back|ahead

Josef Albers
Sketch of dimensions of an Homage to the Square
pen and pencil on graph paper
20.3 x 28.6 cm
JAAF Archive Box 118, Folder 3
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BOOK REVIEW: Data Design by Per Mollerup

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A lot of design has happened in the 50 years since *Visible Language* was founded: typesetters – gone; desktop publishing – a passing blip; computers – moved from desktop to pocket. The term graphic design had hardly entered the dictionary before the discipline started to consider renaming itself visual communication design or just communication design. Because communication continues to grow in quantity and importance there's no reason to disbelieve in a promising future for a communication design discipline. What the promising design future looks like is, as always, sketchy. A well-known 20th century Danish proverb states that predictions are easy except when they involve the future and George Santayana famously warned of the trouble that awaits failure to examine the past. If we take Santayana's statement less as a warning than as a prescription to guide action, we might reflect thoughtfully on the past in order to plan our steps today to help shape a future the Danes say is so difficult to predict. Reflecting on the past may not make predictions easier, but it might make them more realistic.

To celebrate its 50th year *Visible Language* will revisit themes from the journal's past to help chart the design discipline's future. This issue features articles by Meredith Davis, Sharon Poggenpohl, and myself commenting on design's direction, design journals, and design research. As a special homage to the journal's roots in typographic research issue 50.2 will revisit typography and see what we have learned in the past 50 years and project where typographic study should be going next. Issue 50.3 will look at *Visible Language* in light of design history and theory with a similar aim: to reflect on the past to help guide and inspire the future: reflecting back – reflecting ahead. Reflecting in the sense of thinking deeply or carefully about something and at the same time suggesting the visual nature of much of human cognition and the essential visual nature of design. Reflection is a physical process wherein light or energy is thrown back from a surface. We learn about ourselves through reflection. We see things in a new light, from a new vantage point, and if the mirror is placed properly we can see not just where we've been but where we are going: around the corner we have not yet turned.

This year we are devoting part of the journal to not predicting the future but to shaping it. We can't wait to see what they'll say about our efforts in 2065!

Typographic features of text and their contribution to the legibility of academic reading materials:

An empirical study

Maria dos Santos Lonsdale

ABSTRACT

An experimental study provided evidence that text layout affects performance when reading text to search for specific information under time pressure in an examination-type situation. The present paper reports a second experimental study conducted to ascertain whether this effect extends to similar academic reading materials and situations that, contrary to examinations, are performed under no time pressure. Three layouts were used for comparison, which replicated real-life examination materials and represented three distinct levels of legibility. The results revealed that text layout affects performance under conditions of search reading even when time pressure is absent. Moreover, participants performed better with the layout conforming to legibility guidelines and considered this layout to be the easiest to use and the most attractive. In order to understand these findings, an attempt is made to specify a theoretical model of reading in academic-type situations. The model identifies and analyses the stages of the reading process that might be affected by typographic layout and adopts the hypothesis that such effect takes place at the perceptual level of reading. The outcomes from this study will prove useful to those involved in the development of written materials used in academia such as textbooks, journal articles, magazines, and tests.

KEY WORDS:

Typographic legibility; Text layout; Academic texts; Search reading; Perceptual level of reading

1. INTRODUCTION

In an earlier paper Lonsdale et al. (2006) reported an experimental study testing the effect of text layout on performance in the particular context of examination-type situations. The rationale behind the study was that if the layout of text affects performance, then the construct validity of the examination is put at risk since legibility is confounded with candidates' reading skills.

Lonsdale et al. (2006) showed that text layouts different in legibility lead to variation in the speed and accuracy with which participants performed tasks that involved reading a text and answering questions on it under time pressure. Of the three layouts tested, the layout conforming to legibility guidelines resulted in a shorter task time, better accuracy, and more correct answers per second. This layout was also perceived as making it easier to locate answers.

The texts and layouts tested by Lonsdale et al. (2006) were the ones used in the English language reading examination IELTS (International English Language Testing System). In order to match real academic reading activities, IELTS uses texts based on authentic academic sources such as journals, textbooks, newspapers, magazines, etc., and seeks to replicate the original typographic layout of the source material (Lonsdale et al., 2006; Moore et al., 2011; Weir et al., 2012).

Although in normal academic life students may find themselves in situations where they have to read under some time pressure if they have to meet deadlines, they do not feel the stress of having to read as quickly and accurately as possible as when they have to complete an examination.

With this in mind, the experimental study reported in this paper sought to expand Lonsdale et al.'s (2006) research by answering the following questions:

Is the effect of typographic layout on performance limited to academic situations where students read to search for specific information under time pressure, and therefore applies only to assessment materials?

Alternatively, does the effect of typographic layout on performance extend to other academic situations where students also read to search for information but do so under no time pressure (a normal reading speed, which applies to other academic materials such as textbooks, journals, magazines, etc.)?

Additionally, in order to provide a theoretical basis for the outcomes of the study, an attempt is made to specify a general model of the process for search reading in academic situations.

2. BACKGROUND INFORMATION AND RATIONALE

Literature on the legibility of printed text informed the selection of the text layouts tested by Lonsdale et al. (2006). Such literature includes both experimental findings as well as the perspective of typographic practitioners and authors. Moreover, it addresses how each individual typographic feature may affect legibility (interpreted as the speed and accuracy of reading a text).

Several authors (e.g. Hartley and Burnhill, 1976; Lund, 1999; Lonsdale et al., 2006; Lonsdale, 2014) argue, however, that it is important to consider, combine, and manipulate all the typographic features as a group in order to achieve good legibility. This is because in real documents several features interact simultaneously in the same layout.

However, very few studies have actually tested the effects of combined typographic features on the speed and accuracy of reading (e.g. Hartley and Burnhill, 1976; Hartley and Trueman, 1981; Lonsdale et al., 2006; Lonsdale, 2007). A series of experiments conducted by Paterson and Tinker (described by Tinker, 1963a, 94-102 and Tinker, 1963b) have at least considered the relationship between interlinear space, type size, and line length. This relationship is extremely important because an inadequate ratio between these features will result in an unbalanced typographic layout. For example, when it is necessary to use long line lengths, legibility can be maintained if the interlinear space is increased (Schriver, 1997, 263).

The findings that emerged from the various studies to test the effects of single features on performance have nonetheless proved quite insightful. When combined with the opinions of practitioners and authors, the findings provide useful information on the legibility of text. Table 1 lists the main outcomes from research and practice with direct relevance for the study reported here (for a more in-depth literature review see Lonsdale, 2014).

In terms of time pressure, it is not clear from the little research available whether text layout affects performance when searching for specific information in a text if no time pressure is imposed. For example, Hartley and Burnhill (1976) found significant differences in time and accuracy when students were asked to locate information with different text layouts under no time pressure. In contrast, Burnhill et al. (1975) did not find significant differences in time and in the number of errors made when two text layouts were compared under no time pressure.

Concerning reading strategies, the ones tested in IELTS reading examinations reflect the main reading strategies used in an academic context. Scanning, skimming, and careful reading are listed as the three main reading activities used by students during their academic life (Hughes, 1989; Weir, 1993; Enright et al., 2000). Scanning and skimming activities, in particular, are used in a high percentage of the reading practiced by

Typographic Features of Text

.....
TABLE 1.

Research findings and opinions regarding the typographic features of text.

Typeface

Research

- No significant differences in the speed of reading and comprehension between serif and sans serif type No preference for either serif or sans serif type.

- Italic retards reading.

- Medium type is considered more legible and more pleasing than bold.

- Lowercase is read more rapidly than all-capitals and reders prefer lowercase.

Tinker and Paterson 1928, Paterson and Tinker 1932 and 1940 [described in Tinker, 1963a], Tinker and Paterson 1942, Tinker 1955, Poulton 1965 and 1967, Moriarty and Scheiner 1984, Schriver 1997.

Practice

- Serif should be used for the body of the text and continuous prose, and sans serif should be used for instructional manuals, headings, captions, etc.

- Typefaces with unusual features should be avoided, as well as typefaces that call attention to themselves rather than the text, that have not been tested objectively and that may lose their identity when printed or copied.

- Italic and bold can be used to distinguish pieces of information. Bold can also be used as a technique to thicken the line of characters that will be printed on a black or coloured background.

- Capitals should be reserved for the initial letter of nouns, sentences and headings.

Simon 1945, Hartley and Burnhill 1977a and 1977b, Rehe 1979, McLean 1980, Glynn et al. 1985, Black 1990, Bringhurst 1992, Luna 1992, Gilreath 1993, Hartley 1994 and 2004, Simmonds and Reynolds 1994, Schriver 1997, Wijnholds 1997, Carter et al. 2015.

Type size

Research

- Moderate arrangements are read more quickly than text in relatively long or short lines, smaller type sizes and with little or no interlinear space.

- For optimal sizes of type (9-, 10-, 11-, and 12-point), an interlinear space of one to four points can be added in order to increase legibility. This depends, however, on the typeface used.

Tinker 1963a and 1963b.

Practice

- An arrangement of 10- and 11- point size, with a line length of 60 to 70 characters per line, and additional interlinear space of one to four points is read more quickly than text in relatively long or short lines, smaller type sizes and with tight interlinear space.

Simon 1945, Tschichold 1967, Hartley and Burnhill 1977a, Spencer 1969, Black 1990, Bringhurst 1992, Schriver 1997, Wijnholds 1997, Carter et al. 2015.

Columns

Research

- With a medium line length no difference in performance was found between fully justified and left aligned text. No difference in preferences either.

Alignment

Margins

- When locating target words the double column layout seems to have an advantage. For scientific journals and reading examinations, the single column layout is read quicker.

Paterson and Tinker 1940 [described in Tinker, 1963a], Poulton 1959, Zachrisson 1965, Fabrizio et al. 1967, Becker et al. 1970, Foster 1970, Gregory and Poulton 1970, Wiggins 1977, Hartley et al. 1978, Lonsdale et al. 2006, Lonsdale 2007.

Practice

- Fully justified text with rivers and excessive hyphenation should be avoided because it disrupts reading.

- A double column layout with a medium line length or a single column layout with wide margins (to avoid long line lengths), are the best solutions for straightforward prose.

- If headings or non-textual elements that could occupy the space of two columns need to be integrated, then it is advisable to use a single column layout.

- As column/line length measure increases, the interlinear space needs to increase as well.

- Margins are very functional and should be considered. Margins allow to make notes, punch and clip copies for filing without damaging the text, and hold the book without covering the text.

Simon 1945, Tschichold 1967, Spencer 1969, Hartley and Burnhill 1977a, Rehe 1979, McLean 1980, Southall 1984, Bringhurst 1992, Simmonds and Reynolds 1994, Schriver 1997, Hartley 2004, Carter et al. 2015..

Headings

Research

- The best cue to distinguish the hierarchy of headings is to use relative differences in size. Readers seem to agree.

- Paragraphs denoted by one line space are significantly superior. Readers prefer paragraphs denoted by indentation and additional space.

Hartley et al. 1978, Hartley and Trueman 1983, Williams and Spyridakis 1992, Schriver 1997.

Practice

- If serif is used for the main text, the headings should be set in semi-bold or bold (either serif or sans serif). But, if sans serif is used for the main text, then the heading should be set only in sans serif.

- Headings should be aligned left and the first paragraph in an article/chapter should have no indent.

Simon 1945, Tschichold 1967, Simmonds and Reynolds 1994, Carter et al. 2015.

students (Enright et al., 2000, 4). These strategies are intrinsic to the search reading process of looking for specific information in a text.

As described and exemplified by Weir (1993, 70), in academic life scanning for specific information is used when attempting to locate specific parts of a text or specific information (table of contents, headings, an index, key words, words in dictionaries, checking spelling, a quotation, a date, etc.). Skimming text quickly to obtain the gist is used when attempting to anticipate what the text might contain; to determine what is most relevant to read first and/or more carefully; and to review what has been already read, etc.

This is further reinforced by Weir et al.'s (2012) survey conducted for a study on the relationship between the academic reading tasks tested in IELTS and the reading experiences of students in their first year of study at a British university. Weir et al. (2012) concluded that expeditious strategies (scanning and skimming) are equally important for academic study as careful reading.

Linking typographic layout with students' reading strategies, Lonsdale et al. (2006) suggested that when searching for specific answers in a text under time pressure, participants use visual features (i.e. key words). Lonsdale et al. (2006) therefore suggested that, based on Masson's (1982 and 1985) theory of cognitive processes in skimming stories, the effect of text layout on performance may occur at the perceptual level of reading. More specifically, the treatment of typographic layout might facilitate or impede the speed and accuracy with which candidates move their eyes over the text in order to find key words. The key words are used as perceptual guides to locate the relevant information that answers the questions.

Therefore, it seems possible that even if no time pressure is imposed, participants might still use the same search reading strategy, i.e. use key words to complete the reading task as efficiently as possible (maximizing accuracy and minimizing time). In other words, it seems unlikely that participants will read the whole text each time they have to find specific information. Instead, they will probably scan/skim the text using key words. In the same way, when participants have to refer back to the text to double check whether the information they have found is accurate, they will probably scan to find that information again, rather than re-read an entire section.

Thus, and assuming that participants use a search reading strategy (involving scanning and skimming), the search reading strategy alone might be sufficient to create an effect of text layout on performance at the perceptual level of reading. Consequently, a layout conforming to legibility guidelines would result in better performance.

The study conducted to test this hypothesis is reported next. The results are then discussed and compared with the results of the study conducted by Lonsdale et al. (2006), where time pressure was imposed.

3. EXPERIMENTAL COMPARISON

3.1. METHOD

The study replicated Lonsdale et al.'s (2006) study in all respects except that no time pressure was imposed. The legibility of three text layouts was therefore compared to ascertain whether some layouts result in better performance than others when reading at a normal reading rate.

3.1.1. Participants

A similar sample to the one in Lonsdale et al.'s (2006) study was tested. Thirty undergraduate and postgraduate students at the University of Reading volunteered as participants. Their ages ranged from 21 to 44 with an average of 29.3 years. There were twenty female and ten male participants. Ten were native English speakers and twenty were non-native English speakers. Five were undergraduate and twenty-five were postgraduate. Nineteen were normal eye-sighted and eleven used vision correction (glasses or contact lenses).

3.1.2. Materials

The same material used in Lonsdale et al.'s (2006) study was tested in the study reported here. Three text layouts were used, which according to the literature differ in terms of their legibility (in a combination of typographic features, not just one individual feature).

- Text layout T1 – conforming to legibility guidelines: serif type for the main text; sans serif type for the headings; type size of 10.5 points; interlinear space of 14 points; line length of 70 characters; text left aligned; single column; wide margins; paragraphs distinguished by one line space with no indent (Figure 1)
- Text layout T2 – using medium legibility: serif type for the main text and headings; type size of 10.5 points; interlinear space of 11 points; line length of 42 characters; text fully justified; double column; average margins; paragraphs with an indent of 35mm (Figure 2)
- Text layout T3 – disregarding legibility guidelines: serif type for the main text and the headings; type size of 9.5 points; interlinear space of 8.5 points; line length of 115 characters; text fully justified; single column; wide narrow margins; paragraphs distinguished by an indent of 15mm (Figure 3)

The three passages were all approximately 800 words long and addressed matters of general interest suitable for postgraduate and undergraduate students. As for the three question and answer sheets, they contained matching tasks to test the speed and accuracy of locating particular information in the corresponding passage.

This material replicated the layouts, passages, and the matching tasks used in the reading module of the IELTS examination. As already pointed out, IELTS aims to reflect real-academic reading materials. (Permission was obtained to use these texts and questions.)

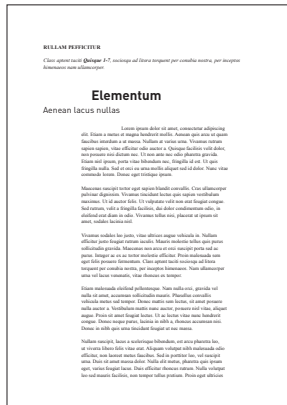


FIGURE 1.
Layout T1 using dummy text.



FIGURE 2.
Layout T2 using dummy text.



FIGURE 3.
Layout T3 using dummy text.

3.1.3. Measures and Experimental Design

A within subject design was used whereby each participant used each text layout to ascertain the effect that different layouts can have on the same participant. Text layout was therefore the within subject factor. A within subject design also replicated the context of reading examinations where the same candidate read different passages, each passage with a different layout, and answered questions on them.

Since each participant had to use all three layouts, each layout had to be combined with a different passage. A Greco-Latin square design was used to balance the combination of each passage with each text layout and to control the order of presentation in order to eliminate sequence effects (i.e. the same layout was not used always in first or last place).

The effects of text layout on performance were measured according to task time (time taken to read a text passage and answer questions on it), task accuracy (number of correct answers), and task efficiency (number of correct answers per second).

A one-way analysis of variance (ANOVA) looked at each of the three measures separately and tested for statistical significant differences between the means for Layout T1, T2 and T3. With an analysis of variance, a significant result indicated that at least two layouts differed from each other, but it did not identify which layouts differed.

Therefore, *Post hoc* comparisons using the Newman-Keuls test followed the ANOVA to compare all of the layouts with each other in order

to identify exactly where differences lay.

A questionnaire was also used, which asked participants to rank the text layouts according to ease of locating the answers and attractiveness. Kendall's Coefficient of Concordance was used to examine the extent of agreement between participants.

3.1.4. Tasks

In the current experiment participants were asked to complete the matching tasks as accurately as possible and at their normal reading speed (not as quickly as possible). Thus the individual sessions took between 30 and 80 minutes.

Participants were asked, as in Lonsdale et al.'s (2006) study, to judge the ease of finding the answers using the three layouts and the attractiveness of the layouts. With these types of questions it is possible to determine whether judgments are in agreement with performance.

3.2. RESULTS

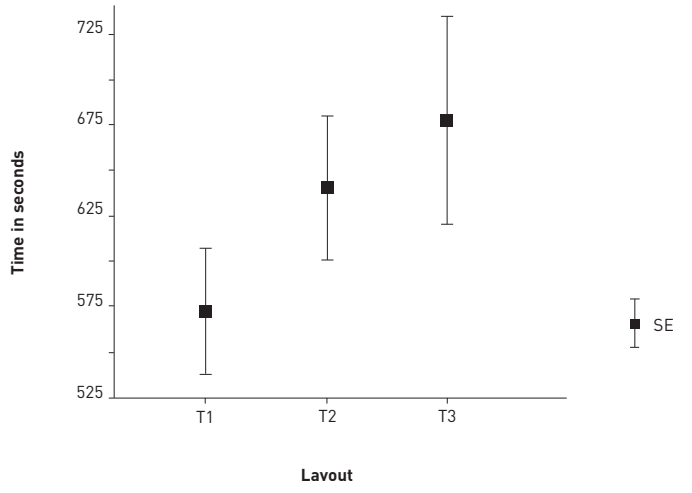
3.2.1. Task Time

The one-way repeated measures ANOVA, with text layout as a within subject factor, showed a significant difference between text layouts ($F(2,58)=5.47, p<0.01$). Moreover, post hoc comparisons using the Newman-Keuls test demonstrated the significant superiority of layout T1 in relation to either layout T2 ($p<0.05$) or layout T3 ($p<0.01$). Layouts T2 and T3 did not differ significantly from each other.

Therefore, this provides evidence that reading and answering was faster when the layout intended to be most legible was used. Figure 4 shows the mean task times in seconds and standard errors of the means, which were as follows: layout T1 (Mean=572.3; SE=34.4); layout T2 (Mean=640.6; SE=39); layout T3 (Mean=677.8; SE=57.2).

FIGURE 4.

Mean task time in seconds and standard error of the mean for the three layouts.



3.2.2. Task Accuracy

The one-way repeated measures ANOVA showed that there was no statistically significant difference in the number of correct answers among the three text layouts. The data for the means and respective standard error are given in Figure 5 and were as follows: layout T1 (Mean=5.93; SE=0.20); layout T2 (Mean=5.4; SE=0.31); layout T3 (Mean=5.47; SE=0.26).

3.2.3. Task Efficiency

The one-way repeated measures ANOVA showed that task efficiency scores were significantly different among text layouts ($F(2,58)=6.59, p<0.01$).

FIGURE 5.

Mean task accuracy measured by the number of correct answers, and standard error of the mean for the three layouts.

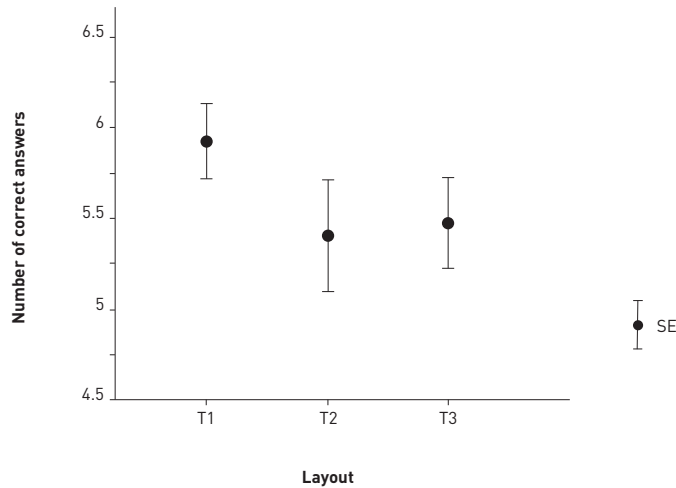
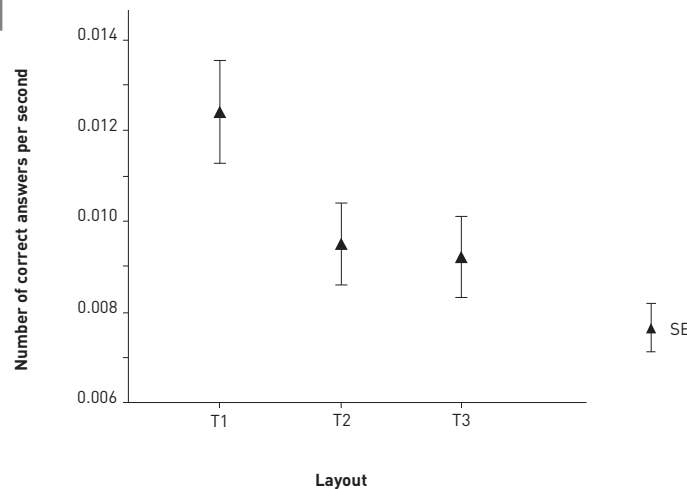


FIGURE 6.

Mean task efficiency measured by the number of correct answers per second, and standard error of the mean for the three layouts.



Furthermore, with layout T1 there were significantly more correct answers per second than with layouts T2 ($p<0.05$) or T3 ($p<0.01$). No differences were found between T2 and T3. The highest number of correct answers per second was found when the layout intended to be most legible was used – layout T1. The mean scores and standard error data for task efficiency appear in Figure 6 and are as follows: layout T1 (Mean=0.0124; SE=0.0012); layout T2 (Mean=0.0095; SE=0.0009); layout T3 (Mean=0.0092; SE=0.0009).

3.2.4. Judgments of Ease of Use and Attractiveness

Kendall's Coefficient of Concordance showed that participants agreed as to which text layout made it easiest to locate the answers ($W=0.35, \chi^2=21.1, p<0.001$) and which was the most attractive ($W=0.60, \chi^2=36.4, p<0.001$). Layout T1 was slightly preferred over layout T2 in terms of ease of locating the answers. Layouts T1 and T2 were both preferred over layout T3 in relation to both perceived ease of locating the answers and attractiveness. The data are shown in Table 2 (a ranking of one corresponds to the easiest to use and most attractive layouts).

According to participants' comments, layout T1 was considered to make it easier to locate the answers mainly because of good line length, adequate interlinear space, and distinction between paragraphs. In general, layout T1 was identified as having the clearest structure, making it easiest to locate information. Concerning attractiveness, participants were in agreement that the generous space of layout T1 made reading relaxing and easy, and the 'journal look' of layout T2 was familiar to them. Other comments included the fact that in layout T1 there was enough space to take notes, and the question and answer sheet was very clear.

TABLE 2.

Judgments of ease of use and attractiveness.

Layout	Ease of locating answers			Attractiveness		
	1	2	3	1	2	3
T1	17	10	3	16	12	2
T2	11	14	5	14	15	1
T3	2	6	22	0	3	27

T1 – text layout intended to be most legible

T2 – text layout intended to be of medium legibility

T3 – text layout intended to be least legible

3.2.5. Participants Groups

Although the sample used in this study was selected to represent the typical mix of students who attend higher education, it may be of interest for future research to see whether the pattern of performance is the same across different groups: native and non-native English speakers, male and female, postgraduate and undergraduate, and normal eye-sighted and those using vision correction (glasses or contact lenses).

Table 3 shows the average time, number of correct answers, number of correct answers per second, and preferences obtained per group and per layout. A comparison between the means revealed that the layout conforming to legibility guidelines (T1) always lead to better performance regardless of the participants' group. Moreover, even those groups that understandably read faster (native English speakers, postgraduate, and female participants) perform better when reading a more legible layout.

TABLE 3.
Performance obtained in
Experiment 2, per group and
per layout.

	Groups									
	All	Native	Non-native	Male	Female	Undergrad	Postgrad	NES*	VC**	
N	30	10	20	10	20	5	25	19	11	
Experiment 2										
Time										
• T1	572.3	468.6	624.2	622.5	547.2	627	561.4	586.1	548.5	
• T2	640.6	514	703.9	683.1	619.3	754.4	617.2	650.8	622.9	
• T3	677.8	523.8	754.7	698.7	667.3	897.6	633.8	687.9	660.2	
Accuracy										
• T1	5.93	6.3	5.75	5.8	6	6.2	5.9	5.9	6	
• T2	5.4	6.2	5	5.1	5.55	6.2	5.3	5	5.55	
• T3	5.47	6.1	5.15	4.4	6	5.6	5.3	5.6	6	
Efficiency										
• T1	0.0124	0.0145	0.0113	0.0126	0.0122	0.0116	0.0126	0.0129	0.0115	
• T2	0.0095	0.0133	0.0075	0.0079	0.0102	0.0093	0.0095	0.0095	0.0094	
• T3	0.0092	0.0132	0.0072	0.0067	0.0104	0.0081	0.0094	0.0090	0.0097	
Ease of use										
• T1	17	6	11	7	10	2	15	11	6	
• T2	10	4	7	2	9	2	8	7	3	
• T3	3	0	2	1	1	1	2	1	2	
Attractiveness										
• T1	16	5	11	5	11	3	13	10	6	
• T2	12	5	9	5	9	2	10	9	3	
• T3	2	0	0	0	0	0	2	0	2	

Note: within the body of the table, the numbers for 'Ease of use' and 'Attractiveness' refer to the number of participants who ranked the layouts as first, i.e. as the easiest or as the most attractive.

* Normal eye-sighted

** Using vision correction (glasses or contact lenses)

3.3. CONCLUDING COMMENTS

The hypothesis underlying this experiment was that typographic layout would affect performance when participants were asked to read a text and answer questions on it at their normal reading rate.

The findings revealed that text layout affected performance when there was no time pressure, with this particular material and this reading task. It was evident that with layout T1, the one conforming to legibility guidelines, participants performed best. Moreover, layout T1 was also regarded as making it easiest to locate the answers, as well as being attractive.

However, contrary to the results found in the experiment conducted by Lonsdale et al. (2006), in the present experiment there were no differences in task accuracy among the layouts. As participants were given all the time they wanted to complete the reading task, they may have focused more on the accuracy of the answers than on the time spent. This, therefore, would have resulted in differences in task time with little difference in task accuracy.

An informal observation of how participants completed the task revealed two different general approaches:

- Participants read the questions first and then went straight to the text to scan/skim for the answers.
- Participants read the whole text first, then the questions, and then went back to the text to scan/skim for the answers.

It is clear that, with either approach, participants used search-reading strategies to locate the specific information that answered the questions. Moreover, the frequent underlining of words in the text and questions also revealed that participants used key words to help them complete the task. This therefore reinforces Lonsdale et al.'s (2006) suggestion that the effect of text layout on performance may occur at the perceptual level of reading. In other words, text layout may help or impair readers' attempts to locate the key words in the text and identify the relevant information necessary to answer the questions more efficiently.

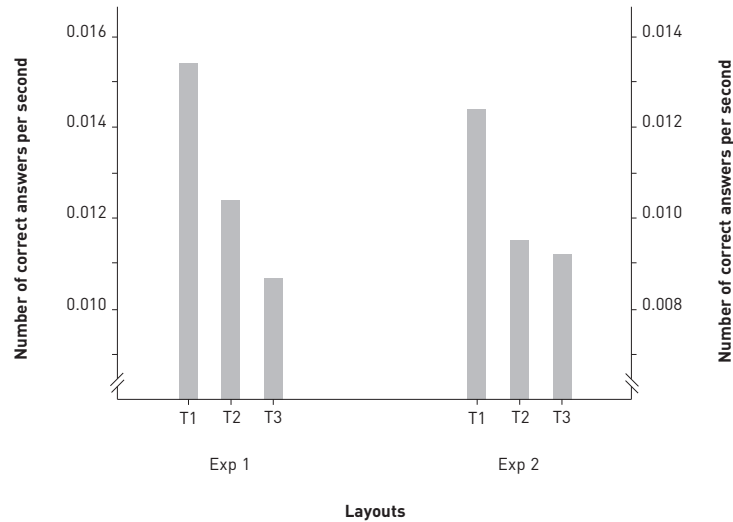
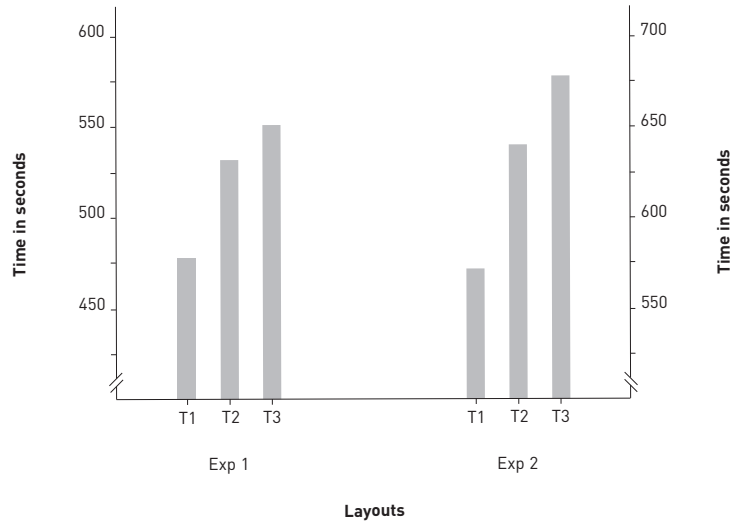
If people have to search for target information in academic-type situations where no time pressure is imposed, then the layout of the texts used can make a difference to performance.

4. COMPARISON BETWEEN THE TWO EXPERIMENTS

There is accumulating evidence from the experiment reported by Lonsdale et al. (2006) – Experiment 1 – and the experiment reported in this paper – Experiment 2 – for the superiority of layout T1, the one conforming to legibility guidelines (Figure 7).

FIGURE 7.

Comparison of the effects of text layout on performance across Experiments 1 and 2.



In addition, according to the similar comments made by participants in the two experiments, layout T1 made it easiest to locate the answers and was attractive mainly because of good line length, generous interlinear space and the clear separation of paragraphs. This evidence suggests that the effect of text layout on performance may have been caused by these particular typographic features: line length, interlinear space, and paragraph distinction. Further and systematic investigation would be required to confirm this.

Moreover, text set according to legibility guidelines made it easiest to locate the information in two distinct situations:

- An examination-type situation where readers had insufficient time to carefully read a whole passage whilst at the same time having to answer questions on it.
- A general academic situation (class activity, assignment, library search, etc.) where readers could look for specific information in a text at their normal and comfortable reading speed.

An additional two-way repeated measures ANOVA was done, which combined the results of the two experiments to confirm that there was no interaction between them, i.e. the two experiments were independent. The ANOVA included one within subject variable (text layout) and one between subject variable (experiment). The results were as follows (Table 4, 5, and 6):

- In task time, there was a significant effect of text layout ($F(2,116)=10.55, p<0.001$) and of experiment ($F(1,58)=4.63, p<0.05$).
- In task accuracy, there was an effect of text layout ($F(2,116)=4, p<0.025$) but no effect of experiment.
- In task efficiency, there was a significant effect of text layout ($F(2,116)=16.54, p<0.001$) but no effect of experiment.
- There was no interaction between the two variables text layout and experiment in task time, task accuracy, or task efficiency.

There are two points of interest to note. First there were significant differences in time across the two experiments. Examination of the means revealed that participants took less time in Experiment 1 (where

TABLE 4.
Mean task time in seconds and standard error of the mean for the text layouts and experiments..

TASK TIME

Layout	Exp1			Exp2			Overall mean
	N	Mean	SE	N	Mean	SE	
T1	30	477.4	34.3	30	572.3	34.4	524.4
T2	30	532.6	33.1	30	640.6	39	586.6
T3	30	550.9	34.3	30	677.8	57.2	614.3
Overall mean		520.3			630.2		

Exp 1 – participants were asked to perform as quickly and accurately as possible

Exp 2 – participants were asked to perform as accurately as possible but at their normal reading rate

T1 – text layout intended to be most legible

T2 – text layout intended to be of medium legibility

T3 – text layout intended to be least legible

T A B L E 5 .
Mean task accuracy measured by the number of correct answers, and standard error of the mean for the text layouts and experiments.

Layout	TASK ACCURACY						
	Exp1			Exp2			Overall mean
	N	Mean	SE	N	Mean	SE	
T1	30	5.86	0.23	30	5.93	0.20	5.89
T2	30	5.86	0.20	30	5.4	0.31	5.63
T3	30	5.1	0.25	30	5.47	0.26	5.28
Overall mean		5.61			5.6		

Exp1 – participants were asked to perform as quickly and accurately as possible
Exp 2 – participants were asked to perform as accurately as possible but at their normal reading rate
T1 – text layout intended to be most legible
T2 – text layout intended to be of medium legibility
T3 – text layout intended to be least legible

T A B L E 6 .
Mean task efficiency measured by the number of correct answers per second, and standard error of the mean for the text layouts and experiments.

Layout	TASK EFFICIENCY						
	Exp1			Exp2			Overall mean
	N	Mean	SE	N	Mean	SE	
T1	30	0.0145	0.0013	30	0.0124	0.0012	0.0134
T2	30	0.0125	0.0010	30	0.0095	0.0009	0.0109
T3	30	0.0107	0.0011	30	0.0092	0.0009	0.0099
Overall mean		0.0125			0.0103		

Exp1 – participants were asked to perform as quickly and accurately as possible
Exp 2 – participants were asked to perform as accurately as possible but at their normal reading rate
T1 – text layout intended to be most legible
T2 – text layout intended to be of medium legibility
T3 – text layout intended to be least legible

time pressure was imposed) than in the Experiment 2 (where there was no time pressure). However, there was no significant difference in accuracy across the two experiments. This validates the method of imposing time pressure used in Experiment 1 and indicates that participants did follow the instructions to read as accurately as possible, whether under time pressure or not. Second as no interaction was found between text layout and experiment for any of the three measures, the pattern of performance across the three text layouts was not affected by time pressure. Thus given that

with no time pressure participants may focus more on the accuracy than on the time spent, the explanation above is not supported.

5 . R E C O M M E N D A T I O N S

As suggested by Lonsdale et al.'s (2006) study and later by Lonsdale (2007), the general reading strategy used in examination-type situations accommodates the strategic reading process known as search reading. They also suggest that their findings could assist in the design of academic texts that students often read/use in and outside the classroom (e.g. periodicals and magazine articles, journal papers, book sections, textbooks). Such a claim is now supported by the findings emerging from the study reported in this paper.

As already mentioned, Lonsdale et al.'s (2006) and Lonsdale (2007) go even further by suggesting that two distinct aspects of selective processing of text seem to be involved in the search reading strategy: perceptual and conceptual processing of text. In sum, participants use key words to search for the specific information that answers the questions as efficiently as possible (i.e. as quickly and accurately as possible).

In order to discuss the findings from this research and as an attempt to understand more clearly the role typographic layout may have in academic reading, it seems reasonable to attempt to specify a single general model for the process of reading in academic situations.

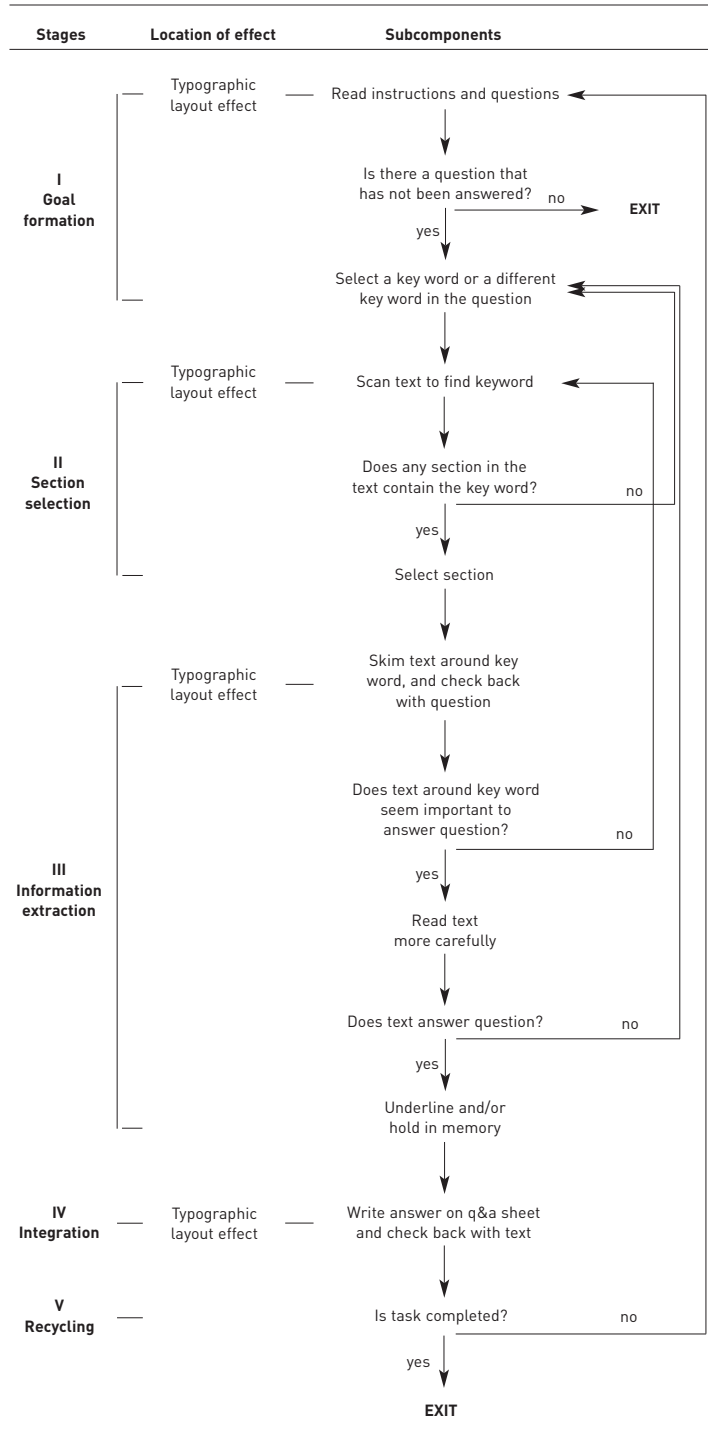
It is obvious from several descriptions of reading models (e.g. Harri-Augstein et al., 1982; Masson, 1985; Rayner and Pollatsek, 1989; Urquhart and Weir, 1998; Allen, 2003; Samuels and Kamil, 2003), that search reading, when compared to careful reading, has received little attention from reading researchers. This is true even though the wide use of search reading in professional and academic contexts is recognized (e.g. Urquhart and Weir, 1998; Guthrie and Mosenthal, 1987; Guthrie, 1988; Guthrie et al., 1991; Dreher, 1992; Enright et al., 2000; Weir et al., 2012). Consequently, even fewer search-reading models have been proposed.

Of relevance to this paper is Guthrie's (1988) process model, which accounts for performance on document searching. Guthrie's search-reading model addresses text search as a problem-solving process (as also emphasized by Symons and Specht, 1994, 268-9). That is, readers attempt to locate information that fulfills a particular goal requirement, i.e. that answers a specific question. Moreover, it involves the efficient selective search of documents as the solution to maximize accuracy and minimize time, and not other reading skills such as recalling prose material.

Guthrie's (1988) model proposes that the searcher engages in five component processes, which are adapted here to illustrate where specifically in the reading process typographic layout might have an effect on performance at the perceptual level of reading. Deconstructing the reading task into its component stages is important as it will provide

FIGURE 8.

Process model of searching information in academic written materials.



information on what proportion of the task will be affected by the typographic layout (as suggested also by Dillon et al., 2004, in relation to the quality of image presented on screen).

The model proposed in this paper is first divided into three general areas, as illustrated in Figure 8.

- Stages, i.e. each of the component processes involved in reading a text to locate information, which will fulfill a particular goal or answer predetermined questions
- Location of effect, i.e. where in the reading process typographic layout of the reading material might influence the way the reading strategy is carried out and, therefore, influence readers' performance
- Subcomponents, i.e. each of the steps readers take during the strategic process of reading

Five stages of the strategic reading process are also proposed (as described next), and each stage addresses the perceptual and conceptual processing of text. It should be highlighted that the main purpose of identifying these stages is to understand, as far as possible, how (and not just where) the effect of typographic layout on performance might occur: i.e. how typographic layout might decrease or increase speed and accuracy of reading and locating information in order to answer specific questions (in examinations, achievement tests, assignments, essays, classroom activities, homework, quizzes, etc.).

It should be further noted that in the experiment conducted by Lonsdale et al. (2006), as well as in the present study, the comments made by participants suggested that the layout of the question and answer sheet could also affect speed and accuracy of reading and answering. This is actually supported by Lonsdale's (2007) experimental studies testing the effect of typographic layout of question and answer sheets on performance. It seems therefore logical that in the proposed model the effect of both text layout and question and answer sheet layout on performance should be considered.

Theoretical predictions for future research paths are also suggested for each stage of the reading model to add value to research regarding the legibility of instructional materials.

Stage I – Goal Formation

When given an assignment with a question sheet, students read the instructions and questions carefully before they read the text that might answer those questions. This is essential to complete the task efficiently. However, according to some authors (e.g. Hartley, 1994), the layout of questionnaires and forms can affect the way the respondent deals with them. Some common typographic faults have been identified that may lead to difficulties in using questionnaires and forms (Hartley, 1994, 111-2; Wright, 1981; Waller, 1984): insufficient space, inappropriate sequencing of information, oddly positioned instructions, and instructions in small type.

This seems to be a stage at which typographic layout may affect students' performance at the perceptual level of reading. If the accuracy and the speed with which the instructions and questions are read can be affected by the legibility of the layout, then the efficient completion of the assignment can be compromised.

Space could be systematically manipulated to show the structure of the question sheet, clearly indicating the hierarchy and sequence of the information on the page. As Hartley (1994, 111) argues, systematic spacing in the text of a questionnaire or form is required to help the respondent deal with the complexity of the information.

Additionally, instructions also set the scene for the task and indicate exactly what the task is. The clear understanding of what the question is asking is therefore crucial because it will direct the students more quickly to the correct information and relevant text section. It is also common practice that students highlight key words in the question sheet because it helps to focus on what is being asked. Understanding the questions and choosing key words involves conceptual processing of text.

Stage I Future Research

Although the three text layouts tested in the study reported above differ in their typographic design, the instructions that accompany the text and questions share the same design (as shown in Figure 1, 2, 3 and 9) and are always set in italic. Research shows, however, that italic retards reading when compared to Roman lowercase text (e.g. Tinker and Paterson, 1928; Paterson and Tinker, 1940; Tinker, 1955). Future research could therefore compare, at Stage I (Goal Formation) of the reading model, the impact on student performance of reading instructions in italic versus Roman type. It seems that setting the instructions in Roman type could further improve the speed and accuracy of completing reading and academic tasks involving search reading, specially in situations involving complex and long instructions.

FIGURE 9.

Question and answer sheet using dummy text.

Quisque 1-7

Lorem ipsum dolor sit amet, consectetur adipiscing elit Etiam a metus. Magna hendrerit (A-E), Aenean quis arcu ut quam (1-7).

Nullam at varius urna Vivamus (A-E) trum sa 1-7 sapien vitae efficitur.

NB *Quisque facilisis velit dolor; non posuere nisi dictum nec non ante nec odio pharetra.*

- 1 Etiam nisl ipsum, porta vitae bibendum nec id est.
- 2 Forci eu urna mollis aliquet sed id dolor.
- 3 Ut quis fringilla nulla sed et.
- 4 Maecenas suscipit tortor eget sapien blandit.
- 5 Cras ullamcorper pulvinar dignissim.
- 6 Nunc vitae commodo lorem donec eget tristique.
- 7 Vivamus tincidunt lectus quis sapien vest.

ID AUCTOR FELIS	
A	Donec neque purus
B	Maecenas
C	Intergeracs
D	Nullam efficitur justo tortoram
E	Suscipit porta sed ac purus

Stage II – Section Selection

Students quickly locate the section of the text containing the relevant key words in order to identify where in the text the answer is to be found. For that, students scan the text, i.e. move their eyes over the text very quickly in order to find the specific key word. This is compatible with what Masson (1982) describes as 'perceptual selectivity', where readers use perceptual guides to locate only those parts of the text containing evidence relevant to the question (avoiding wasting time reading irrelevant text).

This, therefore, seems to be another stage at which typographic layout may influence students' performance at the perceptual level of reading. Typographic layout might affect (facilitate or impede) the speed with which students move their eyes over the text.

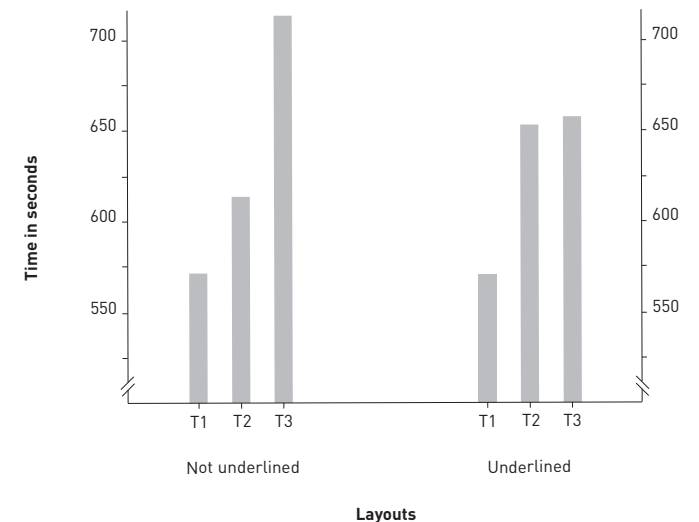
By making the structure of the text sufficiently clear, typographic layout should help students to quickly and easily locate the section of text they are looking for to answer the question. This claim is consistent with empirical evidence concerning text structure (e.g. Hartley and Burnhill, 1976; Hartley and Burnhill, 1981; Lonsdale et al., 2006; Lonsdale, 2007). A legible structure could be achieved, for example, manipulating the space systematically in order to distinguish clearly the several paragraphs of the text and to distinguish successive text lines from one another (as it is the case of Layout T1 shown in Figure 1).

Stage II Future Research

Taking a close look at the data of the study described in this paper, it is interesting to note that for layout T3 (less legible) the average time spent completing the examination was a lot lower when participants underlined relevant information (as shown in Figure 10). Layout T2 (medium legibility) did not benefit from the underlining (participants actually spent more time on the task when they underlined the text). As for Layout T1, once again this

FIGURE 10.

Comparison of the average time spent between participants who underlined text/key words, versus no underlining.



was the layout where participants always performed better, and the average time spent remained the same whether participants underlined information or not.

This seems to indicate that typographic legibility principles have a greater impact on reading speed than typographic cueing. However, for layouts disregarding legibility principles, underlining might enhance performance.

Research has actually shown that students understand and recall pre-underlined information in a long text passage better than when the same information is not underlined (e.g. Crouse and Idstein, 1972; Cashen and Leicht, 1970) or when readers underline the information themselves (e.g., Fowler and Parker, 1974; Rickards and August, 1975; Fass & Schumacher, 1978).

However, there are situations in academia where underlining is not permitted, such as textbooks that students borrow from the library. In this case, cueing could be used instead. As several studies have shown, using typographic cueing to emphasise specific information in a text is beneficial to achieve visual relief in uniform pages of text. For example, bold typeface not only helps readers to comprehend information (e.g. Foster and Coles, 1977) but also helps to follow directions (e.g. Poulton and Brown, 1968; Salcedo et al., 1972). Colour is also a more effective and attractive highlighting technique than black and white (e.g. Katzman and Nyenhuis, 1972) for both high and low aptitude learners (e.g. Chute, 1979).

It should be noted, however, that whilst research supports specific typographic cueing, it also shows that multiple cueing (i.e. using several cueing techniques together) can be confusing and impair comprehension (e.g. Hershberger and Terry, 1965; Glynn and Di Vesta, 1979).

In conclusion, although typographic legibility seems sufficient to enhance performance, combining typographic legibility principles with single typographic cueing could be beneficial in a few particular cases (i.e. adult language learning). Learning a second language in adulthood can be frustrating and very difficult: i.e. because with age our brain's plasticity and ability is reduced (Asher and Garcia, 2011) or because (contrary to children) adults approach learning a new language with a problem-solving process (Gass and Schachter, 1989).

Future research could therefore assess, at Stage II (Section Selection) of the reading model, the impact of typographic legibility together with single typographic cueing on adult language learning. Such a combination of typographic features could lead to better comprehension and learning, especially in terms of vocabulary and grammar.

Stage III – Information Extraction

Once the key word has been found in the text, students skim the text immediately before and after the key word to get an idea of whether that section might contain the right answer. In the particular situation where students

are given a question sheet they might use it in parallel with the text. In that case, while skimming the text around the key word to get a general idea as to whether it answers the question, students may find themselves switching rapidly from the section where the key word is, back to the question sheet, and back again to the text, and so on. This means that at Stage III both text layout and question and answer sheet layout might have an effect on the speed and accuracy of reading a text and answering questions at the perceptual level of reading.

In relation to the text layout, it seems likely that the more legible the layout is, the quicker the text is skimmed. This statement is supported by empirical evidence concerning the legibility of text (as summarized in Table 1 and by Lonsdale, 2014).

In relation to the question and answer sheet, when several questions are asked, legible questions and a clear typographic structure are necessary for students to quickly locate the question that is being answered among all the other questions. This claim is strengthened by the findings of Hartley et al. (1973) who showed that the design of the response sheet in a test could affect the scores obtained. Similar results were also found by Lonsdale (2007), whose experiments showed that significant differences in performance were always in favour of the question and answer sheet layout conforming to legibility principles.

Once students have skimmed the text immediately before and after the key word, they decide whether the section contains the right answer. If the section does not seem important, then students quickly check other possible sections in the text containing the same key word (the arrow in Figure 8 reflects this return in the strategic reading process). Even if students feel that they have found the answer, they might still want to quickly check other remaining possible sections.

As soon as students feel they have found the section that contains the answer, they read it more carefully in order to confirm whether the text answers the question fully or not. Getting this part right involves conceptual processing. Once again, if the text does not answer the question, students might go back to the question and choose another key word (the arrow in Figure 8 illustrates this return). If it does answer the question, students either memorize the words or underline them for reference. Stage III is therefore another stage involving conceptual processing of text.

Stage III Future Research

When observing students taking class tests and examinations, it is interesting to note their physical interaction with the assessment, i.e. how they handle the sheets of paper. Tests/examinations are usually printed on both sides of the page. Reading text on a page and answering questions that are printed on the back of that same page, or on another page, can prove difficult. When switching rapidly from the section where the information that answers the question might be, back to the question sheet, and back again to the text, students find themselves turning the pages over numerous

times. A few more audacious students, when the examination is stapled, end up removing the staple in order to have the text and the questions side by side to save time and avoid inaccuracies.

Future research could therefore compare, at Stage III (Information Extraction), the impact on students' performance of completing an examination that is stapled and printed on both sides versus completing an examination with loose sheets and printed only on one side. Although no research is available on this matter, it follows that the former scenario would slow down the answering process and result in more inaccuracies when checking the information (Stage III – Information Extraction), as well as transferring it to the answer sheet (Stage IV – Integration, as will be discussed next).

Stage IV – Integration

This stage applies to academic situations where students are required to write the answers down on a question and answer sheet and integrate the text with the question on the sheet. Examples of such situations are assignments, class activities, textbooks, quizzes, examinations, achievement tests, etc.

Once more, it seems plausible that the layout of the question and answer sheet may affect speed and accuracy of answering at the perceptual level of reading. As stated by some authors (e.g. Hawkes et al., 1936, 115), the answer sheet should be made as suitable and useful as possible to fulfill the needs of the responder. For example, marked spaces for students to write their responses should be provided to the left of the question, and written instructions should be provided at the top (Jacobs and Chase, 1992, 98).

Therefore, in addition to directing students' attention to the place where the question being answered is located on the question and answer sheet, typographic features may also be used to help locate the precise place to write the answer. This can further increase, not just the speed of answering the questions, but the accuracy as well, as shown by Lonsdale (2007). If an answer is written in the wrong place, it will not be considered correct in an assessment, or (in the case of textbooks) will lead the student into error when revising at a later date.

At this stage students might also want to go back to the text in order to double check and make sure the information they transferred is accurate. This also reinforces the importance text layout can have for students to find and review this information quickly. (Double checking information is common practice in academia, such as the transfer of text extracts from a book to a notebook, computer, etc.).

Stage IV Future Research

The effect that text layout has on performance when answering different types of question has been ascertained by Lonsdale (2015). The two types of questions tested by Lonsdale (2015) had some slight typographic differences, but the aim was not to compare their typographic layout. Instead, the

aim was to compare two questions that require different reading processes, i.e. location versus comprehension processing. Language examinations, however, include a range of questions that differ in their design, and some of them have a complex structure. Examples are 'table completion' and 'diagram completion' types of question which are very common in examinations such as IELTS, as well as standard language examinations.

Future research could therefore ascertain, at Stage IV (Integration) of the reading model, the effect typographic layout has on performance when answering questions with a more complex typographic structure. Based on Hartley et al. (1973) and Lonsdale's (2007) findings, it follows that the application of typographic legibility principles to types of question displaying a complex structure would also result in better performance.

Stage V – Recycling

If the reading task is not completed, students return to Stage I, i.e. carefully re-read the instructions and questions (this is again indicated with an arrow in Figure 8). Completion of the reading task means either the completion of a whole class activity, or a test, or an assignment, etc.

5.1. CONCLUDING REMARKS

The reading model proposed here is a research tool capable of covering academic reading tasks that involve one, two, three, four, or all stages of the model. If students read with the single purpose of identifying specific information (i.e. an author's name, a date) but do not have to answer a pre-set question, then only Stage II – Section Selection – of the reading model needs to be researched. If, however, students read to find specific information, as well as make sense of it (i.e. a definition), then the reading process needs to be studied up to Stage III – Information Extraction. Finally, if students read to find specific information, make sense of it and then write down the answer to a set of questions (i.e. an examination), then the reading process should be investigated all the way up to Stage IV – Integration. Stage V – Recycling – applies to any reading task that has not been completed.

It is also important to make a connection between the reading model, the findings of the study reported in this paper, and Lonsdale et al.'s (2006) findings. At every stage of the reading model where typographic layout might affect performance at the perceptual level of reading, text layout T2 (medium legibility) and T3 (less legible) seem to slow down the reading process and lead to inaccuracies, whilst text layout T1 (more legible) seems to allow reading and answering to flow better. Furthermore, such slow-down and error-increase is greater with text layout T3 than with text layout T2. Although the layout of the question and answer sheet was not addressed in the experiment reported here, Lonsdale's (2007) findings provide strong evidence to suggest that the exact same effect occurs with less and more legible question and answer sheet layouts.

Certain typographic features can also be linked to each individual stage of the reading model:

- Stage I – Goal formation should be supported by structure and hierarchy-related features such as well positioned instructions, sufficient space between instructions and remaining text/questions, and appropriate sequencing of information. It should also be supported by legibility features such as type size of 10 to 11-point, a line length between 60 to 70 characters and spaces per line, and an additional interlinear space of one to four points.
- Stage II – Section selection should be supported mainly by structure related features such as clear distinction of paragraphs and sufficient interlinear space to distinguish successive text lines.
- Stage III – Information extraction should be supported mainly by legibility features such as the ones listed for Stage I.
- Stage IV – Integration, which relates greatly to the question and answer sheet, should be supported by sufficient space between questions, adequate space to write the answers, and numbers placed close to the corresponding question. Because of the switching process that happens at this stage between text and question and answer sheet, the same structure-related features listed in Stage II should be used here.

- Skimming the text immediately before and after a key word to get an idea of whether that section contains the right answer.
- Referring back to the text to make sure the information is accurate.
- Writing down the answers (in those cases where students have a question sheet).

By emphasizing the relationship between the findings emerging from the present experimental study and the reading model suggested here, more information is provided to those designing academic and instructional materials. In other words, the design of academic texts that are published in journals, textbooks, periodicals, magazines, etc., can be improved if legibility is considered. Consequently, these outcomes can apply to a vast range of written materials that students have to read/use in and outside the classroom in order to support learning and search for specific information on the subjects they are studying.

The present research is also relevant to people in academia other than students (e.g. lecturers, researchers, librarians, etc.), who also practice search reading on a daily basis to look for specific information in written documents. (Of course, some written documents will be closer than others to the circumstances of the experimental work conducted in the present study.)

Furthermore, the present study can make a valuable contribution to knowledge. Documents requiring exclusively or predominantly search reading have not been given much attention. Legibility research on the effects of several typographic features in combination (not as independent features) has not been given much attention either. However, the treatment of typographic features as a whole is validated by consistent better performance with the typographic layout intended to be more legible.

In relation to readers' judgments, this study can also provide information on layout characteristics that are considered to contribute to the ease of locating information, the ease of answering, and attractiveness. The reactions to the particular materials tested here may well reflect the reactions to other printed materials if they are typographically similar or read for the same purpose of locating specific information and answering.

Further evidence on the reading model proposed here could be obtained as suggested above. Experimental studies could also assess whether people actually go through the stages proposed in the model and whether the theory that typographic layout affects readers' performance at the perceptual level of reading is valid.

The value of experimental findings is reinforced if more research is carried out to confirm them. The present study therefore indicates a need to conduct more studies on the typographic layout as a whole, as well as studies on the design of teaching and learning support material.

6. DISCUSSION AND CONCLUSION

The main conclusion to be drawn is that text layout affects performance in academic reading situations involving both time and no time pressure. Specifically, a text layout displaying a combination of typographic features that conform to legibility guidelines seems to support efficient search reading in both situations of time and no time pressure. This suggests that the superiority of the layout conforming to legibility guidelines is related to search reading strategies used to complete the reading task and not to time pressure.

A theoretical explanation for such an effect of typographic layout on performance was given by attempting to specify a general model of the process of reading in academic-type situations. The model refines Guthrie's (1988) model to try to capture the search reading strategy used and proposes the stages of the strategic reading process where typographic layout might influence performance at the perceptual level of reading. According to the reading model, text layout may help or impair students' performance in the following activities:

- Reading the instructions and questions.
- Scanning the text to locate relevant information that answers specific questions.

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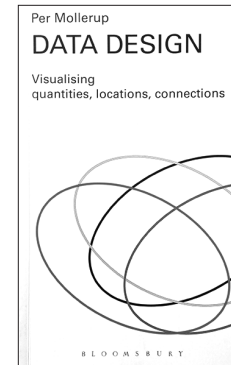
A u t h o r

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Book Review

DATA DESIGN Visualizing quantities, locations, connections
by Per Mollerup



When a book arrives that belongs to a well-populated category on my bookshelf it makes sense to review it in the context of its neighbors. In this case, *DATA DESIGN Visualizing quantities, locations, connections* by Per Mollerup joined 27 books on information design already on my “active books” bookcase, that is, the books not on bookcases in the basement.

Per opens his book explaining foundational concepts in a chapter titled “Basics.” Existing information design books such as *The Wall Street Journal Guide to Information Graphics* by Donna M. Wong open similarly with a first chapter titled “The Basics.” Whereas Wong briefly touches upon various functional components of design such as color, typography, and legibility Mollerup draws in principles from research such as Gestalt psychology.

Where Per does discuss color he does so in relation to a color system rather than functional advice. Per’s introduction also introduces the concept of simplicity as well as several historic milestones such as William Playfair’s *The Commercial and Political Atlas* and Isotype. Jenn and Ken Visocky O’Grady also mention Isotype in their “Overview” chapter of *The Information Design Handbook*, but in comparison to these other books *DATA DESIGN* tends to found build arguments more on established findings in other fields than issues particular only to design.

Per’s descriptions of data design are characterized by their simplicity. Simplicity in this case does not mean lacking nuance, sophistication, or insight but rather that he absents explanations of jargon and academic pretension. For example, on page 57 Per writes, “Categorical variables are known by their distinctive difference, by their lack of universal order, and by not being quantifiable. Gender is a categorical variable.” This is as simple, detailed, and clear an explanation as I can remember. However, at times such admirable simplicity provides less help when on one hand it links word to definition while lapsing into circular redundancy such as on page 56 “A variable is a factor that may vary.” Most dictionaries avoid using the root word to define the word and I think both simplicity and comprehension would have been served if the book had more carefully observed this convention.

The bulk of the book is devoted to well organized and amply illustrated examples of data design organized into three broad categories: visualizing quantities, visualizing locations, and visualizing connections. This makes it an easy reference for designers facing a particular kind of task. The clear, simple yet insightful quality of the entire book makes it well worth owning.

Mike Zender

Journal Information

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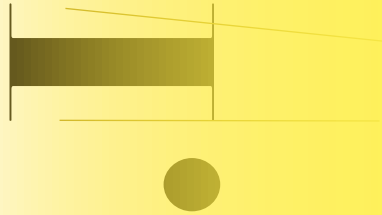
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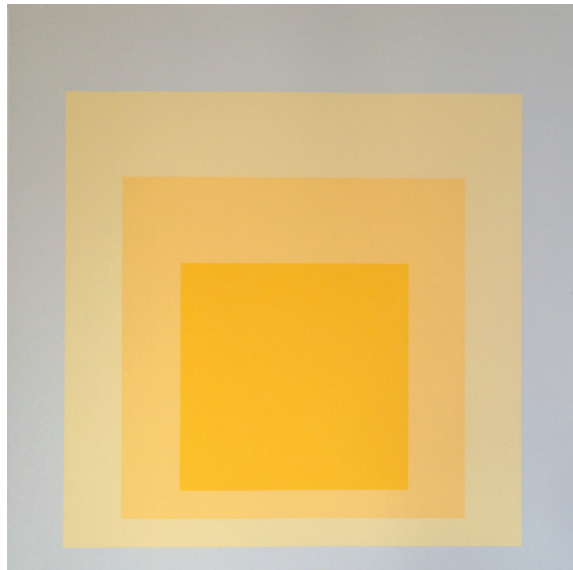
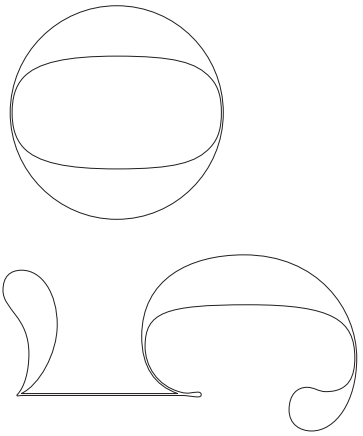
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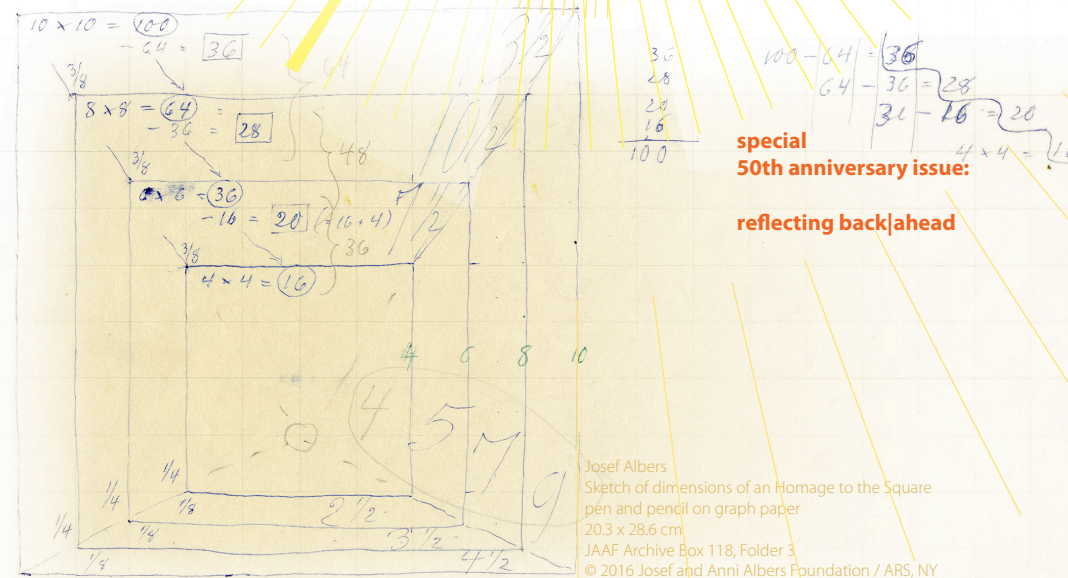
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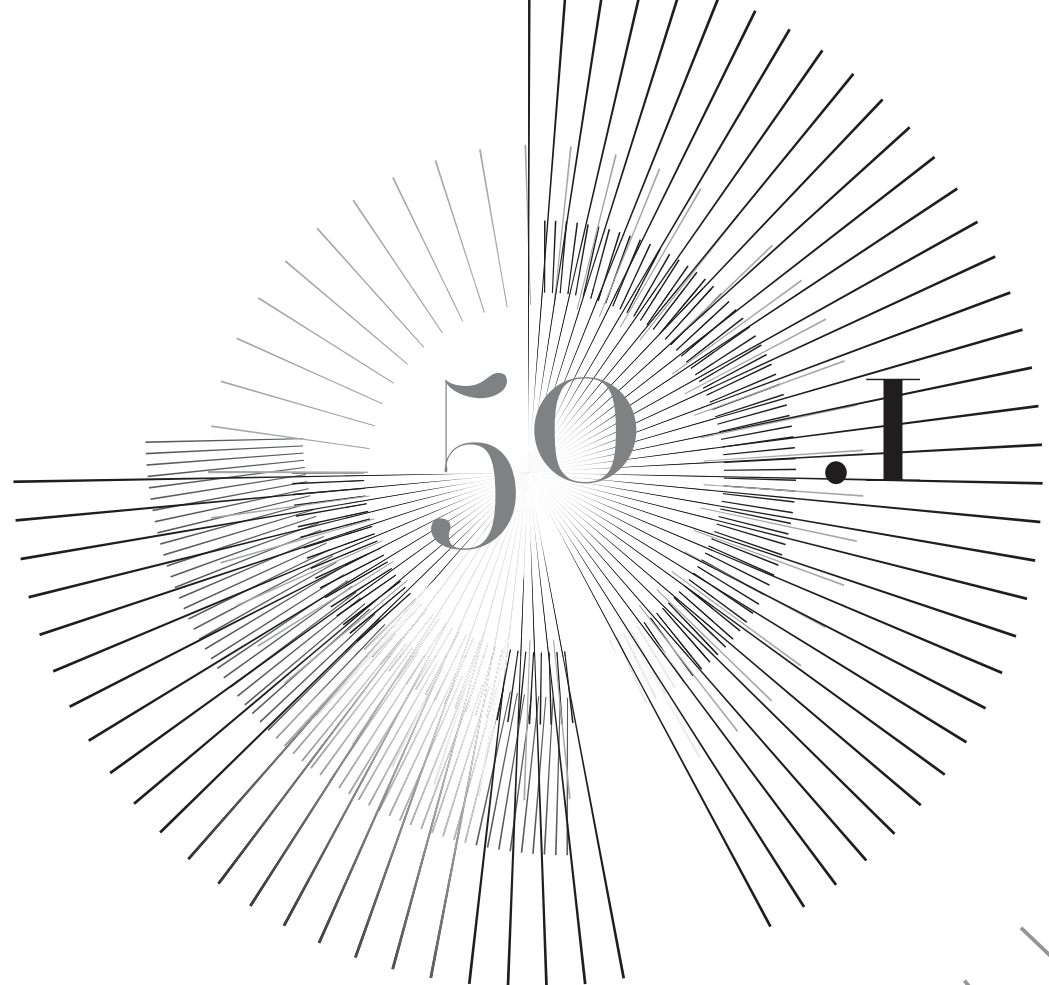


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Sketch of dimensions of an Homage to the Square
pen and pencil on graph paper
20.3 x 28.6 cm
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A lot of design has happened in the 50 years since *Visible Language* was founded: typesetters – gone; desktop publishing – a passing blip; computers – moved from desktop to pocket. The term graphic design had hardly entered the dictionary before the discipline started to consider renaming itself visual communication design or just communication design. Because communication continues to grow in quantity and importance there's no reason to disbelieve in a promising future for a communication design discipline. What the promising design future looks like is, as always, sketchy. A well-known 20th century Danish proverb states that predictions are easy except when they involve the future and George Santayana famously warned of the trouble that awaits failure to examine the past. If we take Santayana's statement less as a warning than as a prescription to guide action, we might reflect thoughtfully on the past in order to plan our steps today to help shape a future the Danes say is so difficult to predict. Reflecting on the past may not make predictions easier, but it might make them more realistic.

To celebrate its 50th year *Visible Language* will revisit themes from the journal's past to help chart the design discipline's future. This issue features articles by Meredith Davis, Sharon Poggenpohl, and myself commenting on design's direction, design journals, and design research. As a special homage to the journal's roots in typographic research issue 50.2 will revisit typography and see what we have learned in the past 50 years and project where typographic study should be going next. Issue 50.3 will look at *Visible Language* in light of design history and theory with a similar aim: to reflect on the past to help guide and inspire the future: reflecting back – reflecting ahead. Reflecting in the sense of thinking deeply or carefully about something and at the same time suggesting the visual nature of much of human cognition and the essential visual nature of design. Reflection is a physical process wherein light or energy is thrown back from a surface. We learn about ourselves through reflection. We see things in a new light, from a new vantage point, and if the mirror is placed properly we can see not just where we've been but where we are going: around the corner we have not yet turned.

This year we are devoting part of the journal to not predicting the future but to shaping it. We can't wait to see what they'll say about our efforts in 2065!

Calculating Line Length: an arithmetic approach

Ernesto Peña

A b s t r a c t

This paper introduces an arithmetic formula for the calculation of text line length (also referred to as line width) for roman alphabet from 1) the length of the alphabet in lowercase, 2) a value for the desired character density and 3) a mathematical constant. A short-range study with this formula has shown a margin of error of less than 5% in common serified text typefaces. The potential application of this formula in both print and digital editorial products could be diverse, from the approximate calculation of pages in a book to the establishment of control parameters in responsive web pages. Moreover, this formula would allow designers to make decisions about formal aspects on reading devices based on principles of readability and reading experience.

KEY WORDS :

Typography, Editorial Design, Metrics, Line length, Character density

Introduction

The understanding of what makes a text readable has been a concern across several fields of study since—at least—the last century, although the records of the use of the term *readability* started by the first half of the XIX century (Michel et al., 2011; “Readability, N.,” 2014). By the mid 1960s, the term *readability* was applied to different conceptions, referring on the one hand to the ease of comprehension of the text either due to the complexity of the topic or the writing style and on the other to formal aspects such as the layout of the information or the typeface (Klare, 1963). Rather than considering the properties of the font such as size of ascenders and descenders, x-height, color and stroke weight, the design of the serif and other distinctive features, which have been encompassed within the concept of *legibility* (Gaultney, 2001), the line length might be one of the most—if not *the* most—relevant factor of readability in a text.

Nanavati and Bias (2005) reported the existence of at least 100 years of research on line length and gave an overview of the results of such research from the studies conducted by Tinker and Paterson since the late 1920s to the impact thereof in digital media applications (Miles A. Tinker, 1928; Paterson and Tinker, 1929; M. A. Tinker and Paterson, 1929; M. A. Tinker and Paterson, 1931; Paterson and Tinker, 1940; Paterson and Tinker, 1943; Paterson and Tinker, 1946; Miles A. Tinker, 1963a; Miles A. Tinker, 1963b; Miles A. Tinker, 1966). The results are diverse not only in respect to the data, but also respect to the format that researchers have historically employed to express them, given either in continuous data units such as millimeters, centimeters, or picas, or in discreet data units such as words per line (WPL) or characters per line (CPL). The implications of the choice of units go beyond the mere format. As a readability value, the metric length of the line itself is trivial unless it is combined with others such as the width of the characters, the font size (Bringinghurst, 2004, 27), or the quantity of words or characters that are contained within that length. If any, the information that could be considered from this sole value would be the reading area and the necessity of the reader to follow up with the head while reading. However, even the latter would require other data such as the distance between the reader and the reading space or the font size. In contrast, values such as the number of words or characters, also known as word- or character “density” (Dyson, 2004, 379), would be independent of the chosen typeface or its metrics.

Inherently more convenient than the continuous data units, and despite the fact that they have been used interchangeably (e.g., Spencer, 1969, 35), there are crucial differences between the use of WPL and CPL. For instance, in the case of the former, the number of words that a fixed line length could contain would depend on the average of letters per word, a value that would vary between languages and even genres. A self-conducted study by De Buen (2014) reported the a difference in the

average of characters per word between English and Spanish in narrative and non-narrative genres:

TABLE 1.
Difference in average letters per word between English and Spanish, in narrative and non-narrative (De Buen, 2014, 157)

	Narrative	Non-narrative
English	3.46	4.09
Spanish	3.92	3.97

Considering these findings, within English alone, the character density of 12 words from a non-narrative piece would be higher than 14 words from a narrative piece on two equally long text lines. It is likely that this and other circumstances have provoked CPL to be largely favored as a line length unit. Several contemporary authors and researchers (e.g. Bringinghurst, 2004; De Buen, 2014; Dyson, 2004) have employed this measure routinely enough to claim that if there is something close to a standard in regards to line length, it might be CPL.

The use of the character density as a criterion for the line length is not free of challenges. Unlike with what happens with continuous data units where the line length can be easily induced with any text processor or self-publishing software, the resources for calculating the character density are limited: from all the scholars that have embraced CPL as a unit for determining line length, only few (i.e., Bringinghurst, 2004; De Buen, 2014) have provided resources for the calculation thereof. Bringinghurst (2004) recommends staying within a range of 45 to 75 CPL “for a single-column page set in a serifed text face in a text size”, with 66 characters including spaces, “widely regarded as ideal” (26). To induce these metrics, Bringinghurst has proposed a “Table of Average Character Count per Line” (29) that uses the length of the lowercase alphabet (LCA) in typographic points (1/12 inches) set in the typeface and font size that would be used in the text.

TABLE 2.
Fragment of the table of average character count per line by Bringinghurst (2004). The extreme left column indicates the approximate length of the LCA in points (90). The following numbers of that row indicate the approximate character density (36, 43, 50...), and the top row indicates the approximate length of the text line in picas (10, 12, 14...). The original table includes an indication of the ranges of CPL recommended by Bringinghurst.

	10	12	14	16	18	20	22	24...
							
90	36	43	50	57	64	72	79	86...

Although the origin of Bringinghurst’s criteria is unclear, Nanavati and Bias (2005) report on a study conducted by Dyson and Kipping (1998) in which lines of 55 characters were perceived by the participants as easier to read on screen than lines of 25 and 100 characters. In this case, the number computed of characters does not include spaces. Nevertheless, if De Buen’s calculations on the average of characters per word in English are accurate, the inclusion of spaces in Dyson and Kipping’s would result in lines of between 68 and 70 ($55 + [52 \div 4.09/3.42 - 1]$) characters, falling relatively close to Bringinghurst’s suggestion.

For his part, De Buen (2014) argues that the length of the text line should depend not only on the requirements of the layout of the text

but also on different factors among which should be the proficiency of the reader, which would be gauged within a range between novice and expert¹. According to De Buen, the character density in a document for a novice reader should range between 34 and 60 characters (including spaces) with 45 as optimal. A document for an expert reader should range between 45 and 80 characters with 60 as optimal. The method offered by De Buen (2014) for the calculation of line length from the character density suggests to obtain the value of the LCA and subsequently multiply it by 1.75 to obtain the optimal line length, denominated *l*. This new value should be then multiplied by 0.75 to determine the minimum length, denominated *n*, and by 1.5 to determine the maximum, denominated *m*. Arguably, the origin of these values respond to an approximate extrapolation from the 26 characters of the LCA:

Optimal	$26 \times 1.75 = 45.5$	45
Minimum	$45.5 \times 0.75 = 34.125$	34
Maximum	$45.5 \times 1.5 = 68.25$	60

I would argue that despite the effectiveness of these resources for the calculation of the line length, they still posit a few operative limitations. On the one hand, the “Table of Average Character Count per Line” (Bringhurst, 2004, 29) is comprehensive enough to cover a broad range of possible scenarios: from 10 to 160 CPL, 80 to 360 points of LCA (in increments of 5 points) and 10 to 40 picas of line length (in increments of 2 picas). However, the calculation of the line length depends completely on the access to the table. On the other hand, the mathematical formulas introduced by De Buen (2014, 216) give more freedom to the designer, but its reach is limited to the prescribed ranges. The proposal presented here seeks to provide one possible resource to overcome these limitations.

A P r o p o s a l

What I propose is an arithmetic formula that could be used to calculate the metric space within which a particular character density can be applicable. This formula considers different scenarios in print or digital media, regardless of the chosen criteria for the definition of the character density within a text line. It is constituted by three components: the LCA of the chosen typeface at the size and spacing that would be used including the space character (LCA'), the desired character density (C_p), and a mathematical constant that I have provisionally denominated *S*. This formula could be expressed as follows: $LCA' \times C_p(S) = Ll$. These components are intended to take account of the horizontal metric features of the chosen font (width, size), the linguistic

¹ De Buen (2014) uses the labels *bajo lector* and *alto lector*, translated literally as ‘low reader’ and ‘high reader’, respectively (221).

features of the text and the criterion of the designer. The denominated LCA' and the *S* constant are described below.

EXTENDED LOWER CASE ALPHABET (LCA')

As with the previously mentioned devices (Bringhurst's table, De Buen's formulas), the formula presented here employs LCA as a starting point. The idea of using the length of the lower case alphabet as a reference for the estimation of the efficiency of a typeface is not new: Legge and Bigelow (2011) have qualified it as “a traditional typographic measure” (4) which inclusion in typographic specimens used to be a common practice (e.g., American Type Founders, 1953, 1968; Mergenthaler Linotype Company, 1951) along with—in some cases—the characters that a pica could contain. Traditionally, the LCA is obtained by writing the basic characters of the Roman lowercase alphabet without accents, diacritics or digraphs [abcdefghijklmnopqrstu-vwxyz] (Bringhurst, 2004; Legge and Bigelow, 2011) and measuring the length of the string of characters, whether with physical instruments or digitally. I would assume that the aim of this exercise is to consider all the different widths that the characters in the lower case alphabet have. Therefore, if that is the case, even when there are languages in which the basic alphabet includes digraphs or accented characters, when digraphs are combinations of already existing characters, it would be assumed that they are metrically identical to another one and omitted. Accented characters would be omitted as well as accents; diacritics do not usually affect the width of the character, and their inclusion in the LCA string would yield duplicated values². However, in cases in which the alphabet or idiomatic practices of a given language include letters that are not part of the previously introduced string of characters (e.g., æ, ß, or l-l), such characters would have to be included within the LCA string for they have a width of their own. Based on these criteria and on the fact that the space character might be the most common in written manifestations of practically every language³, I would argue that the LCA should include the space character as well. I refer here to this extended version of the LCA as LCA'. The inclusion of non-Roman and space characters and the way their inclusion would affect the formula is discussed below.

THE S CONSTANT

The third component of the formula is a number that derives from a version of the LCA that includes the space character (LCA'), and therefore, it would change depending on the features of the basic alphabet of the language in

² For instance, in Spanish, the *ch* and *ll* used to be considered part of the alphabet until its recent removal. Their inclusion in the LCA string would yield an incidence of three *l* (*l* and *ll*), two *c* and two *h* (*c*, *h* and *ch*). In turn, the *ñ* is still considered a letter of the alphabet, but being metrically identical to an *n*, its inclusion would duplicate a width metric in the string of characters (“Exclusión de ‘ch’ y ‘ll’ del abecedario,” n.d.).

³ De Buen (2014) reports that this is surely the case in Spanish and English.

which the text is laid out. However, this constant is intended to be calculated only once for each scenario and used recursively, that is, once for basic Roman alphabet, once for German, etc. Here, for illustrative purposes, I focus mainly on the basic Roman alphabet, but the same principle could be applied to any other. The *S* constant is the result of counting the inter-word and inter-character metric spaces (as opposed to the optical spaces) within the LCA as characters themselves, and dividing the resulting number by 1.

FIGURE 1.

On the left, the inter-character metric space. On the right, inter-character optical space.

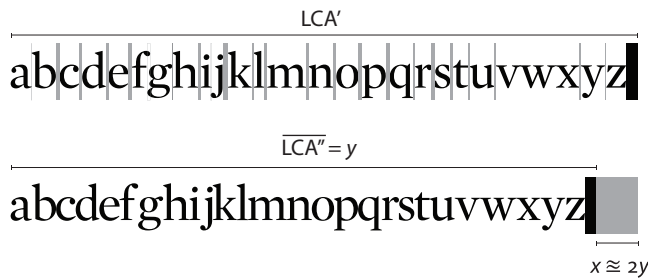


The outcome of this operation is a number that multiplied by the LCA' would give the average width of a single character considering the inter-character space, providing a unit accountable for both characters and space by treating space as if it was a character and getting an average of both categories (characters and space). The procedure followed for the acquisition of this number is described as follows:

1. The LCA' was composed with a given typeface and its length measured.
2. The metric spaces between characters were removed to obtain a new inter-character space-less LCA' denominated LCA". The average width of the characters in LCA" is determined and subsequently used to measure the metric difference between LCA" and LCA'.
3. This difference, determined in LCA" average characters, is added to the LCA' characters.

FIGURE 2.

First row: Lower case alphabet plus the space character, denominated LCA'. Indicated in gray is the inter-character spacing. Second row: The calculation of the average of the LCA' without inter-character spaces, denominated LCA". This average is subsequently used to measure the inter-character spacing.



4. This new number of characters divides one. The 26 characters of the alphabet and the space sum 27 characters, but as the inter-character space units depend on the design of the typeface, it would vary between fonts. I have found that, among professional serif fonts for continuous reading, this number tends to be close to two, which would give a total of 29 characters. This value responds to a general estimation to which I have arrived

after applying the previously described protocol to several typefaces, and it is by no means exact or infallible. During my own tests I have found typefaces in which this number is closer to one (e.g., MT Dante) or to three (e.g., Fedra serif A, Proforma), but I still have not found any typeface that yields an average of inter-character space smaller or larger than this range. However, it is worth pointing out that despite the variance of this value in some typefaces, the formula introduced here presents a relatively small margin of error ($\pm 5\%$), even when applied to typefaces in which the number resulting of the previously described operation is closer to 1 or 3, including those mentioned before. The best possible scenario might be to calculate this number for every typeface used in a document and to keep a personal record, but I would consider the formula provided here is—as it is—a fairly good starting point.

The rounded quotient of the division of 1 by 29 results in what I have denominated the *S* constant: 0.0345, which arguably applies to most serif typefaces in languages with basic roman alphabet, in attention to the exceptions described in *Extended Lower Case Alphabet (LCA')*. This number multiplied by the LCA' and the desired character density (the amount of characters that the designer wants to fit in the text line) give the length needed to fit the required character density in the same units of the LCA'. The number of characters that the line length result of the application of the formula would fit responds to the criteria of the designer and the requirements of the text and its format, hopefully informed by the pertinent research. For instance, to calculate the line length to fit a desired density of characters of Proforma at a size of 10 points would require laying out the 26 characters of the Roman alphabet plus one space character (LCA')⁴. Assuming that the LCA' is 126.15 pt. (10p6.15) and that the desired density is 80 characters, the operation would be as follows:

$$126.15 \text{ pt.} \times 80(0.0345) = 348.17 \text{ pt.} (29p0.17)$$

Applying a density of 40 to the same data, the result would be:

$$126.15 \text{ pt.} \times 40(0.0345) = 174.08 \text{ pt.} (14p6.08)$$

For an extended Roman alphabet, or the use of characters beyond the 26 of the Roman alphabet such as the German eszett (ß), a similar criterion could be applied, but it would require to add the extra characters to the LCA and to modify the *S* constant by adding the extra number of characters. Applying these changes to the previous example, the LCA' of

4 For ease of measurement, the space character added to the LCA should be anywhere within the string of characters except for the beginning or the end.

132.10 (11p0.10) (abcdefghijklmnopqrstuvwxyz ß) laid out in Proforma 10, the S constant would have to be modified to a rounded 0.0333 to consider the new character (1/30). Assuming that the desired densities are 80 and 40, the operations would be as follows:

$$132.10 \text{ pt.} \times 80(0.0333) = 351.91 \text{ pt. (29p3.91)}$$

$$132.10 \text{ pt.} \times 40(0.0333) = 175.95 \text{ pt. (14p7.95)}$$

A Short-range Study

To test the effectiveness of the formula presented here, I performed a simple study: I took the first 20 serif typefaces for continuous reading that I found installed in my computer at the moment (most of them system fonts) and applied the formula to calculate the line length for a density of 65 and 45 characters, values chosen for mere illustrative purposes. The protocol was applied to a single paragraph of a placeholder text consisting of 6500 characters obtained from a public website ("Lorem Ipsum"). In every case, the

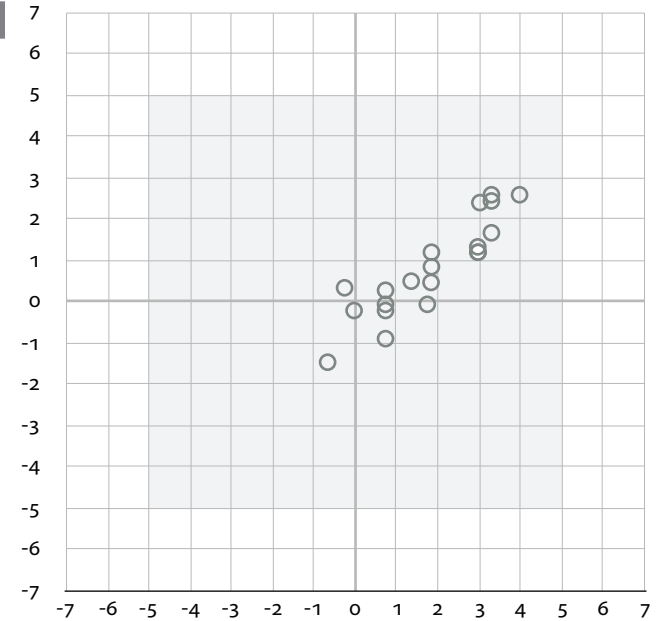
TABLE 3 .
Results of applying the formula to 20 serif fonts for continuous reading: The first column lists the typeface, the second lists the value of the LCA, the third and fourth, the percentage of deviation from the desired character densities, 65 and 45 respectively.

Typeface	LCA' pt.	σ (%) 65 C	σ (%) 45 C
Adobe Caslon	119.60	1.84	0.84
Adobe Garamond	115.70	1.74	-0.07
Baskerville	119.60	1.83	0.46
Cambria	128.60	2.96	1.19
Century	137.80	-0.26	0.33
Chaparral	122.80	1.84	1.19
Charter	129.90	0.73	-0.22
Dante MT	118.08	3.01	2.39
Fedra Serif A	151.70	-0.03	-0.22
Fournier	110.70	3.29	1.66
Georgia	132.00	0.73	0.27
Hoefler Text	125.80	1.35	0.49
ITC Mendoza	130.60	-0.67	-1.47
Mercury G1 roman	130.60	3.29	2.43
Minion	120.90	2.97	1.19
Palatino	135.40	3.29	2.58
Proforma	126.90	3.97	2.58
PT Serif	132.90	0.73	-0.07
Scala	125.45	0.73	-0.90
Times New Roman	121.75	2.96	1.32

text was laid out ragged (aligned to the left) at a size of 10 pt., and the average was obtained by dividing the number of characters by the number of lines. As the purpose was to measure the density of characters within a line, the last line was omitted from the average calculation when the text did not fully reach the right margin. The results of this exercise showed that all the operations stayed within a margin of difference of 4% between the desired density and the character density resulting of the calculation.

FIGURE 3 .

A scatterplot based on the results of the study. On the x axis, the deviation of the result of the application of the formula for a desired density of 45 characters per line. On the y axis, for a desired density of 65 characters. The inner square delimits a 5% of deviation. As shown in this table, most of the results of the operations fell into slightly higher numbers, but never over 5%.



Conclusion

The formula presented here does not pretend to be the ultimate resource to line length calculation from character density; I would consider it to be a reference instead. There are in fact conditions for which this formula or any other resource might not be effective, such as justified text or very low character densities. Regardless of whether or not this formula is helpful or accurate in the conditions for which it was meant, the factors that might have an influence on the character density, and therefore on the line length, might be too many to take into account in a single arithmetical resource. A few of these factors have been already listed here, and I would argue that some of them are circumstantially taken into consideration within this formula, but there are many others that would require more complex protocols. A particularly complicated factor that has been only partially discussed here

is language. Bringhurst (2004) has addressed the fact that the features of a particular language have (or should have) an impact on the way a text is laid out. According to Bringhurst (2004), highly inflected languages like Spanish would require less inter-word space than less inflected languages such as English or German. This feature would be easily taken into consideration in the formula presented here as the space is part of the string of characters that compose the LCA. De Buen (2014) has pointed out that because the frequency of use of characters varies among languages, this would have an impact in the calculation of the character density. To be able to accommodate this factor within the formula presented here, the LCA' would have to consider not only the width of the characters but also their frequency, which might be doable by measuring the characters widths individually and modifying this number accordingly to frequency. However, this would result in a very intricate method. The difference between such hypothetical method and the one presented here might be minimal, although this is subject of further investigation. I would argue that beyond the formula itself, having a dynamic arithmetic approach might well open a door to other possibilities, such as the development of digital tools which could easily take into account factors that seem too problematic to be considered for a shorthand method, as this formula pretends to be.

Future endeavors

De Buen's (2014) contentions on the relation between the reader experience and the character density within a text line is appealing and a possible avenue for further research, but until this research is given and its results published, it might be possible to focus not on the reader but on the intended reader by gauging the readability level of specific content through readability formulas. In a recent study, Begeny and Greene (2014) tested 8 of the most popular readability formulas for determining their effectiveness in calculating the difficulty of reading materials. The findings show that despite extensive use in several fields, the success of their sample of formulas on such a task is questionable except for the Dale-Chall formula: $\text{Grade} = (0.1579 \times \text{percent unfamiliar words}) + (0.0496 \times \text{word/sentence}) + 3.6365$. The only resource outside of the text itself that this formula employs is a list of 3000 words publicly accessible (e.g., "Dale-Chall Easy Word List Text File" 2014); there are online resources for the calculation of readability by this formula (e.g., Scott, n.d.) and others. According to Begeny and Greene (2014), this formula was identified as "a valid measure of text difficulty level" (210) from grade 4 and above. I would argue that whatever the formula employed for its calculation by finding the relation between readability and character density and applying this criterion to the desired character density value (Cp) of the formula introduced here, the two understandings of readability

presented at the beginning of this paper (namely ease of comprehension and formal aspects) could potentially converge in a single device such as an digital application that could calculate not only the readability of a text but also the line-length that would be appropriate for laying out such content.

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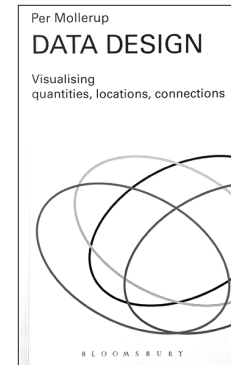
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Book Review

DATA DESIGN Visualizing quantities, locations, connections
by Per Mollerup



When a book arrives that belongs to a well-populated category on my bookshelf it makes sense to review it in the context of its neighbors. In this case, *DATA DESIGN Visualizing quantities, locations, connections* by Per Mollerup joined 27 books on information design already on my “active books” bookcase, that is, the books not on bookcases in the basement.

Per opens his book explaining foundational concepts in a chapter titled “Basics.” Existing information design books such as *The Wall Street Journal Guide to Information Graphics* by Donna M. Wong open similarly with a first chapter titled “The Basics.” Whereas Wong briefly touches upon various functional components of design such as color, typography, and legibility Mollerup draws in principles from research such as Gestalt psychology.

Where Per does discuss color he does so in relation to a color system rather than functional advice. Per’s introduction also introduces the concept of simplicity as well as several historic milestones such as William Playfair’s *The Commercial and Political Atlas* and Isotype. Jenn and Ken Visocky O’Grady also mention Isotype in their “Overview” chapter of *The Information Design Handbook*, but in comparison to these other books *DATA DESIGN* tends to found build arguments more on established findings in other fields than issues particular only to design.

Per’s descriptions of data design are characterized by their simplicity. Simplicity in this case does not mean lacking nuance, sophistication, or insight but rather that he absents explanations of jargon and academic pretension. For example, on page 57 Per writes, “Categorical variables are known by their distinctive difference, by their lack of universal order, and by not being quantifiable. Gender is a categorical variable.” This is as simple, detailed, and clear an explanation as I can remember. However, at times such admirable simplicity provides less help when on one hand it links word to definition while lapsing into circular redundancy such as on page 56 “A variable is a factor that may vary.” Most dictionaries avoid using the root word to define the word and I think both simplicity and comprehension would have been served if the book had more carefully observed this convention.

The bulk of the book is devoted to well organized and amply illustrated examples of data design organized into three broad categories: visualizing quantities, visualizing locations, and visualizing connections. This makes it an easy reference for designers facing a particular kind of task. The clear, simple yet insightful quality of the entire book makes it well worth owning.

Mike Zender

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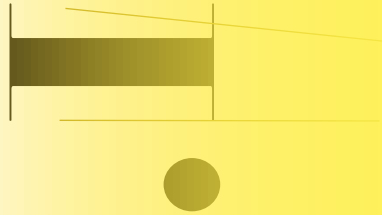
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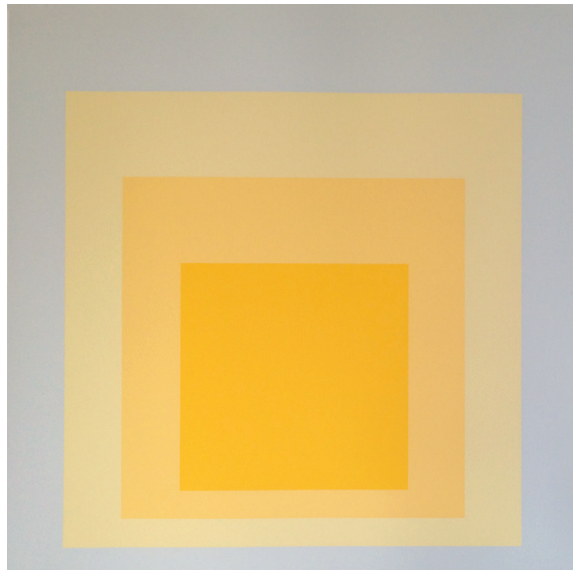
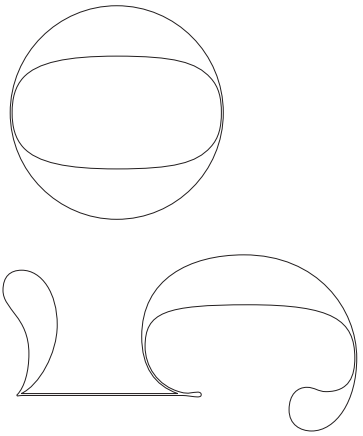
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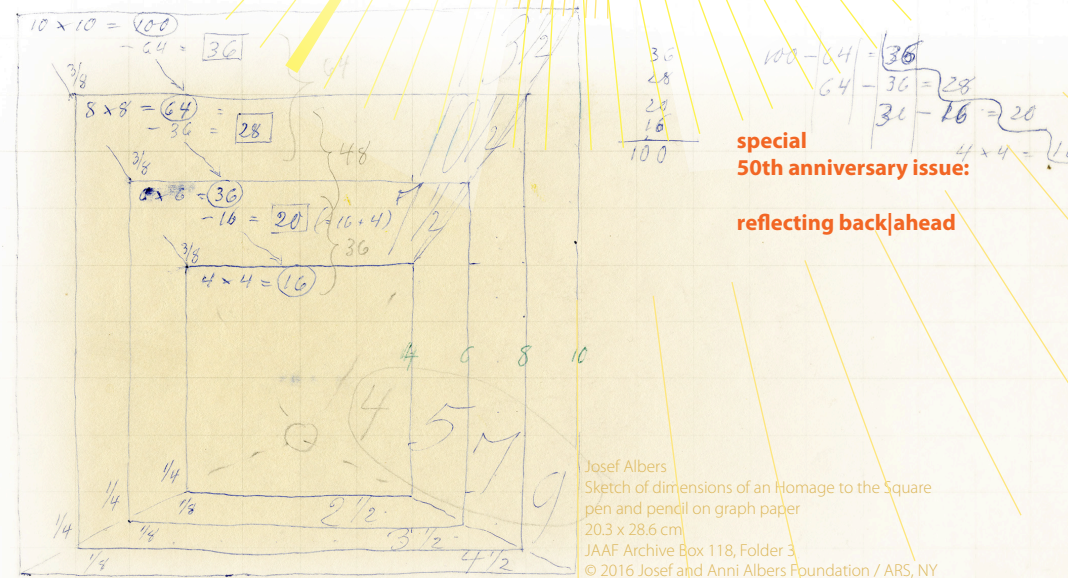
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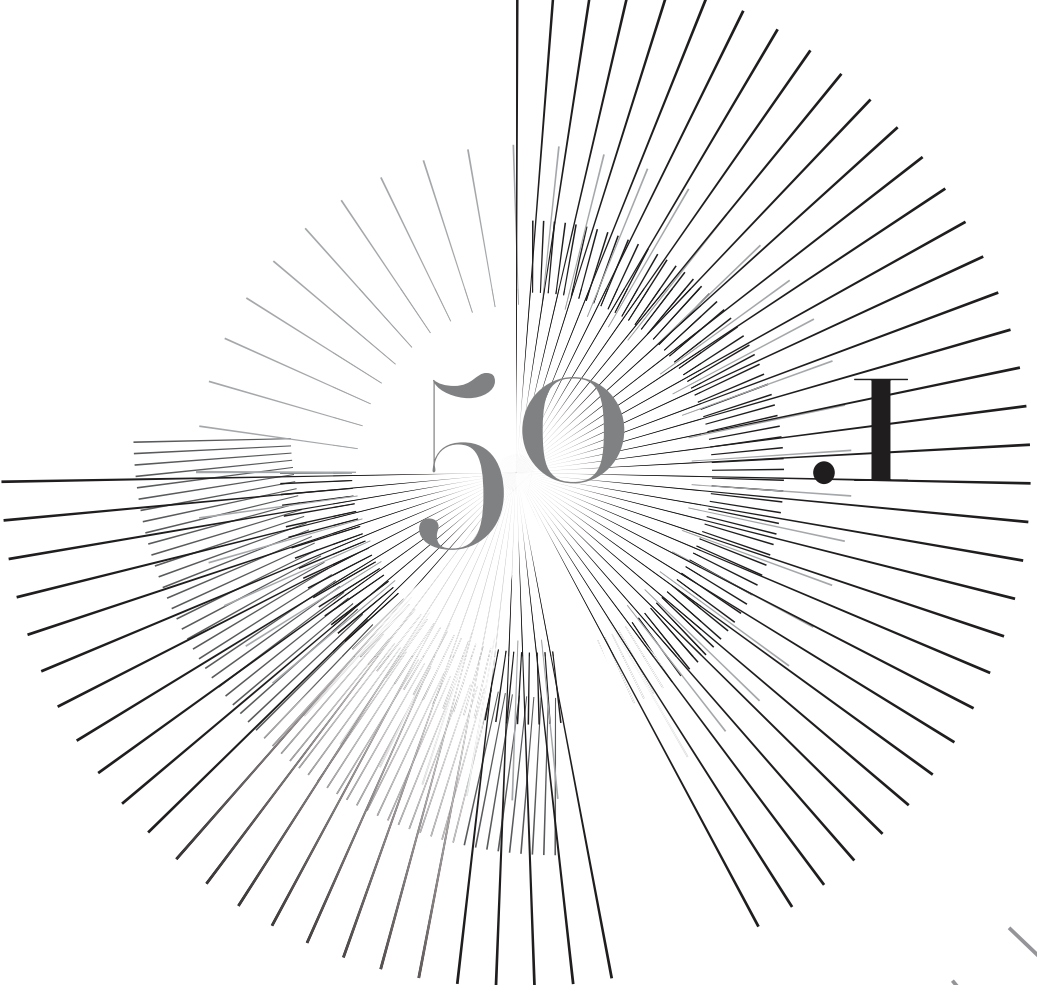


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Josef Albers
Sketch of dimensions of an Homage to the Square
pen and pencil on graph paper
20.3 x 28.6 cm
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BOOK REVIEW: Data Design by Per Mollerup

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A lot of design has happened in the 50 years since *Visible Language* was founded: typesetters – gone; desktop publishing – a passing blip; computers – moved from desktop to pocket. The term graphic design had hardly entered the dictionary before the discipline started to consider renaming itself visual communication design or just communication design. Because communication continues to grow in quantity and importance there's no reason to disbelieve in a promising future for a communication design discipline. What the promising design future looks like is, as always, sketchy. A well-known 20th century Danish proverb states that predictions are easy except when they involve the future and George Santayana famously warned of the trouble that awaits failure to examine the past. If we take Santayana's statement less as a warning than as a prescription to guide action, we might reflect thoughtfully on the past in order to plan our steps today to help shape a future the Danes say is so difficult to predict. Reflecting on the past may not make predictions easier, but it might make them more realistic.

To celebrate its 50th year *Visible Language* will revisit themes from the journal's past to help chart the design discipline's future. This issue features articles by Meredith Davis, Sharon Poggenpohl, and myself commenting on design's direction, design journals, and design research. As a special homage to the journal's roots in typographic research issue 50.2 will revisit typography and see what we have learned in the past 50 years and project where typographic study should be going next. Issue 50.3 will look at *Visible Language* in light of design history and theory with a similar aim: to reflect on the past to help guide and inspire the future: reflecting back – reflecting ahead. Reflecting in the sense of thinking deeply or carefully about something and at the same time suggesting the visual nature of much of human cognition and the essential visual nature of design. Reflection is a physical process wherein light or energy is thrown back from a surface. We learn about ourselves through reflection. We see things in a new light, from a new vantage point, and if the mirror is placed properly we can see not just where we've been but where we are going: around the corner we have not yet turned.

This year we are devoting part of the journal to not predicting the future but to shaping it. We can't wait to see what they'll say about our efforts in 2065!

Pictograms: Can they help patients recall medication safety instructions?

Louis Del Re , B.Sc
Dr. Régis Vaillancourt , Pharm D, B. Pharm,
Dr. Gilda Villarreal, PhD, MHA,
Dr. Annie Pouliot , PhD

A B S T R A C T

Objectives: The effectiveness of pictograms to enhance the recall of information through a review of the literature was evaluated. **Methodology:** A search was conducted using "Pictogram" AND "Recall" on PubMed, SCOPUS, and Web of Knowledge databases. Additional searches were conducted on the above-mentioned databases and on Google Scholar using various combinations of key words "pictorial", "picture", "aid", "memory" and "medication". The main inclusion criterion was recall measurement. **Results:** Nineteen articles were analyzed. Ten studies measured immediate/short-term recall; five compared immediate/short-term to long-term recall; and four measured only long-term recall. Eight measured cued recall of pictograms and eleven measured free recall. Three studies failed to support pictograms as means to enhance recall for all subjects regardless of demographic characteristics. Recall abilities of elderly participants were lower than young individuals. Literacy level, education level, prior knowledge, and cultural familiarity are factors that may influence pictogram recall. **Conclusion:** Pictograms enhance patients' recall of information. Professionals using pictograms in healthcare settings should consider 1) educating patients about pictograms; 2) providing patients with pictorial cues; 3) measuring free recall with "true" method; 4) assessing patient's reading, education level, and prior knowledge of pictograms; 5) using text and pictograms; 6) and having special considerations for the elderly.

Key Words:

Non-verbal Communication, Pictogram, Mental Recall, Visual Aids, Medication, Health Literacy, Health Communication, Review Literature

INTRODUCTION

Difficulties in comprehending medication information often lead to medication errors, misinterpretation of instructions and/or symptoms, and lesser self-care behavior (Bains & Egede, 2011; Wolf, Feinglass, Thompson, & Baker, 2010). Hence effective communication of medication information is key in assuring patients' understanding of their medication regimen and the safe and effective use of their medications. Effective communication of medication information is derived from factors stemming from both the patient and the healthcare provider. Patient factors such as knowledge, literacy, numeracy, cognitive skills, language barriers, beliefs on health, specific health conditions, and socio-economic factors (such as social connectedness, access to health care, age, education, immigration status and employment) influence health literacy and, consequently, communication with healthcare providers (Volandes & Paasche-Orlow, 2007). Factors external to the patient that influence health communication effectiveness are the provider's communication skills, complexity of health information, characteristics of the healthcare setting, system demands and expectations upon patients, as well as time pressures upon health care professionals that may limit the building of a relationship with the patient (Makoul, 2001).

Unfortunately, too many people do not have the necessary health literacy skills to make informed decisions about their health and do not adequately understand health information received from their healthcare provider (Canadian Council on Learning, 2008; Statistics, 2006). One solution identified to support health literacy is to reduce demands placed on individuals (US Department of Health and Human Services, 2008). Pictograms can be used to simplify the process; they are symbols and pictures often combined with simple text to support verbal and written information to help the transmission of health and medication information and support communication between healthcare providers and patients. It is assumed that humans have a cognitive preference for picture-based rather than text-based information (Peter S Houts, Doak, Doak, & Loscalzo, 2006b); however, research on the impact of using pictograms on comprehension and recall has yielded contradictory results. Indeed, some studies have reported no impact of using pictograms on improving health messages comprehension (Friedmann, 1988; Hardie, Gagnon, & Eckel, 1979; Sansgiry & Cady, 1995; Wogalter, Kalsher, & Racicot, 1992).

Recall is the process of retrieving individual words or picture elements from memory and is closely related to comprehension, which is the process of interpreting the meaning of words or pictures to understand their collective meaning (Peter S Houts, Doak, Doak, & Loscalzo, 2006a). Patients with complex medication regimes and with low health literacy levels may have difficulty recalling all verbal instruction from memory (Ley, 1982; Board on Population Health and Public Health Practice, 2013; The Institute

of Medicine, 2004). Research shows that patients can only recall 29% to 72% of information they receive, with recall rates decreasing as the quantity of information increases (Sadoski & Paivio, 2000). The aim of the literature review is threefold. First to provide an overview of the literature on the impact of using pictograms to enhance recall of written information. Second to structure the information in such way that research contributions can easily be found and compared to each other. Thirdly to identify challenges and elements that need to be explored in order to further refine knowledge into this area of research.

MEASURING PICTOGRAM RECALL

There is no consensus on the best methodology to measure recall of pictograms. However, the literature shows some common elements in the methodology, which includes presentation of information (either study or training phase) followed by a recall test which may take place the same day (immediate/short-term recall) or later (long-term recall). A recall test may consist of free recall or cued recall. Free recall is repeating information from complete memory, whereas cued recall is repeating information from paired-associate cues such as pictures or pictograms (Peter S Houts et al., 2006b). Both types of tests can be used to measure immediate/short-term or long-term recall. To measure immediate or short-term recall, a distraction phase should occur between the presentation phase and the testing phase. This is to ensure the recall test is measuring memory storage, rather than working memory. Working memory is the ability to store new information, to retrieve previously stored information, and to hold information with awareness (Lesch, 2003a) particularly by the elderly. The studies analyzed in this review measured recall effectiveness of pictograms in different populations, which include young adults and the elderly, high literate and low literate subjects, highly educated and poorly educated subjects, and actual patients.

COGNITIVE THEORIES

The use of pictograms to enhance recall is supported by various psychology theories including Paivio's Dual Coding Theory (the pictorial superiority effect) and Wickens' Redundant Theory. Allan Paivio proposed the Dual Coding Theory in 1971 and has performed many studies to support it (Paivio, Rogers, & Smythe, 2013a). The theory states that information is processed by two coding systems: 1) a verbal system and 2) a nonverbal system. Activation of one system can trigger activation in the other system. Dual Coding Theory also suggests that pictures trigger activation of both coding systems much better than words, resulting in improved recall of information (Sadoski & Paivio, 2000). Recalling information better from pictures than words is known as the "pictorial superiority effect" (Paivio, Rogers, & Smythe, 2013b);

this theory was expanded by Nelson in 1976 (Nelson, Reed, & Walling, 1976). Nelson's experiments suggested that the meaning representations for simple pictures and their labels may be identical, and that the pictorial superiority effect is related to the qualitative superiority of the sensory codes for pictures (Lesch, 2003b; Nelson et al., 1976) particularly by the elderly. The evidence of dual coding provided by Paivio suggests that pictograms with associated text could provide optimal processing and improve recall of medication information.

Similar to Paivio's theory is Christopher Wickens' theory which is based around redundancy. His theory states that words associated with pictures present information in two ways simultaneously, hence redundant communication. Depending on the situation or subject's cognitive preferences, the spatial information depicted by pictures is more effective than the semantic information depicted by words or vice versa. Having both forms of communication (text and pictures) allows an individual to extract information from the presentation method most beneficial for them. Wickens states that redundant communication (pictures and text) enhances recall over text or pictures alone (Wickens, Hollands, Banbury, & Parasuraman, 2015).

M E T H O D O L O G Y

A narrative review of the literature, informed by Baumeister and Leary, was conducted. This type of review is useful where the aggregation of data is difficult because of the diversity in the field of research (Baumeister & Leary, 1997). A search was performed between September and June 2014 in the databases PubMed (Medline), SCOPUS, and Web of Knowledge and used keywords "pictogram" and "recall" to begin the search process. Due to the small body of medical literature concerning pictograms in healthcare, further searches were conducted on the databases mentioned adding combinations of keywords: "pictorial", "pictures", "aid", "visual aid" or "symbol", "recall", "memory", "medication", "health literacy", and "training". Although these terms are conceptually different, they are often used interchangeably because of the lack of familiarity in the medical literature. We also searched reference lists of included studies and review manuscripts. The relevant literature was selected and presented in this review.

The main inclusion criterion was that the study measured recall of graphic information. Presentation of information via pictures, or a combination of pictures with verbal or written information, followed by a recall test, confirmed that recall was measured. All studies up until September 2014 were included; all relevant articles found were analyzed regardless of publication date. Only English studies were included. Negative findings were also included. The review will discuss studies on pictogram recall in terms of immediate, short-term, long-term, cued and free recall.

Each article included in this literature review was summarized into a broad table, which included three main sections: 1) the article title, year published, and authors' names, 2) study design and methodology, and 3) results. Population characteristics including the sample size (n) and age (range or mean) were collected. In addition, other important characteristics such as education level, reading level, and cultural background were collected if provided in the study. Second, common themes in the study design were identified. The study designs had different variations of the following phases: 1) a presentation phase, 2) a distractor phase (not all studies included a distractor phase) and 3) a recall phase or test. Third, the specifics of each phase were examined, and two key differences between the studies were identified: 1) the length between the presentation phase and recall phase and 2) the type of recall test – cued or free. These two key differences determined the organization of the results section and provided a foundation for the discussion points.

For this article, we considered pictograms as a combination of signs, icons and pictures to represent a story or data set. Where a sign is a visual representation without resembling, an icon represents a specific thing by resembling simply. Finally a picture visually represents a specific thing by resembling specifically (Zender & Cassedy, 2014).

R E S U L T S

The "pictogram" and "recall" search on PubMed found seven studies, SCOPUS found nineteen, and Web of Knowledge found twenty-nine. From the fifty-four studies found, only three studies were selected. The search of "visual aid" and recall on PubMed found 681 manuscripts. A literature review found in the initial search, plus two additional ones were used to provide background knowledge and references to other relevant studies (Dowse & Ehlers, 1998; Peter S Houts et al., 2006b; Katz, Kripalani, & Weiss, 2006). From the database searches and the studies found through literature reviews, a total of nineteen studies were selected and are presented in this review. It should be noted that not all studies could be accessed.

Ten studies presented measured only immediate/short-term recall, five studies analyzed measured immediate/short-term recall and compared it to long-term recall, and four studies measured long-term recall. Tables 2 to 4 summarize the methodology and findings of the studies included in this review. Due to the heterogeneity in the studies, the findings are presented in a narrative manner.

IMMEDIATE/SHORT-TERM RECALL

Cued Recall

From the immediate/short term studies analyzed, only two studies measured cued recall of pictograms (Carpenter & Olson, 2012a; P S Houts et al., 1998). Subjects who received verbal instructions and a pictogram were able to recall significantly more information when cued with the pictogram than subjects who were required to perform free recall from verbal instructions alone (P S Houts et al., 1998). When attempting to recall foreign words, providing pictures as cues did not improve recall compared to providing English translations as cues. However, warning the subjects presented with picture not to be overconfident resulted in pictures being superior to the English translations as cues for foreign words (Carpenter & Olson, 2012b).

Free Recall

In the majority of immediate/short-term studies, pictograms enhanced subjects recall of information from complete memory. Moreover, free recall was enhanced for subjects when presented with a pictorial aid during the presentation phase compared to subjects who did not receive a pictorial aid (Carpenter & Olson, 2012b; Cherry, Dokey, Reese, & Brigman, 2003a; Kakkilaya et al., 2011; Mayer & Gallini, 1989a; Morrell, Park, & Poon, 1990; Sojourner & Wogalter, 1998; Stewart & Stewart, 2001). However, the benefit of pictures in recalling information is not consistent in all age groups, as pictures with text reduced older subjects' recall abilities (Morrell et al., 1990). In one study, when subjects were presented with pictures and text, subjects freely recalled more information pertaining to the pictures than information within the text (Patel & Others, 1989a). Only one study had negative results in all subjects for using pictorial aids to enhance recall, as no significant difference was found in recall rates between subjects presented with text, text with symbols, or symbols only (King, 2012).

SHORT-TERM RECALL COMPARED TO LONG-TERM RECALL

Cued Recall

Two studies measured immediate or short-term cued recall and compared it to long-term cued recall. Subjects were able to recall a significant amount of information immediately, retain the information over a long period of time, and recall the majority of the information again (P S Houts, Witmer, Egeth, Loscalzo, & Zabora, 2001; Lesch, 2003a). Four weeks after the training phase, subjects were able to recall more information from simple pictograms

Study	Population characteristics		Method/Intervention	Recall test	Recall rate (% or score correct answer)
	N	Other			
Carpenter et al, 2012	254	Undergraduate students	<p>- Subjects in one of four condition groups Group 1: Swahili + picture (cued Swahili word)</p> <p>Group 2: Swahili + picture (free English word)</p> <p>Group 3: Swahili + English word (cued Swahili word)</p> <p>Group 4: Swahili + English (free English word)</p> <p>Presentation Phase: Subjects taught new Swahili word by seeing it paired with its English translation or a picture. Each item presented on computer screen for 6 seconds with one-second interval between. Order was randomized, full list presented twice</p> <p>Recall Phase: subjects were to recall Swahili word from picture or English translation (cued recall- unlimited time), or subjects were to recall English word from memory (free recall- 5 min) by typing answer on computer screen- type of recall test was dependent on condition assigned to subject.</p> <p>Fictional information used to create medication leaflet. Three different formats of the leaflet were made: (1) text only (2) text with symbols, and (3) symbols only.</p> <p>Subjects were given 1 minute to study the leaflet that was randomly assigned to them.</p> <p>Recall test: Subjects completed an 8 item administered questionnaire based on the eight instructions contained in the leaflet</p>	Free and cued recall	<p>Cued Recall of Swahili Word (groups 1 & 3): - No statistical significance</p> <p>Free Recall of English Word (groups 2 & 4): - Group 2: ~ 51% recall - Group 4: ~ 41% recall</p> <p>* Results show no benefit of pictures for cued recall of foreign words from pictures</p> <p>*Positive results- Increased free recall of English word from picture</p>
King et al, 2012	161	Reading Level: 6 th grade or <	<p>Fictional information used to create medication leaflet. Three different formats of the leaflet were made: (1) text only (2) text with symbols, and (3) symbols only.</p> <p>Subjects were given 1 minute to study the leaflet that was randomly assigned to them.</p> <p>Recall test: Subjects completed an 8 item administered questionnaire based on the eight instructions contained in the leaflet</p>	Free recall	<p>(1) text only = 6.54</p> <p>(2) text with symbols = 6.65</p> <p>(3) symbols only = 6.36</p> <p>* Results do not support the use of pictograms</p>
Cherry et al, 2003	96	Young and older adults	<p>Presentation Phase: Subjects were presented with information in one of three different formats: (1) sentence only, (2) sentence with matching pictures, and (3) incomplete sentences with matching pictures.</p> <p>Distractor Phase: 2 minute subtraction test</p> <p>Recall Test: Subjects instructed to answer questions based on symbols and associated text presented. Two types of scoring were used: 1) Strict score and 2) Lenient score.</p> <p>Demographic Questionnaire: given to subjects.</p>	Free recall	<p>* Results support use of pictograms</p> <p>*Young adults recall more information, elaborate sentences were recalled more for lenient scoring in older adults:</p>
Stewart et al, 2001	39	University students	<p>-Subjects were put into 13 groups of 3 -Each subject received package containing 15 shared words, 15 shared pictures, 5 unshared words and 5 unshared pictures.</p> <p>Study Phase 1: Subjects were instructed to study each word or picture for 5 seconds.</p> <p>Recall Test: Subjects given 10 minutes to write down any recalled information with their three-person group.</p> <p>This was repeated twice.</p>	Free recall	<p>Shared words: Recall Test 1: 7.77/15 Recall Test 2: 13/15</p> <p>Shared pictures: Recall Test 1: 11.15/15 Recall Test 2: 13.92/15</p> <p>Unshared words: Recall Test 1: 1.54/15 Recall Test 2: 7.31/15</p> <p>Unshared pictures: Recall Test 1: 5.54/15 Recall Test 2: 10.77/15</p> <p>* Positive - Shared information was recalled more than unshared information, but unshared pictures were recalled more than unshared words.</p> <p>*Subjects indicated pictures were more easily recalled in the questionnaire</p>
Houts et al, 1998	21	Reading Level = grade 8.7	<p>Presentation/Training Phase: Subjects verbally presented with two sets of instructions on cancer symptom management: Sore mouth 50 instructions; fever 38 instructions. -Pictograms were presented with one set of instructions (cross-over design)</p> <p>Patients were distracted with an 8 min music video and then asked to verbally communicate information recalled. -Six differently formatted fictitious drug information sheets were created for the same medication instructions. -Sheet contained eight instructions about directions and warnings -Subjects were given medication bottle and 1 of 6 associated drug information sheets (information sheet randomly assigned)</p> <p>Study phase: Subjects given 60 seconds to study sheet and medication bottle</p> <p>Distractor phase: Demographic questionnaire</p> <p>Recall Phase: Subjects wrote down all information relevant to their medication</p>	Cued and free recall	<p>Verbal instructions with pictograms = 84%</p> <p>Verbal instructions alone: 14.2%</p> <p>* Positive- all subjects had higher recall with pictograms</p>
Sojourner et al, 1998	216	Undergrads, Adults, Elders	<p>-Six differently formatted fictitious drug information sheets were created for the same medication instructions. -Sheet contained eight instructions about directions and warnings -Subjects were given medication bottle and 1 of 6 associated drug information sheets (information sheet randomly assigned)</p> <p>Study phase: Subjects given 60 seconds to study sheet and medication bottle</p> <p>Distractor phase: Demographic questionnaire</p> <p>Recall Phase: Subjects wrote down all information relevant to their medication</p>	Free recall	<p>Text alone Mean recall = 9.1</p> <p>Text + pictorials: Mean recall = 7.9</p> <p>Incomplete pictorials 1: Mean recall = 7</p> <p>Incomplete pictorials 2: Mean recall = 7.8</p> <p>Pictorials alone: Mean recall = 4.0</p> <p>No instructions Mean recall = 0</p> <p>*Undergraduates had statistically significant higher scores on recall than adults and elderly (ANOVA). *Text and pictorials scored the highest (ANOVA).</p>

TABLE 1. Immediate/short Term Recall Studies¹

Table 1. Immediate/short Term Recall Studies¹

Study	Population characteristics		Method/Intervention	Recall test	Recall rate (% or score correct answer)
	N	Other			
Mayer et al, 1990	96	College students	-Subjects completed questionnaire to determine prior knowledge on breaking systems and to classify them into two groups: low prior knowledge and high prior knowledge learners. <u>Study Phase:</u> Subjects randomly assigned to 1 of 4 booklets and given 8 minutes to read. Contained 750 words and 95 idea units on how 4 different breaking systems operate. <u>Distractor phase:</u> None <u>Recall Phase:</u> 3 different recall tests: - <u>Free Recall:</u> 10 min to write down everything they remembered - <u>Problem Solving Recall:</u> 12.5 minutes to answer 5 questions - <u>Verbatim Retention:</u> 3 min to identify exact phrase used in the booklet from a pair of phrases	Free recall	No illustrations: Free recall: 15% Verbatim recall: 24% Diagram with text: Free recall: 17% Verbatim recall: 26% Steps illustrations: Free recall: 21% Verbatim recall: 26% Diagram + steps illustrations: Free recall: 35% Verbatim recall: 43% *In the group of higher prior knowledge learners, no benefit of pictograms was found
Morrell et al, 1990	64	18-22 y.o. (young group) 59-89 y.o. (old group)	-Ten medicine bottles with hypothetical information on label were presented to subject by the investigator ("physician") Subjects received verbal instructions about eight of the ten medicine bottles (random ordering for each subject) in one of two formats: (1) verbal instructions or (2) verbal and pictures. <u>Study Phase:</u> Subjects were given unlimited time to study label and add to perform a subtraction exercise (distraction) before being asked to recall information about the medicine.	Free recall	Verbal instructions: Old group= 45% Young group = 70% Verbal and pictures: Old group= 37% Young group= 86% *Positive results for young subjects, negative results for older subjects
Patel et al, 1990	40	Mothers living in Kenya	<u>Presentation Phase:</u> subjects were presented with instructions on preparing medication for diarrheal dehydration either using (1) 5 pictograms with a brief text, plus original ORT (oral rehydration text) or (2) 5 pictures and brief text as previous group plus revised ORT. Subjects were then instructed to read the instructions aloud and immediately after they were verbally asked to recall any information they could remember.	Free recall	All recalled information was from the pictures and not the text. Mothers recalled procedures for the preparation as in the pictures, but not those presented in the written instructions (original text being more difficult than revised text).
Kakkilaya 2011	89	28 weeks pregnant low income	<u>Randomized study:</u> Prenatal counselling, fetus viability at 23 weeks: counselling with/without visual aids. <u>Distractor phase:</u> none Surveyed for survival chances, disabilities, short/long term problems, resuscitation	Free recall	Before/after survival rate difference 1.6±2 (no visual aid) 2.74 ±2.74 (visual aid) p 0.04 NICU longer stay 85 vs 100 (p 0.03) Disabilities recall 2.3 ±1.5 vs 3.2 ±1.1, p 0.005

¹ For the purposes of this review, long term is defined as more than one day
² USP = Standard pharmaceutical pictograms developed by the United States Pharmacopeia

TABLE 1. CONT.

compared to complex pictograms (P S Houts et al., 2001). Explanations of symbols with verbal labels played a key role in enhancing recall. Eight weeks after explanation of symbols with a text label, subjects were able to retain and recall a significant amount of information (King, 2012). Using pictogram elements to create a storyboard concept as a visual cue to aid verbal communication, also showed significant retention and recall of information after three days (Sorfleet, Vaillancourt, Groves, & Dawson, 2009).

Study	Population characteristics		Method/Intervention	Recall test	Recall rate (% or score correct answer)
	N	Other			
Houts et al, 2001	50	Reading level: < 5 th grade	-193 pictograms representing actions listed for six problems: fever, sore mouth, nausea, depression, fatigue and how to control spread of HIV/AIDS. - The 193 pictograms included a total 236 actions. - Pictograms ranked by panel of six judges into 1) Simple, 2) Intermediate and Complex categories. 40 ranked as simple, 32 ranked as intermediate and complex and 121 complexity was not agreed upon. Subjects were unaware of the pictogram complexity rankings. <u>Training Phase:</u> Subjects individually taught meaning of 29 standardized parts ("conventions") that would remain consistent in all pictograms. Then the instructor explained meaning of pictograms to each subject. After each problem section, immediate recall was tested. <u>Immediate Recall Test:</u> Each subject asked to verbally describe meaning of each convention and all actions in pictograms. <u>Long Term Recall:</u> 4 weeks later, same recall test was conducted. Pictograms appeared in same order initially taught. Probing questions may have been used by the instructor.	Cued	<u>Immediate recall mean</u> =85% <u>Long term 4 week recall mean</u> = 71% <u>Simple Pictogram mean recall</u> = 87% at 4 weeks <u>Complex Pictogram mean recall</u> = 71% at 4 weeks. -Positive results, people with low literacy are able to retain a significant amount of information over time from pictograms. -Simple equals better recall
Thompson et al, 2010	100	Literacy Can read English Education < High school no prior knowledge on testing info	Six single page pamphlets containing information on methotrexate was created. -3 pamphlets were pictorial and text base and 3 were prose-based. <u>Study Phase:</u> 1 of 6 pamphlets was randomly selected and given to the subjects. Subject was instructed by interviewer to study the pamphlet for 5 min. <u>Distractor Phase:</u> None <u>Recall Test (immediate):</u> two different types of recall tests conducted: 1) subjects verbally recall as much information as they could remember and 2) answer 20 multiple-choice questions. <u>Recall test (Long-term):</u> Same two tests conducted 7 days later.	Free	Pictorial and text: Immediate recall 1 = 20.45% 7 days recall 1 = 11.65% Immediate recall 2 = 48.15% 7 days recall 2 = 45.55% Text only: Immediate recall 1 = 20.45% 7 days recall 1 = 11.35% Immediate recall 2 = 49.6% 7 days recall 2 = 44.45% *No statistically significant results in recall (in both tests) immediately and at 7 day follow up *Negative results- No benefit of pictorial/text based info over prose based.
Lesch et al, 2003	92	Education 52% high school 38% college 10% grad degrees	-31 warning symbols were tested and trained -10 warning symbols were tested without training - All symbols contained 1 of 3 associated texts (refer to condition method). -Participants were assigned to one of the three conditions <u>Pre-test:</u> Warning symbols shown on computer screen twice: once with correct text and once with incorrect text. Subjects were to indicate "yes" if the correct text was shown or "no" if incorrect text was shown by pressing a labeled key. <u>Training Phase:</u> subjects were shown symbol with its correct associated text label on computer screen. Subjects were to indicate by pressing the "3" key when they were done reading the text to move onto the next symbol. <u>Distractor Phase:</u> Demographic Questionnaire completed by subjects <u>Immediate Recall Test:</u> Subjects were to match symbols with associated text on computer screen. <u>Medium-Term Recall Test:</u> One week later, same test as pre-test <u>Long-Term Recall test:</u> 6-8 weeks later, same test as pre-test. Storyboard developed to depict medication information using pictograms tested during medical mission to Gabon, Africa. <u>Training Phase:</u> Medication dispensed to subject and researcher using standard script and storyboard to explain how to take medication <u>Immediate Recall Test:</u> At 1 st Interview subjects comprehension was tested - explain through oral retelling and answer questions related to storyboard and medication information. <u>Long-Term Recall Test:</u> Same comprehension test given 3 days later.	Cued	Recall Improvement - Old Adults - Pre-test = 37% - Immediate Recall = 68% - Medium-Term Recall = 65% - Long Term Recall= 58% Recall Improvements - young adults - Pre-test= 52% - Immediate Recall= 88% - Medium Term Recall= 83% - Long Term recall= 74% * All Three conditions had similar results *Positive results, supports three theories *Recall of info is maintained over long periods of time
Sorfleet et al, 2009	525	9-61 years old	<u>Training Phase:</u> Medication dispensed to subject and researcher using standard script and storyboard to explain how to take medication <u>Immediate Recall Test:</u> At 1 st Interview subjects comprehension was tested - explain through oral retelling and answer questions related to storyboard and medication information. <u>Long-Term Recall Test:</u> Same comprehension test given 3 days later.	Cued	Initial interview = 81.5% recall Follow-up = 80.9% recall
Zeng-Treitler et al 2008	13	Not healthcare professionals		Free	

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² USP = Standard pharmaceutical pictograms developed by the United States Pharmacopeia

TABLE 2.
Immediate Short and Long
Term Recall Studies¹

Free Recall

Two studies measured free recall immediately and compared it to long-term recall. In one study, the pictorial enhanced pamphlet did not provide recall benefits over the text-based pamphlet immediately or seven days after the study phase (Thompson, Goldszmidt, Schwartz, & Bashook, 2010a). In a well-designed pilot study with 13 volunteers, Zeng-Treitler found a statistically significant difference in recalled information of medical discharge instructions when the text was accompanied by pictograms (Zeng-Treitler, Kim, & Hunter, 2008).

LONG-TERM RECALL

Cued Recall

Subjects who received pictogram-enhanced medication labels outlining targeted information were able to recall significantly more information when presented with the pictogram than subjects who had to freely recall verbal and text information four to eight weeks after presentation phase (Wilby et al., 2011a). Cued recall was enhanced in people with less and higher level of schooling (Paulus, Vaillancourt, & Villarreal, 2015) as well as with people of low literacy level (Dowse & Ehlers, 2001) over a two to three week period.

TABLE 3. Long Term Recall Studies¹

Study	Population characteristics		Method/Intervention	Recall test	Recall rate (% or score correct answer)
	N	Other			
Wilby et al, 2011	72	HIV Positive Patients Initiating or changing ARV medications *ARV= Antiretroviral Therapy	Randomized control study <u>Training Phase:</u> 5 pharmacists provided verbal counseling on AVR medication. Treatment group also received a pictogram-enhanced label on their medication. <u>Recall Test:</u> Conducted at next follow up appointment. Patients were to verbally recall targeted information about their medication.	Cued & Free at 4-8 weeks	2 % of targeted information correctly recalled (control) 88% of targeted information correctly recalled (intervention)
Dowse et al, 2000	46	South African (Xhosa ethnic group) <u>Literacy</u> 57% poor reading & comprehension level. <u>Education</u> No schooling (19.6%) 1-4 years (26.1%) 5-7 years (55.3%)	-46 pictograms used (23 locally modified pictograms and 23 USP ² pictograms) -subjects were educated on pictograms' purpose and application -demographic data collected, literacy level assessed <u>First Interview:</u> subjects shown each pictogram, one at a time, in random order, then asked to explain their interpretation of each pictogram. <u>Training Phase:</u> Pictogram meanings explained. ANSI criterion of ≥85%, before and after training (follow-up)	Cued Recall at 3 weeks	<u>Local pictograms:</u> Initial = 30% Follow-up = 87% <u>USP pictograms:</u> Initial = 8.7% Follow-up = 48%
Delph et al, 1996	205	English speaking	<u>Study Phase:</u> Patients in the Emergency Department received instructions pertaining to wound care in one of two formats (text + cartoons or text only) before they were released to outpatient care. <u>Recall test:</u> Patients were contacted by telephone and asked to answer four questions pertaining to wound care.	Free recall at 3 days	Intervention = 46% Text only = 6% <high school education: average 0% correct answers recalled
Moll et al, 1977	50	Gout patients	<u>Study Phase:</u> Subjects given booklet containing information on gout in one of two formats. Cartoon and text format contained 89 cartoons. <u>Recall test:</u> A questionnaire was answered at the next follow up-appointment	Free recall	Booklet with text and cartoons = 65.5 % Text only = 67% No difference between the groups.

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² USP = Standard pharmaceutical pictograms developed by the United States Pharmacopeia

Free Recall

Two studies used free recall to measure the effects of pictograms use to enhance long-term memory. Three days after presentation phase, subjects were able to freely recall instructions from text with cartoons much more effectively than from text alone (Delp & Jones, 1996a). However in a similar study, there were no benefits for subjects who received dually coded information (text and cartoons) over patients who received text only (Moll, Wright, Jeffrey, Goode, & Humberstone, 1977a).

DISCUSSION

CUED RECALL VERSUS FREE RECALL

Before discussing cued and free recall, it should be noted that free recall can be measured from both text and non-text information, whereas cued recall always requires a pictorial aid (with exception to Carpenter's study when recalling foreign words). Providing pictorial cues to recall information has shown to produce optimal rates of recall (Carpenter & Olson, 2012b; P S Houts et al., 1998, 2001; Lesch, 2003a; Sorfleet et al., 2009; Wilby et al., 2011b). The discrepancy between subjects' recall scores was the greatest when comparing cued recall from pictures to free recall of text or verbal instructions. All studies that provided the same pictorial cue in the recall test that was provided in the presentation phase showed beneficial results. Even when subjects were asked to perform free recall, subjects that received a pictorial aid in the presentation phase showed higher rates of recall in the testing phase than subjects who were freely recalling information from text or verbal instructions alone (Beiser & Stewart, 2005; Carpenter & Olson, 2012b; Cherry, Dokey, Reese, & Brigman, 2003b; Delp & Jones, 1996b; Mayer & Gallini, 1989b; Morrell et al., 1990; Patel & Others, 1989b; Sojourner & Wogalter, 1998). However, not all studies that measured free recall of pictograms or pictures showed beneficial results (King, 2012; Moll, Wright, Jeffrey, Goode, & Humberstone, 1977b; Thompson, Goldszmidt, Schwartz, & Bashook, 2010b).

Although studies support the use of pictograms by health-care professionals to increase patients' recall of information, three studies did not verify this conclusion regardless of their demographic characteristics (King, 2012; Moll, 1986; Thompson et al., 2010b). A common factor between all three of these studies is the design of the presentation phase. Subjects were required to study the information by themselves instead of having an instructor educate them. Misinterpretation or an unclear understanding of pictograms during the study phase may reduce the subject's ability to recall information. A training phase ensures that subjects understand the content before recall is tested.

King's et al study analyzed in the immediate/short-term recall section produced negative results for pictures with text presentation format. All formats (text alone, text with symbols and symbols alone) produced similar rates of recall (King, 2012). There are three factors that may explain the results of pictograms not enhancing recall of information. First, free recall was not measured in its "traditional" or "true" way; a multiple-choice questionnaire was given to subjects rather than having subjects recite information to measure their free recall abilities. Second, over simplicity of language in text may have been easily understood by subjects, despite their low reading level of 6th grade or less. If language was more complex, there may have been a greater discrepancy of recall scores between presentation formats. Last, subjects may have been drawing on information from working memory rather than memory storage as there was no distraction phase. Immediate or short-term recall study designs should include a distraction phase after the presentation phase to ensure information has been stored in memory (King, 2012). Similarly, Moll's et al study found non-significant differences in recall rates between text only to cartoons with text pamphlets (Moll et al., 1977b). Two factors that may account for these findings include free recall being measured with a questionnaire, as well as the previous knowledge of the subjects. When completing the recall test, subjects may have been drawing on their previous knowledge to answer questions rather than recalling the information depicted in the pamphlets.

The discrepancy in results may be due to several additional factors. Age, literacy level, education level, prior validation of the pictogram used, prior knowledge and cultural preferences may all influence the understanding and recall of information.

A G E

Age has an influence on overall recall abilities as well as the effectiveness of pictograms for improving recall. In the studies comparing young and old age groups, mixed results were observed. All studies produced positive results supporting the use of pictograms to aid in recall for the young age group (Cherry et al., 2003b; Lesch, 2003a; Morrell et al., 1990; Sojourner & Wogalter, 1998). However, results were inconsistent for the elder population. In regards to elderly subjects, three studies suggested pictograms enhanced recall of medication instructions (Cherry et al., 2003b; Lesch, 2003a; Sojourner & Wogalter, 1998) while one suggested pictograms did not enhance recall in the elderly (Morrell et al., 1990). In the three studies that demonstrated pictorial advantage, a maximum of two sources (pictures and text) of information was presented to the subjects, unlike the study that failed to demonstrate pictorial advantage, where subjects could receive up to three sources (pictures, text, and verbal explanation) of information. This negative result may be explained by the increase cognitive processing required to decode information from text, verbal instructions and pictures simultaneously

(Morrell et al., 1990). However, the reason behind the negative result needs to be discerned. Studies show that older people have greater difficulty linking the elements of pictograms to the meaning they are trying to portray (Albert, Wolfe, & Lafleche, 1990; Moore, 2003). Therefore, we can speculate that an unclear understanding of the information presented in pictograms may explain why recalling information from pictograms may be more difficult for older people than younger people.

LITERACY LEVEL, EDUCATION LEVEL, PRIOR VALIDATION OF PICTOGRAM USED, PRIOR KNOWLEDGE AND CULTURAL PREFERENCES

Pictograms significantly increase the recall of information in the low literate and poorly educated populations (P S Houts et al., 1998, 2001; Patel & Others, 1989b; Thompson et al., 2010b). Subjects of higher literacy and education levels may be able to understand and process text more efficiently than subjects who have difficulty reading. This may explain the reason why subjects of lower education and reading level benefit from pictograms more than subjects of higher education and reading level. This benefit is clearly depicted in one study that compared subjects with less than high school education to subjects with high school education or beyond. The discrepancy in recall between text-based and text with pictures was greater for subjects of lower education than subjects of higher education. Lower educated subjects recalled no information from text-based instructions (Delp & Jones, 1996b). Low-prior knowledge subjects will benefit from picture with text much more than high-prior knowledge subjects (Mayer & Gallini, 1989b). Healthcare professionals often communicate to low-prior knowledge patients, which require patients to process new information. However, two studies involving subjects of low reading or education levels do not support the use of pictograms in healthcare (King, 2012; Thompson et al., 2010b). Possible reasons for these negative findings have been partly explained above. Pictogram comprehension was not assessed in these two studies. Furthermore, only three studies mentioned the use of validated pictograms prior to testing recall (Dowse & Ehlers, 2001; P S Houts et al., 2001; Sorfleet et al., 2009). According to Montagne, studies on the impact of pictogram have produced mixed results so far because many of these studies have incorporated pictograms that were never tested for comprehension. It is important to assess comprehension prior to recall as recall of information and comprehension are interrelated. One of the few studies that ensured comprehension before assessing long term recall is by Paulus et al who found that even after comprehension was ascertained, schooling level and country of origin influenced pictogram recall (Paulus et al., 2015).

Education or training on the meaning of pictograms has shown to enhance the recall of information, especially for subjects with low

education and literacy levels (Dowse & Ehlers, 2001; Paulus et al., 2015). Prior to training, the interpretation of pictograms was fairly low in these populations. After educating subjects on the meaning of the pictograms, they were able to retain the information over a two to three week period. Both of these studies demonstrated how important patient education and training is to enhance the recall of health or medication related instructions. Both studies also displayed the cultural preferences that need to be considered. In Dowse's study, subjects were able to recall information from locally modified pictograms more often than the information depicted by the standard United States Pharmacopeia pictograms (Dowse & Ehlers, 2001). Sorfleet's study also reinforced the importance of education and cultural sensitivity. Using a culturally sensitive storyboard concept to aid in verbal communication allowed subjects to understand, retain, and then recall the information three days later (Sorfleet et al., 2009).

DUAL CODING, PICTORIAL SUPERIORITY EFFECT AND REDUNDANT THEORIES

The analysis of all studies in this review suggests that pictures alone are not always ideal for communicating information. The results of studies presented herein were inconsistent in their support for the pictorial superiority effect. When comparing recall using pictures alone to other presentation methods, pictures alone scored lower than text or pictures with text. This suggests pictures alone are not sufficient for subjects to retain information (Sojourner & Wogalter, 1998). However, in some instances pictures alone were recalled more often than text alone (Carpenter & Olson, 2012b; Stewart & Stewart, n.d.). In a study conducted by Patel et al, it was observed that subjects recalled information depicted in the pictures rather than the information provided in the text (Patel & Others, 1989b). From the mixed results observed using pictures alone, it can be concluded that the pictorial superiority effect is not present in all situations. However, the pictorial superiority effect demonstrated dominance when pictures were used in conjunction with verbal communication (P S Houts et al., 1998, 2001; Morrell et al., 1990; Sorfleet et al., 2009; Wilby et al., 2011b).

Pictures with text enhance recall rates most effectively, supporting Paivio's Dual Coding Theory and Wickens' Redundant Theory (Cherry et al., 2003b; Lesch, 2003a; Mayer & Gallini, 1989b; Morrell et al., 1990; Sojourner & Wogalter, 1998) particularly by the elderly. Having information presented in two different forms exposes the subject to the same information twice and allows them to extract the information from the format most preferable and beneficial for them. Although the Dual Coding Theory suggests pictures activate both verbal and nonverbal cognitive systems better than text, combining both formats shows optimal activation of both cognitive systems.

After analyzing the factors that influence recall and evaluating the cognitive theories in the context of pictogram recall, it can be concluded that the most effective means of communication to enhance understanding and recall is using pictures with associated text and verbal instructions. With the advent of newer technologies, including videos accessible through the web and other computer technologies, more options have been explored with good results. One of these is called Project Red, a computer-aided visual and verbal aid to medical information recall (in this case, hospital discharge information). This innovation relies heavily on computer-generated visuals and also incorporates interactive behaviour with a computer-generated avatar who issues information orally and who then tests the patients on their comprehension and recall of the information. This program also showed a lower rate of returning to the hospital within 30 days of discharge for patients taking part in the program (Berkowitz et al., 2013). This relates directly to our first conclusion below, that is, "Training is key".

CONCLUSION FOR PRACTICE:

Based on the results and analysis of the studies in this literature review, six considerations have been proposed to all healthcare professionals when communicating to their patients via pictograms or any pictorial aid.

1. TRAINING IS KEY.

Ensuring patients understand the meaning of pictograms will enhance their recall abilities. Understanding is essential to recall. Although comprehension is rarely assessed when training with pictograms, healthcare professionals should ensure patients understand the medication instructions. Training of pictograms has shown to be superior over self-study in terms of recalling information. All healthcare professionals should provide verbal instructions when using pictograms with or without text to effectively increase recall rates. Do not overestimate the strengths of using pictures; patients need to understand the pictures to recall the information depicted by them.

2. PROVIDE PATIENTS WITH PICTORIAL CUES WHENEVER POSSIBLE.

Cued recall is superior to free recall. If healthcare professionals can provide "take home" pictograms for patients, the likelihood of them recalling the information away from the healthcare setting is greater. Pictorial aids may be useful in any healthcare provider-patient communication situation. For example, pharmacists could provide patients with pictograms for prescription medication instructions.

3. MEASURE FREE RECALL WITH "TRUE" METHOD.

When assessing the effectiveness of pictograms, measure free recalls using the "true" method. That is, have patients recite information depicted in pictograms from complete memory rather than providing them with questionnaires or multiple-choice tests to answer.

4. TRY TO ASSESS PATIENT'S READING LEVEL, EDUCATION LEVEL AND PRIOR KNOWLEDGE BEFORE USING PICTOGRAMS.

Healthcare professionals should attempt to evaluate their patient's background, and support their medical instructions with pictograms when necessary. Healthcare professionals should never assume high literacy, education or prior knowledge. Patients with low literacy, poor education or low prior knowledge have the potential to benefit the most from pictograms. Perhaps the most effective way to increase understanding and recall in these populations is to educate patients with pictograms and only with their particular medication regimen.

5. DO NOT REPLACE TEXT WITH PICTURES, USE THEM TOGETHER.

Pictures with text provide optimal recall rates. Healthcare professionals should combine both formats to allow patients to extract information from the format most suitable for them.

6. HAVE SPECIAL CONSIDERATIONS FOR THE ELDERLY.

Regardless of the presentation format, elderly patients are not able to retain and recall as much information as younger patients. Healthcare professionals should be aware of this when communicating with older patients, especially when using pictograms. Due to the increased cognitive effort required to decode a pictogram, healthcare professionals should spend extra time ensuring older patients understand the information depicted in the pictograms.

FUTURE RESEARCH

After analyzing the literature in this review, the following suggestions are made for future research on pictogram recall:

1. COMPARE GROUPS OF DIFFERENT LITERACY LEVELS.

In some studies, the entire sample consisted of low literate subjects but was not compared to a group of higher literacy. Future researchers should recruit participants, assess their reading level and segregate them into comparison groups. This will allow researchers to observe the discrepancy of pictogram recall between different literacy groups.

2. FOCUS ON CHILDREN.

No studies analyzed in this review assessed pictogram recall in children. Young children are in a critical cognitive development stage with low literacy levels. Assessing pictogram effectiveness of recall on children should be an area of focus. Despite the presence of parents, it is still important for children to be informed and remember information related to their health and clinical symptoms.

3. PROVIDE SPECIAL TRAINING PROGRAMS FOR THE ELDERLY

As observed in studies by Morrell et al, Sojourner et al, Cherry et al, and Lesch et al; elderly subjects have reduced recall abilities. In Morrell's study, pictograms have reversed the pictorial superiority effect all together in the elder population. Research should focus on specific interventions or training of pictograms for the elderly, so they may benefit as much as the younger population.

4. STUDY DESIGNS SHOULD INCLUDE MORE INFORMATION AND MEASURE RECALL OVER LONGER PERIODS OF TIME

Medication regimes can be extremely complex. Most studies analyzed in this review required subjects to recall a low quantity of information compared to quantity of information required in some medication routines. Future research should focus on communicating larger quantities of information as well as measuring subjects recall abilities over longer periods of time.

5. ASSESS COMPREHENSION WHEN STUDYING RECALL.

As recall and comprehension are closely related, it is essential to assess comprehension when measuring recall.

CONCLUSION

Most manuscripts described in this review support the dual coding (text and pictograms), pictorial superiority effect, and redundant theories with respect to pictogram recall. We suggest healthcare professionals should consider using pictograms with text in their daily routines when communicating information to patients. Additionally, when providing the pictograms and text, an instructor should explain the significance of the pictograms and ensure comprehension by asking questions. In order to maximize the potential recall benefits of pictograms, healthcare professionals should pay special attention to patients' age, literacy, health literacy, and familiarity with treatment regimen, as well as ensure comprehension of information when using pictograms in a healthcare setting. Targeted direction toward the impact on patient care from the view of the patient will help implement the appropriate tools in the right patient setting for improved outcomes.

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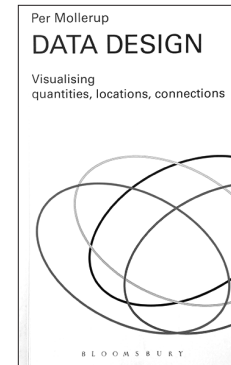
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Book Review

DATA DESIGN Visualizing quantities, locations, connections
by Per Mollerup



When a book arrives that belongs to a well-populated category on my bookshelf it makes sense to review it in the context of its neighbors. In this case, *DATA DESIGN Visualizing quantities, locations, connections* by Per Mollerup joined 27 books on information design already on my “active books” bookcase, that is, the books not on bookcases in the basement.

Per opens his book explaining foundational concepts in a chapter titled “Basics.” Existing information design books such as *The Wall Street Journal Guide to Information Graphics* by Donna M. Wong open similarly with a first chapter titled “The Basics.” Whereas Wong briefly touches upon various functional components of design such as color, typography, and legibility Mollerup draws in principles from research such as Gestalt psychology. Where Per does discuss color he does so in relation to a color system rather than functional advice. Per’s introduction also introduces the concept of simplicity as well as several historic milestones such as William Playfair’s *The Commercial and Political Atlas* and Isotype. Jenn and Ken Visocky O’Grady also mention Isotype in their “Overview” chapter of *The Information Design Handbook*, but in comparison to these other books *DATA DESIGN* tends to found build arguments more on established findings in other fields than issues particular only to design.

Per’s descriptions of data design are characterized by their simplicity. Simplicity in this case does not mean lacking nuance, sophistication, or insight but rather that he absents explanations of jargon and academic pretension. For example, on page 57 Per writes, “Categorical variables are known by their distinctive difference, by their lack of universal order, and by not being quantifiable. Gender is a categorical variable.” This is as simple, detailed, and clear an explanation as I can remember. However, at times such admirable simplicity provides less help when on one hand it links word to definition while lapsing into circular redundancy such as on page 56 “A variable is a factor that may vary.” Most dictionaries avoid using the root word to define the word and I think both simplicity and comprehension would have been served if the book had more carefully observed this convention.

The bulk of the book is devoted to well organized and amply illustrated examples of data design organized into three broad categories: visualizing quantities, visualizing locations, and visualizing connections. This makes it an easy reference for designers facing a particular kind of task. The clear, simple yet insightful quality of the entire book makes it well worth owning.

Mike Zender

Journal Information

Visible Language is an academic journal focused on research in visual communication. We invite articles from all disciplines that concern visual communication that would be of interest to designers.

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Visible Language, an academic journal, seeks to advance research and scholarship for two types of readers: academics and professionals. The academic is motivated to consume knowledge in order to advance knowledge through research and teaching. The professional is motivated to consume and apply knowledge to improve practice. *Visible Language* seeks to be highly academic without being inaccessible. To the extent possible given your topic, *Visible Language* seeks articles written to be accessible to both our reader types. Anyone interested may request a copy of our editorial guidelines for authors.

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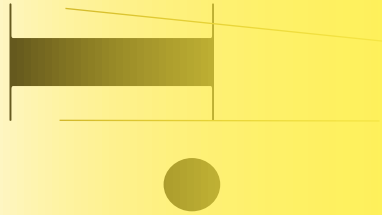
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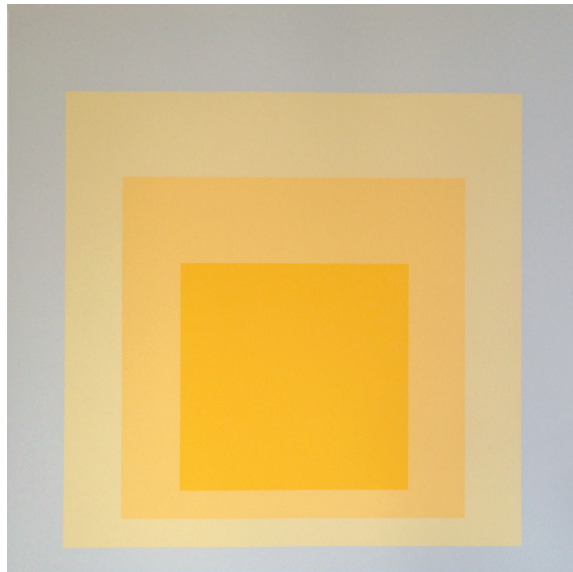
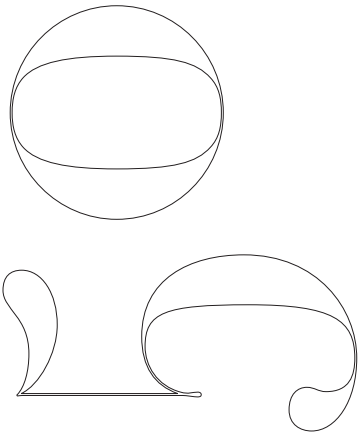
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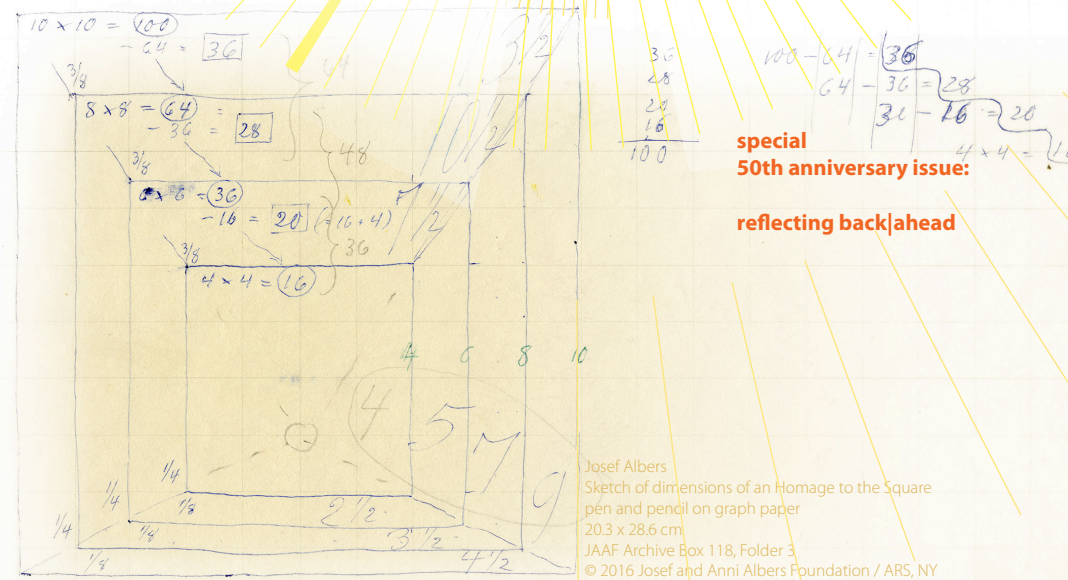
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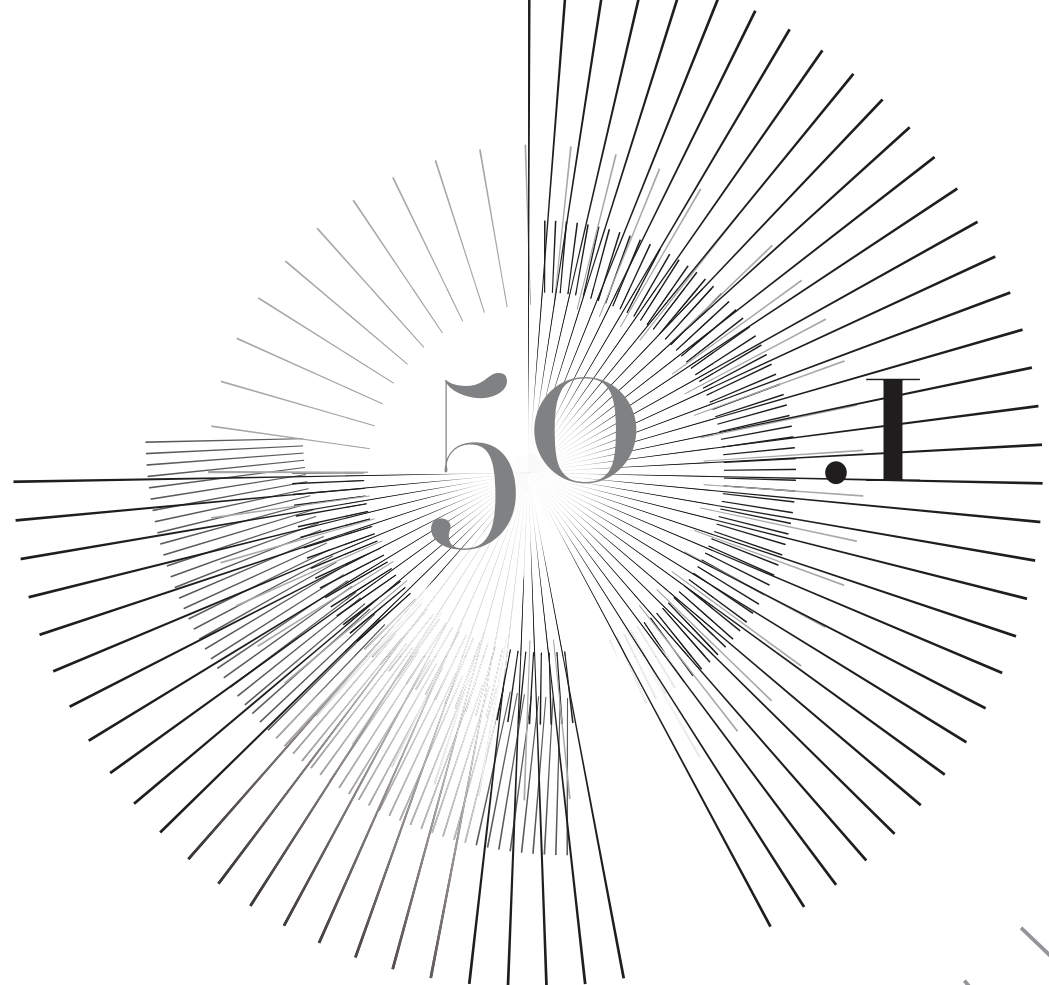


Josef Albers
Sketch of dimensions of an Homage to the Square
pen and pencil on graph paper
20.3 x 28.6 cm
JAAF Archive Box 118, Folder 3
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special
50th anniversary issue:

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BOOK REVIEW: Data Design by Per Mollerup

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A lot of design has happened in the 50 years since *Visible Language* was founded: typesetters – gone; desktop publishing – a passing blip; computers – moved from desktop to pocket. The term graphic design had hardly entered the dictionary before the discipline started to consider renaming itself visual communication design or just communication design. Because communication continues to grow in quantity and importance there's no reason to disbelieve in a promising future for a communication design discipline. What the promising design future looks like is, as always, sketchy. A well-known 20th century Danish proverb states that predictions are easy except when they involve the future and George Santayana famously warned of the trouble that awaits failure to examine the past. If we take Santayana's statement less as a warning than as a prescription to guide action, we might reflect thoughtfully on the past in order to plan our steps today to help shape a future the Danes say is so difficult to predict. Reflecting on the past may not make predictions easier, but it might make them more realistic.

To celebrate its 50th year *Visible Language* will revisit themes from the journal's past to help chart the design discipline's future. This issue features articles by Meredith Davis, Sharon Poggenpohl, and myself commenting on design's direction, design journals, and design research. As a special homage to the journal's roots in typographic research issue 50.2 will revisit typography and see what we have learned in the past 50 years and project where typographic study should be going next. Issue 50.3 will look at *Visible Language* in light of design history and theory with a similar aim: to reflect on the past to help guide and inspire the future: reflecting back – reflecting ahead. Reflecting in the sense of thinking deeply or carefully about something and at the same time suggesting the visual nature of much of human cognition and the essential visual nature of design. Reflection is a physical process wherein light or energy is thrown back from a surface. We learn about ourselves through reflection. We see things in a new light, from a new vantage point, and if the mirror is placed properly we can see not just where we've been but where we are going: around the corner we have not yet turned.

This year we are devoting part of the journal to not predicting the future but to shaping it. We can't wait to see what they'll say about our efforts in 2065!

Recognizing appropriate representation of indigenous knowledge in design practice

Meghan Kelly (PhD)
Russell Kennedy (PhD, FRSA, FIDA)

ABSTRACT

This paper focuses on the need for designers to follow clear, concise, workable practises to engage appropriately and ethically with indigenous knowledge on projects involving the graphical depiction of indigenous culture. Incorporating indigenous symbols into visual communication design strategies impacts a wide range of stakeholders and therefore requires a sensitive approach with broad consultation in regard to permissions and intellectual property rights; issues can be worked through if respectful practice methods are applied. This paper acknowledges cultural appropriation is not new and that creative, cross cultural interpretation and expressions of hybridity should be encouraged. However respectful communication, consultation, and collaboration are required whenever commercial application of indigenous culture is attempted. To demonstrate the need for clarity, three case study examples will be presented, each with design solutions involving the use of graphical depictions of indigenous culture and each selected due to the varying degrees of stakeholder engagement undertaken in the design process. The introduction of the ladder of stakeholder engagement theory is a new concept introduced in this paper that can be employed to better consider the appropriate and ethical engagement of designers with indigenous knowledge.

KEY WORDS :

Typographic legibility; Text layout; Academic texts; Search reading; Perceptual level of reading

The Challenge

In today's global economy, visual communication designers must work with multiple stakeholders and create design solutions that appeal to a diverse range of recipients, each of whom hold a strong emotional investment in the representation presented. With multiple stakeholders there exists an increased potential for debate, dissent, conflict, and miscommunication. Of particular note, the authors recognize the need for designers to follow a clear, concise, workable process to address the concerns of all stakeholders when working with indigenous knowledge on projects involving the graphical depiction of indigenous culture. This paper asserts the need for information and guidance to help designers be more aware of the context in which they are working, as it is a difficult landscape to navigate especially when identifying what is appropriate and what is appropriation.

Three case study examples will be examined demonstrating the challenges surrounding concerns of identity creation and visual representation of indigenous communities in communication design. Revealing differing levels of engagement with stakeholders, the results of this research proposes designers need to embed procedures of stakeholder engagement in design practice to work appropriately and ethically with indigenous knowledge. Introducing this as a new concept to assist designers with their awareness of the context in which they are working, this paper identifies the ladder of stakeholder engagement as an internationally relevant, solid foundation upon which to create an understanding of suitable processes and procedures to better consider the concerns of the client, consumer, designer, and community.

McCoy states: "As professional designers, we have developed an effective body of theory, method, and form to deal with both the sender and message. Now we must do the same for the receiver component of the communications equation" (2006, p.203). In earlier research, Buchanan took a similar position when he explained that despite the impact of mass-production, the solution is to no longer design for a universal audience, or national groups, or even large market segments; "the task is to design for the individual placed in his or her immediate context" (1998, p.20). In agreement to McCoy's comments, Marcus (2004) discusses digital environments and the impact of cultural differences in the ways people engage with graphical layouts. Marcus argues that cross-cultural user-interface designers need to account for dimensions of cultures when they consider potential design strategies and adapt these to the needs of different locales. He points out that there may be cultural biases in traditional industry usability precepts and that deep cultural influences affect the way people think, act, and feel. The symbolic design object selected triggers cultural associations and hence the need to address the symbolic issues of culturally driven representation.

These comments highlight the necessity for visual communication to remain personal in its communication strategies. However, when designing in a cross cultural context where the communication must work with a range of culturally diverse audiences and a broad range of stakeholders, it is difficult to appeal to the multiple recipients who hold a strong emotional investment in the message being sent. In this situation, the stakeholder base expands and the varying levels of appeal increase exponentially. Adding another level of complexity to the discussion is when the design is a graphical depiction of indigenous culture. It does not imply that designers need to have an expanded knowledge of all cultures or indigenous culture, nor does it claim to explain what is appropriate or inappropriate. It does however assert the need for designers to seek information on a case-by case basis and to understand respectful methods of engagement. Designers should not feel a need to avoid the issue; they simply need to start relevant projects with a blank canvas, listen, not make assumptions, and embark on the process without preconceived ideas. They need to be aware of the emotions of the stakeholders, the strong feeling deriving from one's circumstances, mood, or relationships with others (Oxford Dictionary, 2015). Stakeholder sensibilities should be respected and included for effective communication and acceptance.

Despite admirable attempts to navigate a transparent and ethical approach to design involving the graphical depiction of indigenous culture, debate, dissent, conflict, and miscommunication are still evident. It is a complex area to navigate and the associated difficulties have been avoided for many years, particularly in Australia. Discourse involving the indigenous knowledge engagement by non-indigenous involves issues of appropriate or inappropriate representation, self-determination, national identity, reconciliation, and power balance. Knowledge ownership (intellectual property), sharing, and hybridity are at the center of this discussion. Conversely, denying access to knowledge can perpetuate a climate of cultural ignorance. As Socrates stressed, "There is only one good, knowledge, and one evil, ignorance" (1925).

To demonstrate the need for clarity in stakeholder engagement to address ethical transparency, three case study examples will be presented. Each case study example involves the use of graphical depictions of indigenous culture and was selected due to the varying degrees of stakeholder engagement in the design process. Other examples could be chosen; however, these examples were identified to demonstrate key points in our discussion. Evident were different levels of consultation and engagement with variable outcomes. The first example of the Venezuelan government's rebranding of public museums and galleries was widely criticized due to the lack of stakeholder consultation. The second example of Urban Outfitters use of Navajo imagery is an example where there was blatantly no consultation. The final example of Air Pacific's rebrand of Fiji Airways by FutureBrand was conducted with consultation; however, ownership was contested late

in the design process. When mapping the level of stakeholder management from each case study, an ability to categorize engagement in design process is shown to offer clear guidance to designers working in a cross-cultural context and to inform their practice.

Venezuelan Government's Rebranding of Public Museums and Galleries

In 2005 the Venezuelan government set out to rebrand its major cultural institutions including several iconic public museums and galleries. The new visual identity program replaced a series of very popular and long-standing icons with a single unifying mark. The singular representation was based on a traditional symbol from the Venezuelan aboriginal group called Panare.

After the launch of the new program, the Ministry of Culture in Venezuela was widely criticized for the new design. It was felt that many of the previous logos represented Venezuela's rich history of pre-Hispanic influences and were superb examples of modernism in its purest form having been developed by some of Venezuela's great, internationally recognized designers. They were identities of significant cultural value as they were "extremely sophisticated and evidence different strategies of hybridisation between canonical modernist forms and autochthonous" (De La Barra, 2013).

The Venezuelan design community overwhelmingly agreed that to replace such well-established visual identities should require a broad based consultation process involving all cultural stakeholders. According to the Venezuelan design community, the government imposed change without any consultation with the Panare people, the local design community, or design associations. As a result, there was a strong feeling that the change was disrespectful to the highly regarded designers of the original logos. There was a growing belief that the government managed to successfully alienate itself from both the Venezuelan designers and the Panare community whom they were championing. Prominent Venezuelan visual communicator, John Moore's, sentiments reflect those of the local designers:

Important identities, developed by leading Venezuelan designers, which formed part of Venezuela's cultural heritage have been erased. The principal problems are the loss of identity, personality and especially the history of each museum and the appropriation of a sacred aboriginal image for public use in a context where the audience does not understand its significance. This is contrary to an official identity strategy, which would allow each museum to conserve its own personality. This controversial approach has divided the staff of the museums and even the ethnic group that is the source of the imagery (Personal Communication, February 2006).

Apart from the issues of brand identity, Venezuela's introspection reflects a much larger global issue, the appropriate, ethical, and respect-

ful use of indigenous visual iconography. Although intentions may have been valid, the lack of stakeholder engagement and the lack of consideration of the stakeholder base resulted in a negative response to the design strategy. This issue is particularly important when designers are required to visually represent aspects of national identity and engage with indigenous design knowledge to achieve representation.

Urban Outfitters' Use of Navajo Imagery

The second example involving the use of indigenous imagery in design practice reflects upon a total lack of consultation and engagement with all stakeholders. Renown for creating controversy, Urban Outfitters (Inc.), a clothing retailer based in the United States of America, has "in various attempts to look rebellious ... come under fire for selling clothing relating to the Holocaust, anorexia, addiction and racial stereotypes" (Short, 2014). Urban Outfitters in 2011 introduced a line of Navajo-branded clothing and accessories including underwear and a liquor flask. Using geometric shapes throughout the design applications, Urban Outfitters called the range "Navajo" and sold the retail items in stores and online.

Months after sending the clothing retailer a cease-and-desist letter demanding it stop using the "Navajo" name, the Navajo Nation, in February 2012, sued Urban Outfitters. In response, Urban Outfitters removed the products from their website. However, as Urban Outfitters markets and retails its merchandise in more than 200 stores and online, products with the "Navajo" name were still being sold through other company brands (Landry, 2013). The lawsuit filed alleged "trademark violations and violations of the federal Indian Arts and Crafts Act of 1990, which makes it illegal to sell arts or crafts in a way to falsely suggest they're made by American Indians when they're not" (Fonseca, 2012). The Navajo Nation representatives stated the designs were "derogatory and scandalous", particularly when the sale and consumption of alcohol is banned on the reservation¹.

Historically, the Navajo worked in silver and wool (Landry, 2013), creating items for household uses or adornment. Yet with the arrival of Anglo settlers, and their subsequent discovery of the Navajo crafts, arts and crafts have become part of a broader economic landscape. As a result, Urban Outfitters countered the claim by arguing that "Navajo" has become a generic term for a style or design.

In court documentation Urban Outfitters argued that the

¹ "The Indian Arts and Crafts Act, passed in 1990, came as a response to individuals and corporations that misrepresented products as Indian-made. The law prohibits any marketing or sale of items in a manner that falsely suggests they are made by American Indians" (Landry 2013).

Navajo Nation had not taken action against other third parties who had used the term Navajo and had therefore forsaken any rights to that name. The company claimed that the term “Navajo” was “widely used in the industry and by customers to describe a design/style or feature of clothing and clothing accessories, and therefore, is incapable of trademark protection” (Landry, 2013). Urban Outfitters claimed it is common for designers to borrow from other cultural groups, and therefore the company sought “a declaration of non-infringement and cancellation of the tribe’s federal trademark registrations” (Associated Press, 2013). The company also asserted that selling “hip clothing and merchandise” to “culturally sophisticated young adults” in no way competes with Navajo arts and crafts, which generally are not sold in “specialty retail centers, upscale street locations and enclosed malls” (Fonseca, 2012). Urban Outfitters alleged that nothing in the store, its layout or the manner in which the goods were sold suggested Urban Outfitters was marketing or selling projects supplied by the Navajo Nation. The counterclaims requested a declaration of non-infringement from the Navajo and the cancellation of the tribe’s federal trademark registrations.

On April 3, 2013, U.S. District Judge C. LeRoy Hansen declared Urban Outfitters’ counterclaim against the Navajo Nation American Indian tribe was invalid, finding the tribe had sufficiently pled its case. “The factual allegations are ... sufficient to show that the mark is likely to create confusion in the marketplace” (Bishop, 2014). The New Mexico federal judge declared that the geometric prints and designs were fashioned to mimic and resemble Navajo Indian tribal prints, patterns and designs, and the Navajo Nation was plausible in their allegation of violation of the Indian Arts and Crafts Act prohibiting the misrepresentation in the marketing of American Indian arts and crafts products.

Air Pacific’s Rebrand of Fiji Airways by FutureBrand

In contrast to the complete lack of consultation demonstrated by Urban Outfitters, a critically acclaimed design for Fiji Airways, designed by FutureBrand and launched in Fiji October 10, 2013, demonstrates a process of consultation and engagement leading to a well received, award winning design solution. This example highlights how cultural traditions can be reinterpreted to create unique and sincere representation of place, people, and life through design (Kennedy, 2013).

FutureBrand was asked to develop an identity, which was authentic, respectful, natural, and handmade (Kennedy, 2013) and co-created a new identity system with Makereta Matemosi, one of Fiji’s most acclaimed and respected Masi artists. The aim was to celebrate traditional Masi art – an ancient art that embodies the spirit and stories of Fijian culture. Their

methodologies were considerate of the Fijian community as FutureBrand consulted with indigenous representatives to appropriately incorporate ancient motifs across a range of applications. The framework established was inclusive, respectful, acknowledging indigenous ownership, combining traditional visual culture into a commercial branding strategy. The final design has become a proud symbol for the country of Fiji and its people with an end result reflective of a respect for the meanings and use of Fijian symbols (Kennedy, 2013). As FutureBrand states in its case study document, the “brand identity’s flexibility accommodates numerous applications, yet consistently captures the unique elements of Fiji and its culture” with an aim to “redefine a national airline to embody the values and unique spirit of Fiji with a brand experience that would not only create advocacy for the airline itself but create a proud symbol for Fiji and its people” (FutureBrand, 2013)².

The co-creation process and methodology developed and delivered by FutureBrand was both inclusive and respectful. However, prior to launch of the design, Fiji Airways placed an advertisement in the Fijian newspaper requesting copyright for the designs. There was strong objection to handing over the designs to Fiji Airways under trademark laws. These designs were understood to belong to Fijian women and were required to remain available to the Fijian people and their communities. The motifs are easily recognizable, were created by artisans in times past, and are considered as cultural inheritance having been handed down between generations over extensive lengths of time. It was explained in blog discussion; “these items reflect our cultural heritage, have significance and are often used in cultural and traditional ceremonies. The creation of these cultural items are a source of living for many people in Fiji and the Pacific” (Peceli, 2013). Virisila Baudromo, executive director of the Fiji Women’s Rights Movement (FWRM) made a statement explaining Fiji Airways was directly contravening national, regional, and international standards and was in direct violation of the Convention on the Elimination of All Forms of Discrimination against Women [CEDAW] “as women in Fiji are still the primary producers of such Masi designs, and therefore various economic, social and cultural rights of women would be directly and indirectly affected by such an illegal and unethical trademark system” (Peceli, 2013). It was understood that ownership was not that of Fiji Airways to control, and the matter has been resolved in favour of the Fijian people.

The Air Pacific’s rebrand of Fiji Airways example demonstrates human inequity, reflective of Hofstede’s Power Distance model of culture dimension. Hofstede formulated his model of culture dimensions based on surveys and interviews with several hundred IBM employees, originally in 53 countries during (1978-1983). The battle between status and overall equality

2 Three Masi motifs were used on the aircraft’s exterior to represent Fiji Airways: first the Teteva symbol, which represents the airline, its values, and the spirit of Fiji; second the Rova motif placed on the aircraft engine, symbolizing the warm greeting Fijians extend to visitors; finally, the Makare motif which appears around the border of the Teteva on the tail, represents clear water flowing on a white sandy beach (Kennedy, 2013).

is defined as one of the basic issues in human society (Hofstede, 1984, p.67). The unacceptable hierarchical order of society is reflected in the ambitions of some cultural groups to strive to equalise the distribution of power and demand justification for inequalities of power. Studies of colonialism and post-colonialism theorize the actual or metaphorical demonstration of oppression (Moon, 2001, p.102). Colonialism is based on the creation of stories, paintings, and the visual narratives of the new arrivals and how they see the new land to which they have moved. It also involves the consequential displacement or dispossession of indigenous people who are forced to change their cultural narratives. The effect on individuals and their societies impacts language, stories, and beliefs as people are forced to adopt the traditions of the newly arrived settlers. Post-colonialism, the reassertion of a culture that has previously been oppressed by the arrival of a different culture occurs with the resurgence of the minority culture and the backlash that changes the dynamics back to the power of the minority group. Expressions are evident as writers, readers, critics, and visual communicators express the political struggle of colonised people. It is a resource to assist in the interrogation of privilege, power, and inequity (Lazeel, 2012, p.4). The colonised people succeed in re-establishing their language and stories, moving away from the dominant culture; the culture of the newcomers.

The case study examples highlight how choices in the use of visual imagery with a strong cultural connection require consideration. The inappropriate choices of imagery by the dominant cultural group, the borrowing or taking of a valued cultural item, is commonly referred to as cultural appropriation and can be considered equivalent to theft. Ultimately, a moral problem exists if cultural appropriation leads to a loss of income for the original culture and threatens the perceived authenticity or the identity of the original group. Threats may arise in four ways: first, the appropriation of goods by outsiders leading to a false portrayal or caricature image of the original culture; second, the borrowing of ideas and art styles leading to the inability of original owners to further use the ideas and images; third, the use of cultural artefacts or cultural representations by people with different standards to those presented by the original culture; and finally, the unauthorised use of a culture's identity. The case study example of the Urban Outfitters' use of Navajo imagery threatens the community in each of the four categories listed above. This example demonstrates a false portrayal of the culture, the borrowing of ideas leading to the original owners inability to use the images, appropriation by people with different standards to those of the original culture, and unauthorised use of images.

According to Ziff, Pratima, and Rao (1997), cultural appropriation involves a multifaceted dynamic web of forces including politics, power, degradation, and values. They define cultural appropriation as "the taking from a culture that which is not one's own - of intellectual property, cultural expressions or artifacts, history and one's knowledge". Ziff et.al then ask, "what does it mean by taking? What values and concerns are implicated in

the process of appropriation? And how, if at all, should we respond?" (1997, p.1). While some see cultural appropriation as theft, problematic, and unacceptable, others see it as innocent, perhaps useful or even an essential part to the development of a culture. Their interpretation is that it can help to generate interest in the original group, increase the value of traditional or original items, and perhaps bring a culture to a broader audience. Having a cross-cultural aesthetic appreciation can enrich our understanding of different cultures and essentially honour their accomplishments. According to Hal Duncan, "simply representing a culture in terms of artifacts, practices and persons doesn't mean you are laying claim to those artifacts, following those practices, mimicking those persons. It doesn't mean you're doing a big land-grab on that cultural territory, setting up a fence, and saying 'This is mine now'" (Duncan 2006, p.1). Instead you are honouring the cultural group by broadening their appeal. "Local design cultures are both challenged and enabled by the increasing globalization of the marketplace" (Fiss 2009, p.3, p.3) and the use of cultural artifacts. European artisans have been appropriating other cultures for centuries such as in the application of Chinese and Japanese styling in design objects. Kunsthau Zurich, the Museum for Modern Art in Zurich, regards Japanese art as fundamental to the development of Modernism. The museum points out that all the great masters of French painting admired and drew inspiration from its pictorial motifs and characteristic style (Kunsthau Zurich, 2015). This French art practice was referred to as "Japonisme" and remained influential long into the 20th Century.

The problem with determining if there has been an issue of cultural appropriation comes in defining factual information about that culture. This is often difficult to do when appreciation of a culture is deeply rooted within members of that culture. Individuals are conditioned in aesthetic appreciation through non-formal modes of articulation acquired over time and not formally articulated (Heyd, 2003, p.39). Becker (2012) recognizes the layered complexity of creating design that is aesthetically pleasing as well as ethically considered. Becker highlights the need to make explicit methods of ethics to assist with understanding what constitutes the right action to take to avoid bias and group affinities. The concern is the desire of industry to develop ethical work practices as design considers the environmental, social, and economical dimensions of its work. Within that, and more specific to the context of this paper, one must also recognize the intellectual property and cultural ownership rights of people. Coombe (1998), an anthropologist and lawyer, highlights the need to formally recognise those rights of indigenous peoples. She recognises the transportation of local knowledge taken to new locations as people travel between communities, and the fluid, porous, layered nature of communities make delineation and control difficult. "Any new regime of rights will have to be accompanied by a related set of exemptions that are relevant to the different forms of knowledge to be protected and their likely uses, if it is to be congruent with human rights principles" (Coombe, 1998, p.82).

However, designers are not the arbiters of what is right and wrong and instead should focus on determining the intermediaries who have the authority to act on behalf of the custodians of the indigenous knowledge, in a process that is indigenous led. This paper is not about censorship, overt protection, or the promotion of the containment of cultural visual iconography. The authors aim to challenge designers to consider what is appropriate and what not to appropriate, meaning designers always consider these concerns in their design practice. In all cases, determining appropriate use should remain with the owners and defenders of indigenous knowledge.

Stakeholder Theory

Research into the practices of stakeholder theory provides insight into the process that could be utilized in design practice to circumvent some of the conflict commercial enterprise has had when using graphical depiction of indigenous culture and the impact this conflict has had on the balance of power. Stakeholder theory is a frame of organisational management and business ethics that addresses morals and values in managing organisations. This business theory acknowledges the forces at play in business and addresses the strategies required to establish and maintain an ethical practice considerate of all participants. Traditional business practice is based around a competitive culture resulting in winners and losers; however stakeholder theory aims to build a culture of mutual benefit.

Stakeholders are defined as those groups who have a stake in or claim on the firm, specifically including suppliers, customers, employees, stockholders, and the local community, as well as management in its role as agent for these groups (Evan and Freeman, 1988). As defined by Freeman (2010, p.vi), "A stakeholder is any group or individual who can affect, or is affected by, the achievement of a corporation's purpose." The principles of stakeholder theory propose that management is required to "acknowledge and actively monitor the concerns of all legitimate stakeholders" (Friedman and Miles, 2006, p.151) and must take the interests of the stakeholders into account in decision-making processes. They must listen, communicate, and adopt processes sensitive to the concerns of the stakeholders. Managers should work cooperatively with their stakeholders, acknowledging the potential conflicts between their role and the legal and moral responsibility they hold for the interests of others, addressing these with open communication and appropriate reporting. (Friedman and Miles, 2006, p.151).

The complexity of the stakeholder relationship involves many forces at play regarded as obstacles. For example, if a strong financial return is the primary motivation of investors, how does one convince them of the value of broader stakeholder considerations? Stakeholder theory suggests that the firm should be managed for the benefit of its participants and

that management has a fiduciary obligation to stakeholders to act as their agent. It takes the premise that shareholder, investors, and managers need to appreciate and understand that "the 'social responsibility' of business, properly understood, is not an odd number of extraneous obligations of the businesses and corporations. It is the very point of their existence" (Solomon, 1993, p.180). The organizations that recognize the wants and needs of the stakeholders can greatly improve their future opportunities whereas failure to recognize the impact of stakeholders on an organization can significantly impact on reputation (Brower and Mahajan, 2012, p.328).

Based on an ethical business paradigm, stakeholder theory proclaims that in order to achieve sustainable success over time, companies must keep the interests of customers, suppliers, employees, communities, and shareholders allied and moving in the same direction. To have all stakeholders sharing a united vision is deemed more ethical and productive in the long term. This theory is highly applicable for the research of appropriate use of indigenous knowledge in design practice given its professional practice position of success based on mutual respect. Traditionally, stakeholders in the cultural and design fields have worked in isolation of each other's interests, either deliberately or through ignorance. An aligned stakeholder approach can be of mutual benefit to all constituents, ultimately leading to a more ethical, respectful, and visible acknowledgement. Introducing these concepts to designers in professional design practice would assist awareness of the context they are working.

Social Identity Theory

Although stakeholder theory is relevant to design practice, it does have some shortcomings. Identification of stakeholder grouping has been described as vague and limiting (Crane and Ruebottom, 2012, p.77) and a fundamental challenge for any system seeking to ensure an appropriate representation. The generic map of basic stakeholder categories has typically listed owners/financiers/stakeholders, customers, employees, suppliers and competitors. The primary group is identified by their economic relationship to the company and the secondary group is based on community groups (Crane and Ruebottom, 2012, p.80). This arrangement of group membership is not representative of all of the stakeholders who may engage with an organization, and in the case of indigenous representation and the use of indigenous visual references, their position in the stakeholder groups is poorly defined as a secondary group based on community.

For this reason, Crane and Ruebottom (2012) recognized the need to review stakeholder theory, combining this with social identity theory to recognize the need for group cohesion and action with varied categories of stakeholders. Crane and Ruebottom (2012, p.80) identify the

need to move away from generic definitions of stakeholders to identification of stakeholders by their needs and interest. This provides the opportunity to better understand the community stakeholders and create a level of value based on importance to the group. To assist with our understanding of this altered construct of grouping, social psychologists explain that group members attempt to see their group as a different entity from other groups. They are motivated to look at the positive attributes of their group and preserve and protect these differences to achieve a positive group distinction, which in turn increases their loyalty to their group. Tajfel and Turner (1986) defined this act as Social Identity Theory, whereby individuals see their belonging to cultural identities. People have a positive group distinction with their own culture and therefore remain loyal to the membership of that group. They become proud of their differences, and often it is not until they have contact with other cultures that they have an increased awareness of their own differences and feel the need to protect those differences.

To understand this further, culture plays a significant role in social identity theory. Culture is defined by the codes that produce meaning to a group. It can be said that culture embodies the most prominent or powerful that has been thought or said of a group in society maintained through shared values and systems of representation (Hall, 1999). Cultures have a complex set of rules, prohibitions, permissions, values and classifications. Kress (1988, p.12) explains that these codes appear as normal and natural to the general population. As a result, we accept these sets of rules as the natural order of how things should be. People who share a language, a history, and a way of life have connections that run very deep. "Culture gives us a mirror upon which to look and see ourselves, after which we model ourselves" (Simmons, 2006, p.1). According to Usunier (1996, p.383) our own thought framework is established automatically and unconsciously and reflects the values of our national culture, something we do not choose. This allows us to evaluate people, interpret situations, and defines the attitude we should adopt to communicate and negotiate with others from our culture. "Where customs differ, communication is difficult, time is short, and attention spans are limited, both parties are likely to "code" observations in the most efficient way possible" (Pitchford, 2008, p.97) giving people the opportunity to reduce complex information to smaller and more manageable proportions.

Taking into consideration the social identity connections of stakeholders recognizes the emotional connection groups of people have with the corporation or company with which they participate. Business demonstrates the application of such theories. Scott wrote in his article titled *The Concepts, Evidence & Implications of the Stakeholder Theory of a Corporation*:

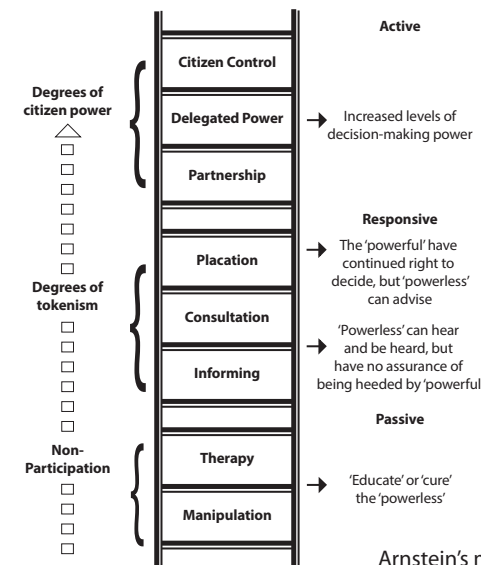
Researchers who study corporate management have identified many companies that focus on stakeholders. The Body Shop is a classic stakeholder theory case study. The natural cosmetics manufacturer and retailer became defined by the activism of its founder. The company adopted a social activist purpose, establishing recycling measures, refusing to test its

products on animals and sponsoring various social-change programs. When the company's commitment to these goals was questioned, the Body Shop's management provided detailed reports to its shareholders, suppliers, customers and other stakeholders to assure them that the company's conduct fulfilled the promise of its brand image. Other successful companies that use stakeholder methods include Johnson & Johnson, Merck, Google and eBay (Scott, 2015).

Ladder of Stakeholder Management and Engagement

In addition to the need to consider the social identity of the stakeholders within the theory of stakeholder theory, there is also a need to provide clarity in the process to engage the stakeholders. Friedman and Miles (2006) propose the *Ladder of Stakeholder Management and Engagement* as a set of

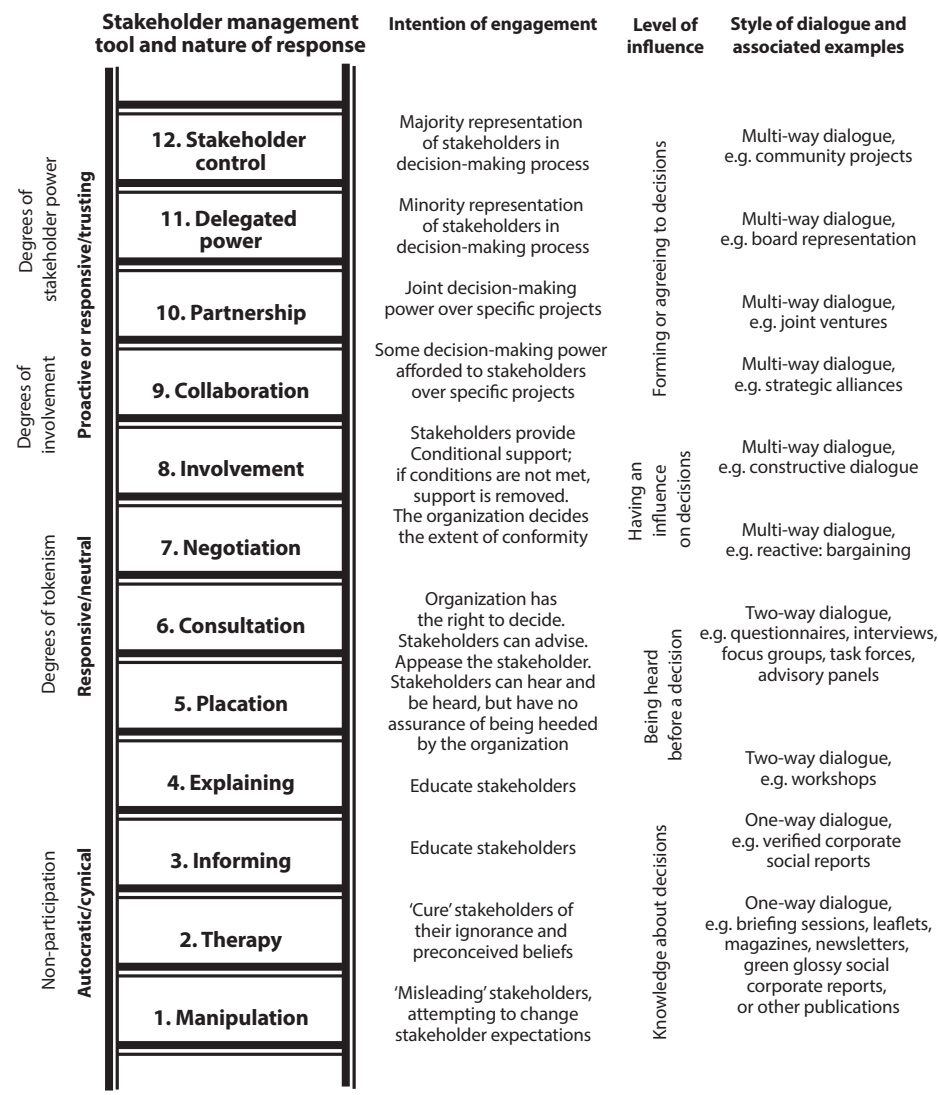
FIGURE 1



guidelines that address the power asymmetries that typify the engagement process. This adaptation of Arnstein's 1969 *Ladder of Participation* offers a comprehensive framework to consider in relation to indigenous knowledge in design practice. The premise of Arnstein's model is based on citizen participation equating to citizen power, redistributing the power so those voices not commonly heard and excluded in the political and economic process may be included in the future (Arnstein 1969, p.216). There are several steps in the ladder representing the numerous levels of engagement required. In summary, the lower rungs of the ladder are based on limitations of stakeholder power to influence decision-making, whereas the top three steps are defined as *Partnership*, *Delegated Power* and *Citizen Control* resulting in complete citizen control over decision-making.

Arnstein's model offers a useful structure for design practice, and although "it was intended for application within public policy, with some modification and development it can provide a clear and useful framework for analyzing stakeholder management practices" (Friedman and Miles, 2006, p.161-162). Arnstein's model contained eight rungs as outlined in Figure 1 above. He admits however that the model presented is an overview of reality, simply defining the level to which stakeholders are able to achieve decision-making power. There have been various redesigns of Arnstein's original model, and the number of rungs may vary according to application (Friedman and Miles, 2006, p.161, Tritter and McCallum, 2006). Some

FIGURE 2



examples have five rungs that reflect various aspects of user involvement; others attempt to incorporate degrees of participation and quality of engagement, and still others have applied the model to work in specific contexts. The model presented by Freidman and Miles is a twelve-step ladder identifying specific levels suitable to stakeholder management and engagement in design practice. Within this model, the first four rungs are non-participatory, educating stakeholders with a one-way dialogue of reports and briefing sessions. The second stage, the next three rungs,

FIGURE 3



presents degrees of tokenism where two-way dialogue of focus groups and interviews are conducted to consult with stakeholders prior to the organization making a decision. The third level, the next three rungs, increases the involvement of the stakeholders in a constructive dialogue through collaboration and partnership leading to joint decision-making over specific projects. The final level, with the last two rungs, offers levels of stakeholder power and stakeholder control with representations of stakeholders in the decision-making process³.

The twelve-step stakeholder ladder helps us understand the complexity of stakeholder engagement. It clearly identifies issues associated with a lack of commitment and, although a proposal put forward by the authors, demonstrates a clear concept of the level of stakeholder consultation required to achieve a clear, concise, workable practice. As previously identified, issues can be worked through when respectful practices are applied, and the stakeholder ladder provides one method to identify the level of engagement required. The authors propose the highest level of the twelve-step ladder, relinquishing authority to the indigenous community as the most ethically appropriate step.

It is not necessary to have all stakeholder relations conducted at level 12; however, for the purpose of this area of investigation, it can be seen to be beneficial to conduct consultations regarding indigenous imagery granting stakeholders power in the decision-making process.

Reflecting on the case study examples presented in this paper, the first case study of the rebranding of Venezuelan museums and galleries, the Venezuelan government did not consult with all of the stakeholder groups holding a strong emotional investment in the original design

3 This discussion aligns with the principles of participatory design practice. Participatory design is one of methods that may be used in the higher rungs of the ladder of stakeholder management to ensure stakeholders have an active multi-dialogue role in the decision-making process and therefore forms one tool in the kit available to achieve collaborative discourse. The area of focus in this paper, however, is on the relationship between the corporate organization and the various stakeholders engaged with that organization, the level of engagement required to achieve the desired outcomes, and not the design process of engagement.

solutions. Both the Panare people and the Venezuelan design community presented the strongest opposition to the rebranding strategy; however, the level of engagement was informing rather than collaborative and hence low on the *Ladder of Stakeholder Management and Engagement*. In the second case study of Urban Outfitters, the level of engagement was manipulative and misleading with a clear attempt to change stakeholder expectation. In the final case study example of Fiji Airways, the decision for assignment of copyright of the design negated the consultation with the community at the very end of what can be defined as a successful process. Considering this in light of Friedman and Miles (2006) *Ladder of Stakeholder Management and Engagement*, it can be considered that throughout the design process conducted by FutureBrand, the intention of engagement was very high in the consideration of stakeholder power, yet in the final stage, Fiji Airways worked within the lower rungs of the ladder in a manipulative manner through its advertisement seeking copyright assignment from the creators without consultation. Having developed a strong partnership, stakeholders required further control in the ladder of participation with majority representation in the decision making process. This clearly represents the strong emotional connection the stakeholders hold with the design strategy to be implemented.

Conclusion

Communicating a point of difference is a challenge for designers as the world rapidly continues on its path of globalization. This paper aims to propose a way forward regarding indigenous representation by suggesting a new emphasis to help designers grapple with the associated sensibilities and to help them determine what is required to achieve effective, respectful outcomes. Principles of stakeholder management stress the need to manage stakeholder engagement and to determine a degree of involvement that is suitable to the problem being addressed. Stakeholder theory and social identity theory, combined with the structure of Friedman and Miles (2006, p.162) *Ladder of Stakeholder Management and Engagement* provide a detailed method of mapping the level of consultation with stakeholders in the design process. In the instance of identity and representation in design practice, the level of engagement must be high.

Examining each rung of the ladder determines the need to involve the community in the higher rungs of the *Ladder of Stakeholder Management and Engagement* to provide majority representation of stakeholders in the decision making process. Had a more succinct, open, and transparent process been followed, the outcomes of each of the case study examples presented would have been very different. A combination of utilizing social identity theory with stakeholder theory and recreating the ladder of participation provides a solid framework for developing guidance

to best practice when navigate the use of indigenous iconography in design. The concept of considering the interests of all stakeholders aligns with the theoretical premise of this research, which proposes shared knowledge, open, transparent, and ethical discussions of imagery use. Designers cannot, and should not, work in isolation when working with indigenous knowledge; there must be mutual benefits for all stakeholders especially the cultural custodians. This implies the need for collaboration between an even wider set of stakeholders and recognition of the broader stakeholder base in design practice. Given the unique challenges of designing in these refined areas of cultural representation, and the examples from the case studies outlined in this paper, a new set of criteria for stakeholder engagement can be recommended. The next step is to formalize the tools to ensure suitable stakeholder engagement with a case by case considerations to assist designers ethically and appropriately when working in cross-cultural contexts.

Acknowledgements

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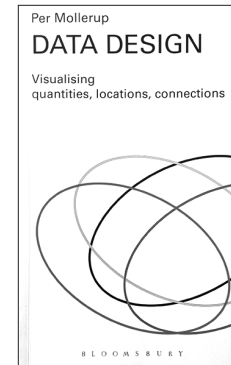
A u t h o r s

Meghan Kelly (PhD) is a Senior Lecturer in visual communication design at Deakin University and currently serves as the Course Director for the undergraduate and postgraduate programs. In 2013 Meghan was awarded a PhD examining cross-cultural visual communication design. Her interests are in exploring issues surrounding identity creation and representation in a cross-cultural context with a focus on Indigenous communities. Her passion for a global understanding of design extends into her teaching practice and continues to be explored in research projects and design opportunities.

Russell Kennedy's (PhD, FRSA, FIDA) research is in the area of cultural representation focusing on the relationship of Indigenous visual culture to national identity. In 2000 he was awarded a Master of Arts from Monash University. Kennedy's PhD thesis is titled *Designing with Indigenous Knowledge: Policy and protocols for respectful and authentic cross-cultural representation in communication design practice*. Kennedy is a Fellow of both the Royal Society for the encouragement of Arts, Manufacture and Commerce (RSA) and the Design Institute of Australia (DIA). He was President of the International Council of Communication Design IcoGrada (2009-2011) and a board member (2003 -2013). Kennedy is currently a Regional Ambassador to INDEX: 'Design to Improve life', the Danish Government's International Award program.

Book Review

DATA DESIGN Visualizing quantities, locations, connections
by Per Mollerup



When a book arrives that belongs to a well-populated category on my bookshelf it makes sense to review it in the context of its neighbors. In this case, *DATA DESIGN Visualizing quantities, locations, connections* by Per Mollerup joined 27 books on information design already on my “active books” bookcase, that is, the books not on bookcases in the basement.

Per opens his book explaining foundational concepts in a chapter titled “Basics.” Existing information design books such as *The Wall Street Journal Guide to Information Graphics* by Donna M. Wong open similarly with a first chapter titled “The Basics.” Whereas Wong briefly touches upon various functional components of design such as color, typography, and legibility Mollerup draws in principles from research such as Gestalt psychology. Where Per does discuss color he does so in relation to a color system rather than functional advice. Per’s introduction also introduces the concept of simplicity as well as several historic milestones such as William Playfair’s *The Commercial and Political Atlas* and Isotype. Jenn and Ken Visocky O’Grady also mention Isotype in their “Overview” chapter of *The Information Design Handbook*, but in comparison to these other books *DATA DESIGN* tends to found build arguments more on established findings in other fields than issues particular only to design.

Per’s descriptions of data design are characterized by their simplicity. Simplicity in this case does not mean lacking nuance, sophistication, or insight but rather that he absents explanations of jargon and academic pretension. For example, on page 57 Per writes, “Categorical variables are known by their distinctive difference, by their lack of universal order, and by not being quantifiable. Gender is a categorical variable.” This is as simple, detailed, and clear an explanation as I can remember. However, at times such admirable simplicity provides less help when on one hand it links word to definition while lapsing into circular redundancy such as on page 56 “A variable is a factor that may vary.” Most dictionaries avoid using the root word to define the word and I think both simplicity and comprehension would have been served if the book had more carefully observed this convention.

The bulk of the book is devoted to well organized and amply illustrated examples of data design organized into three broad categories: visualizing quantities, visualizing locations, and visualizing connections. This makes it an easy reference for designers facing a particular kind of task. The clear, simple yet insightful quality of the entire book makes it well worth owning.

Mike Zender

Journal Information

Visible Language is an academic journal focused on research in visual communication. We invite articles from all disciplines that concern visual communication that would be of interest to designers.

READERSHIP

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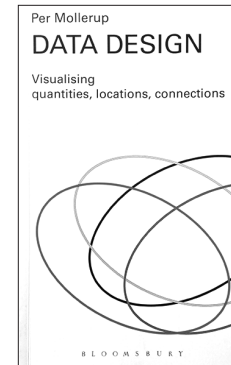
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Book Review

DATA DESIGN Visualizing quantities, locations, connections
by Per Mollerup



When a book arrives that belongs to a well-populated category on my bookshelf it makes sense to review it in the context of its neighbors. In this case, *DATA DESIGN Visualizing quantities, locations, connections* by Per Mollerup joined 27 books on information design already on my “active books” bookcase, that is, the books not on bookcases in the basement.

Per opens his book explaining foundational concepts in a chapter titled “Basics.” Existing information design books such as *The Wall Street Journal Guide to Information Graphics* by Donna M. Wong open similarly with a first chapter titled “The Basics.” Whereas Wong briefly touches upon various functional components of design such as color, typography, and legibility Mollerup draws in principles from research such as Gestalt psychology.

Where Per does discuss color he does so in relation to a color system rather than functional advice. Per’s introduction also introduces the concept of simplicity as well as several historic milestones such as William Playfair’s *The Commercial and Political Atlas* and Isotype. Jenn and Ken Visocky O’Grady also mention Isotype in their “Overview” chapter of *The Information Design Handbook*, but in comparison to these other books *DATA DESIGN* tends to found build arguments more on established findings in other fields than issues particular only to design.

Per’s descriptions of data design are characterized by their simplicity. Simplicity in this case does not mean lacking nuance, sophistication, or insight but rather that he absents explanations of jargon and academic pretension. For example, on page 57 Per writes, “Categorical variables are known by their distinctive difference, by their lack of universal order, and by not being quantifiable. Gender is a categorical variable.” This is as simple, detailed, and clear an explanation as I can remember. However, at times such admirable simplicity provides less help when on one hand it links word to definition while lapsing into circular redundancy such as on page 56 “A variable is a factor that may vary.” Most dictionaries avoid using the root word to define the word and I think both simplicity and comprehension would have been served if the book had more carefully observed this convention.

The bulk of the book is devoted to well organized and amply illustrated examples of data design organized into three broad categories: visualizing quantities, visualizing locations, and visualizing connections. This makes it an easy reference for designers facing a particular kind of task. The clear, simple yet insightful quality of the entire book makes it well worth owning.

Mike Zender

Journal Information

Visible Language is an academic journal focused on research in visual communication. We invite articles from all disciplines that concern visual communication that would be of interest to designers.

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