

sustained research programs

Visible Language

the journal of
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august 2022

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Persistent Failure Occasional Success

Persistent Failure and
Occasional Success:
*The Realities of
Evidence-Based
Interdisciplinary
Scholarship by Design
Faculty at Research
Universities*

Matthew Peterson
North Carolina State University

Abstract

Design units can better integrate themselves within research universities by producing scholarship consistent with institutional expectations, in the form of publications, grants, and patents. But significant challenges face the design faculty who must actualize this integration. I summarize my own strategic research program over three phases: an initial appointment as assistant professor; a second assistant professor appointment up to the submission of my tenure dossier; and the year following that submission. This story of phases in an early academic career illustrates challenges that are particular to junior faculty in design units, and it reveals the work required to secure publications and grants. In established research disciplines, junior faculty continue the work they began when earning their research degrees, much of which occurred in productive labs. But junior faculty in design must often initiate a research program from scratch, while already on the tenure clock. Furthermore, because research in design is heterogeneous, junior design faculty must define their own particular model of research, which also takes time, and advocate for their adopted model. I provide recommendations for design administrators and junior design faculty as a way to help elevate scholarship in design. My final recommendation for junior design faculty is to adopt the mindset of the hedonistic scholar, who does not depend upon success for personal fulfillment, but finds joy in the craft of scholarship. This is important because, as demonstrated by my own research program, significant scholarly outcomes are likely the product of years of dedication with numerous failures along the way.

Keywords

*academic publication;
design faculty;
design research;
design scholarship;
external funding*

Introduction

Two recent articles by Meredith Davis could serve as a primer for this special issue of *Visible Language* on sustained research programs in design: “Confronting the Limitations of the MFA as Preparation for PhD Study” (2016); and “Tenure and Design Research: A Disappointingly Familiar Discussion” (2020). Davis challenges the design discipline to encourage and enact scholarship that is as rigorous as, and is complementary to, that of other disciplines at research universities. Davis identifies *peer-reviewed publications, grants, and patents* as among the outcomes that “universities value most” (2020, pp. 208–209), which can demonstrate the value of design to other disciplines (2016, p. 126), especially in multidisciplinary teams. This special issue of *Visible Language* is an opportunity to reflect on the nature of the hard work required to better integrate design into the core activities of research universities. To that end, I report on my own experiences in sustained research as a junior faculty member in design. It should be obvious that one person’s story is anecdotal, but an honest accounting can nevertheless contribute to a broader conversation.

I do not wish to give the impression, in telling my own story of sustained research, that I consider it to be exemplary. It is not. My story is perhaps best described as periodic success stimulated by nearly continuous failure. But it can be instructive without needing to be prescriptive. I hope to ensure this with sufficient detail for readers to draw reasonable conclusions that are applicable to their distinct situations.

Inextricably bound to interdisciplinary and evidence-based research involving design faculty are promotion criteria and the tenure clock. I thus provide recommendations for both junior design faculty and the administrators who evaluate them, which I hope will contribute to a disciplinary conversation about the practical implications of repositioning design within research universities.

Overview of a Strategic Research Program

This section covers a range of personal scholarly outcomes over more than a decade. The details will not be of interest to all readers. This paper can be read by skipping the following subsections: “Foundational Efforts,” “Phase 1,” “Phase 2,” and “Phase 3.” The final subsection in this section, “Trends Within the Phases” (page 24), is more important for the remainder of the paper.

Foundational Efforts

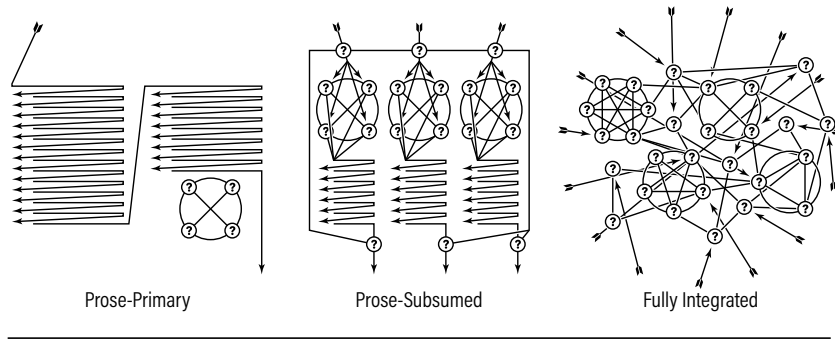
My personal research program was initiated during my doctoral studies—in an evidence-based PhD program—and continues to evolve 11 years after graduation. I left my initial tenure-track assistant professor position at the

end of my fifth year, and am now completing my sixth year in a subsequent tenure-track position. Both institutions are “very high research activity” doctoral universities, according to the Carnegie Classification. At my first institution I was in an art and design unit, and now I am in a design unit. During the preparation of this manuscript I was awarded tenure, and I will be promoted to associate professor as of next academic year. I will describe my research program in three distinct phases following graduation. It is important to note that these phases appear dissimilar (i.e., unequal) in a tenure dossier, and that my productivity in one phase was only possible because of what preceded it. This suggests that a certain degree of nuance is necessary in an equitable review of tenure dossiers in design, which I address in a later section.

For my dissertation (Peterson, 2011), I studied the integration of text and imagery in middle-school level science textbooks, for which I created three versions of textbook spreads: (1) *prose-primary*, in which a conventional center prose column references marginal figures; (2) *prose-subsumed*, in which shorter prose passages are organized by hierarchically superior pictures; and (3) *fully integrated*, in which small chunks of text are situated within pictorially rich visual displays (Figure 1). Though students consistently performed better on comprehension tests with the fully integrated spreads, the relationship was only statistically significant (with 95% confidence, $p < 0.05$) in one of three treatments, with fully integrated spreads resulting in greater comprehension than prose-primary. Situational interest results were stronger, with higher degrees of integration consistently generating greater interest in the visual design. These results suggest that even at a young age, students can not only manage, but also benefit from complicated visuals, and that the standard textbook production model—for which designers are involved late in the process after a dominant prose text has been written (DiGiuseppe, 2014)—may benefit from a reconsideration, because the fully integrated strategy requires early collaboration with designers.

Completion of my dissertation arguably put me in an enviable position. I had a professional master’s degree that qualified me for tenure-track positions in the United States, with an additional research degree. Furthermore, my dissertation was comparably rigorous to the work expected of research faculty, reducing the need for search committees to speculate about my scholarly capabilities. But despite this accomplishment, and the privilege underlying it, the first phase of my professional academic career felt intimidatingly open-ended and I did not have a subjective sense of momentum. With some effort, and over the course of five years, I did extend my earlier dissertation effort to produce four “lines” on my CV: a conference presentation; its corresponding proceedings paper (Peterson, 2014a); and two peer-reviewed journal articles, one in design (Peterson, 2014b) and the other in education (Peterson, 2016). Still, it was many years after

Integration Strategy Schematics



Treatment #2 Stimuli

This figure displays three examples of text-image integration stimuli. **Prose-Primary** shows a text block with a large image of a city skyline at the bottom. **Prose-Subsumed** shows text with several smaller images of lakes and ponds interspersed. **Fully Integrated** shows a complex layout with text, images, and diagrams related to lake formation and turnover, including a section titled 'LAKE TURNOVER' with seasonal diagrams for Summer, Fall, and Winter.

Figure 1. (opposite)

Three text-image integration strategies, from Peterson (2011), used in a quasi-experimental

study with middle school students. The examples shown are from one of three treatments.

my dissertation that I felt I was truly continuing that work instead of simply reporting on it. I can only speculate about whether this was avoidable.

Phase 1

The first phase of my research program corresponds to the five years of my previous assistant professor appointment, August 2011–May 2016. My most common scholarly product over this period was a conference proceedings paper (along with its presentation), often as the sole author. However, four of the seven conference proceedings papers were, in some way, reports related to design education, which often does not count toward a research requirement.

One of those papers (Peterson, 2014c) reports on separate undergraduate courses that paired typography and image making, the first of which I developed and taught during my doctoral studies. For that course, I created—it seemed from scratch—an image function typology, describing a range of ways that imagery might guide cognition. I did this solely for the purpose of structuring coursework. I subsequently discovered a “picture function” body of literature with considerable overlap (Carney & Levin, 2002; Hannus & Hyönä, 1999; Lenzner et al., 2013; Levie & Lentz, 1982; Levin, 1979; Levin & Mayer, 1993; Pettersson, 1998, 2013), which presented an opportunity for me to make a contribution, since my early typology was more extensive and more cognitively focused than its precursors.

In an early draft of my dissertation I had included a section on image function, but my advisor suggested I remove it, viewing it as extraneous material. Yet by 2014—having revisited that section when I incorporated it into my instruction for the second time in 2012—I had created an extensive internal document on image function for myself, which totaled 28 pages, 8,000 words, and over 60 figures (Figure 2). I saw this as a means both to collect my thoughts before seeking out collaborators, and to lay the groundwork for a career research program. This is because my typology offered an organizational structure for a variety of interconnected endeavors, with individual functions (e.g., metaphorical function) worthy of dedicated investigation in a range of disciplines, and the overall structure as a means for relating outcomes to one another in a research narrative. I knew the importance of clarity in research efforts, and that faculty are expected to develop depth of expertise rather than breadth.

My internal document’s figures were drawn from an extensive collection of sample imagery. Between the course offerings that centered on image function, dozens of students had collected and categorized imagery in analytical exercises, and I built a library with those examples. A small internal grant of \$7,000 in 2014 supported, among other things, a research assistant, who continued to collect imagery that

prompted continual revision of my nascent typology. This work helped me develop my ideas, but it was purely theoretical, which placed limits on publication, including pace—in my experience it is far more difficult to get a theoretical manuscript published than one with formal methods.

Following my internal document, this period ultimately produced two journal articles corresponding to specific functions (one on visual narrative and one on visual metaphor), and a conference proceedings paper on visual metaphor. The former (Peterson, 2019a) presented a framework on visual narrative and centered on an illustration found in a medieval manuscript (visible in Figure 2, middle left), while the latter pair (Peterson et al., 2017; Wise et al., 2017) reported on experiments with visual narrative advertisements in a collaborator’s media lab. Figure 3 shows excerpts of preliminary notes on visual metaphor that preceded those experiments, and led to future work in Phase 2 (Delgado & Peterson, 2018; Peterson, 2019b).

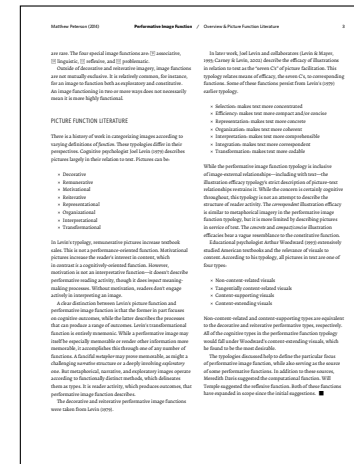
Phase 2

The second phase of my research program corresponds to the six years of my second assistant professor appointment, up to submission of my tenure dossier, May 2016–May 2021. Three of my aforementioned journal articles have publication dates during this phase, despite much of the work being done during Phase 1. Two more journal articles were nearing submission or were under review at the end of Phase 1 and were ultimately published in Phase 2, though one would require edits for a revise-and-resubmit result that rivaled the workload of the initial submission. The articles continued Phase 1 work on general image function (Peterson, 2017) and visual metaphor (Peterson, 2019b). Another general image function manuscript would be developed and eventually published as a journal article (Peterson, 2022a). And two additional journal articles covered topics that do not fit as readily into my overall research narrative (Peterson et al., 2020; Peterson, 2022b).

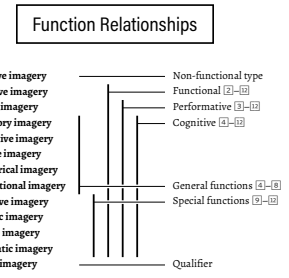
The work on visual metaphor is important to explain in greater detail because it led directly to another fruitful line of inquiry. In Phase 1 I had sought out a colleague in advertising for collaboration on visual metaphor (as documented in Figure 3) because the literature on visual metaphor in advertising addresses visual structure, which is a primary concern of image function. Phillips and McQuarrie (2004) built on previous work (Durand, 1987; Forceville, 1994, 1996; Kaplan, 1990, 1992; McQuarrie & Mick, 1996) to describe the range of ways that metaphorical sources and targets can pictorially suggest a metaphorical relationship.

In a metaphor, a source domain’s characteristics are applied to a target domain, in order to imbue the target domain with a new meaning. In purely visual metaphor, sources and targets take the form

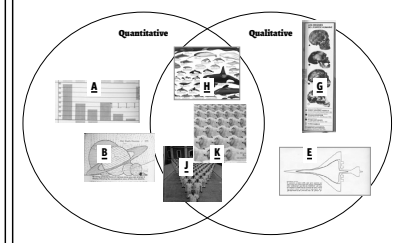
Document Pages



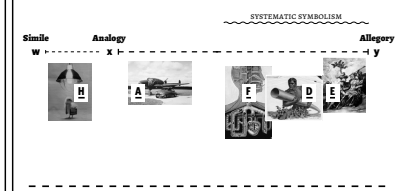
Rudimentary Frameworks



Function Distinctions



Metaphor Strategies



Narrative Strategies

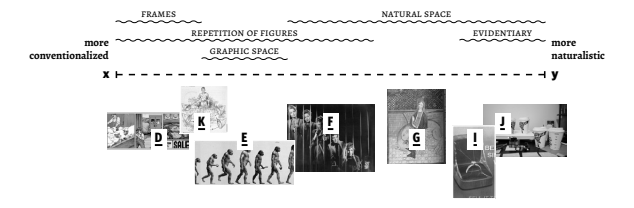
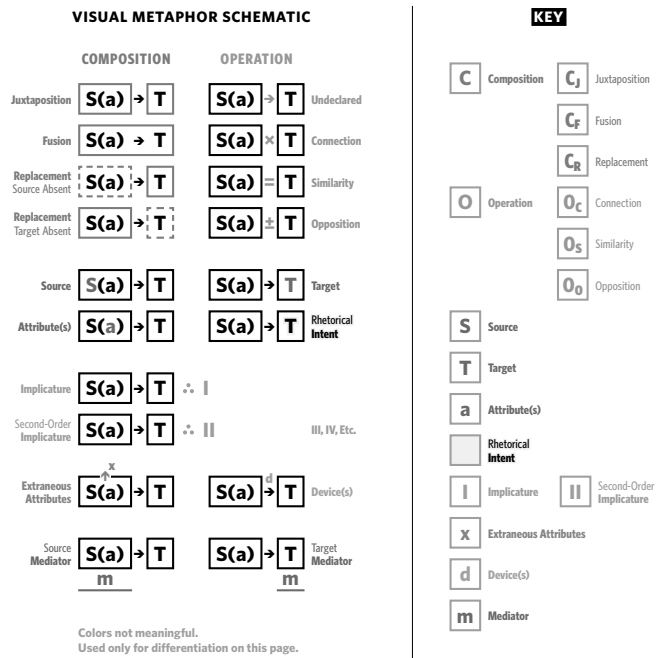


Figure 2.

Internal document on image function, circa 2014. The document includes rudimentary frameworks that were later revised and revised for publications: “function relationships” and “metaphor strategies” in Peterson et al. (2021); “function distinctions” in Peterson (2022b); and “narrative strategies” in Peterson (2019a).

Source (Attribute) → Target ∴ Implicature



Notation in Use for a Nested Metaphor

Thumb drive is enormous and speedy.

$$S(a) \times T(a) = T \therefore II_m$$

- Cheetah (S)
- Whale (T)
- Cheetah-Whale (S)
- Thumb Drive (T)
- Intentional Target
- Hyperbole: Size & Agility/Speed



Figure 3.

A notation system for visual metaphor, with many distinctions that were later abandoned. Informally analyzing metaphorical advertisements to develop this notation system helped me to better recognize nuances of

visual metaphor, enabling later work on Peterson (2019b), as evidenced in Figure 4. This analysis included recognition of nested visual metaphors (bottom), which led to an insight with a collaborator in Delgado and Peterson

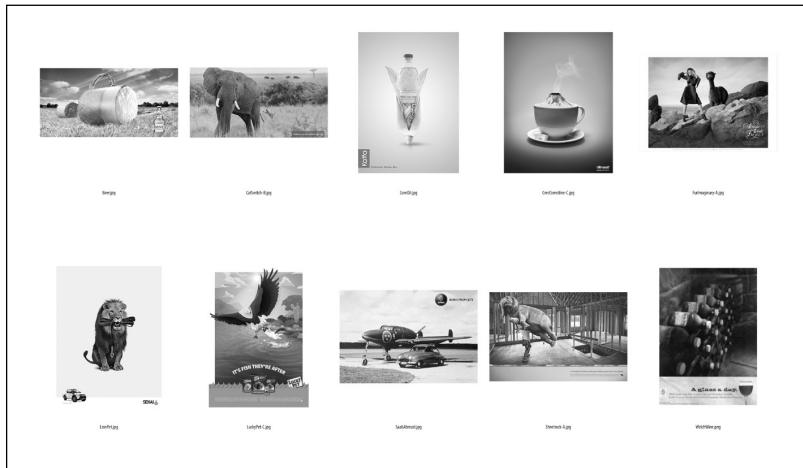
(2018), which related metaphorical mapping to Magaña et al's (2012) cognitive process of logical proportional reasoning. The advertisement was found on adsoftheworld.com, and is likely student work.

of pictured entities. Phillips and McQuarrie (2004) identified three structures by which this commonly occurs in advertisements, and my collaborator and I recognized that existing studies had not yet investigated these structures with "real-time behavioral measures" of cognition (Peterson et al., 2017, p. 65). In an experiment, and with research assistants, we found that *fusion* structures (in which source and target are hybridized together) required greater sustained cognitive processing than *juxtaposition* structures (in which source and target are complete and near one another), and that the former were also easier to recall than the latter. We ran two more experiments (also within the timeframe of my Phase 1) with ambiguous results that we published later at a conference (Wise et al., 2017). I also found another collaborator at my university in Phase 2 with an eye-tracking lab, and we fully prepared a follow-up experiment that would have further interrogated the theory on visual metaphor, but this colleague left the university before the experiment was conducted. This is an example of significant efforts that do not lead to reported outcomes.

During this time, I was putting great effort into a sole-authored manuscript that was ultimately published in another advertising journal (Peterson, 2019b). This theoretical paper further builds on the work of Phillips and McQuarrie (2004) by offering additional visual structures (Figure 4), doubling the total number of identified structures (from three to six). It also hypothesizes cognitive processing stages that will be differentially impacted by visual structure, and identifies additional variables of interest that should influence experimental results on visual metaphor in advertising.

Unlike my collaborator in the laboratory experiments, I did not have a disciplinary interest in advertising. Instead, it represented a stepping stone for me to explore image function in greater depth, and to gain expertise that I could take into my primary interest area: visualization and instructional media in science education. In the first year of Phase 2, I met with a few colleagues in my university's College of Education in hopes of finding a new collaborator. One colleague I met with is an expert on scale cognition in science. *Scale cognition* (Delgado, 2013; Delgado et al., 2007, 2015; Longo & Lourenco, 2007; Magaña et al., 2012; Tretter et al., 2006a, 2006b) refers to the cognitive processes necessary in using numbers and understanding "scale, proportion, and quantity," which is considered a crosscutting concept (National Research Council, 2012) that helps students make connections across topics, disciplines, and grades in science. Magaña and colleagues (2012) identified five distinct scale cognitive processes, including *logical proportional reasoning* (LPR), in which an analogy is created between entities of two equal ratios—e.g., a human is bigger than a chipmunk to the same degree that an elephant is bigger than a cat. My colleague and I realized that LPR could be extended by treating it as a *nested* metaphor—I had found examples of source–target pairs serving in turn as a

“Problems” Document



Visual Structure

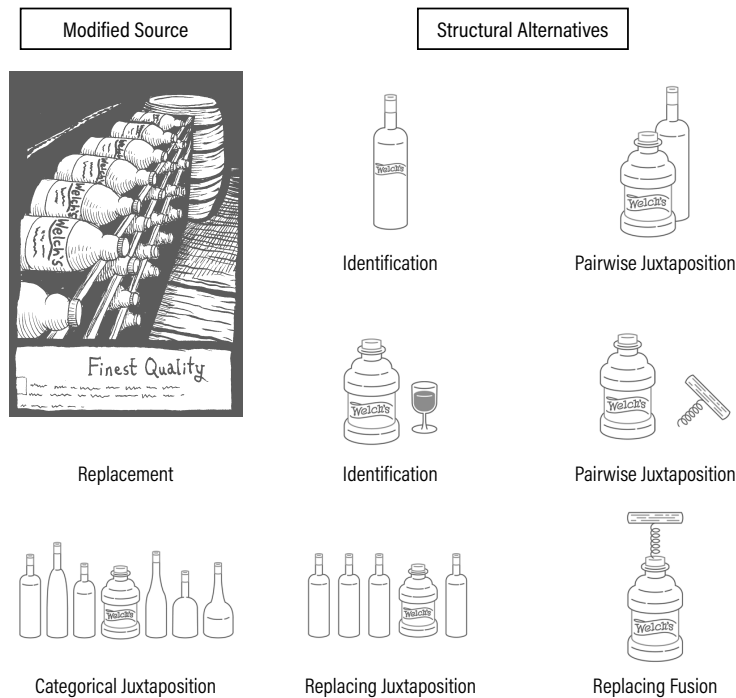


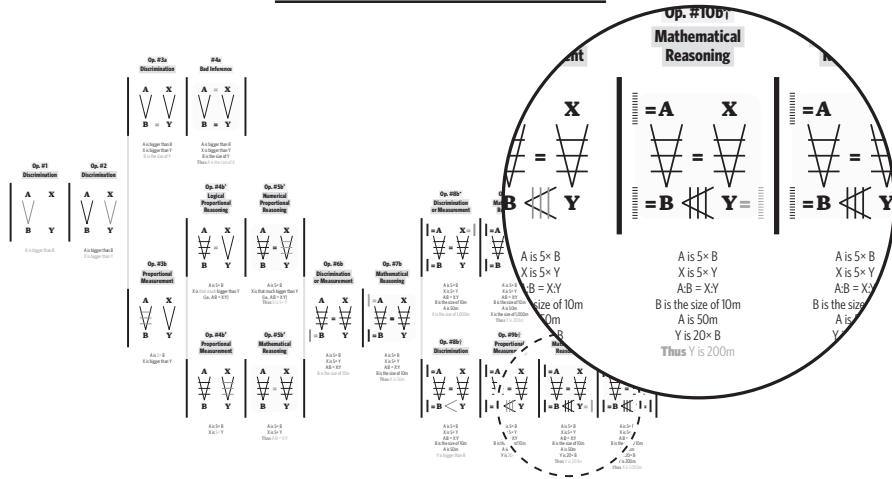
Figure 4. Developmental work on visual metaphor to expand Phillips and McQuarrie’s (2004) visual structure dimension. I compiled advertisements that presented problems when I tried to apply Phillips and McQuarrie’s typology to classify them (top). This ultimately led to my proposing additional visual structures in Peterson (2019b) (bottom). Illustration by Lucas Albrecht and Eric Pryor.

collective source to an additional target in advertisements (an example can be seen in Figure 3). We surmised that if one entity appears in both parts of the LPR analogy—e.g., a human is bigger than a chipmunk to the same degree that the chipmunk is bigger than a honey bee—a chain of scale cognitive reasoning will be formed. We call this a special form of LPR: *nested logical proportional reasoning* (NLPR) (Delgado & Peterson, 2018). NLPR appears promising because people have a tendency to lose track of scale ranges (Tretter et al., 2006a), and it may help to connect extremes of scale back to more familiar scales. This further led us to an interest in virtual reality (VR) to give learners scale experiences that they cannot attain in everyday life, but which are important in science. We then found another collaborator with deep expertise in VR, who transformed and elevated our nascent endeavor, resulting in three collaborators with distinct expertise and equal stakes in the project.

Following a \$4,000 internal grant in 2018 that funded the development of a prototype (Figure 5), and perseverance through declined grant proposals, we were ultimately awarded a grant of over \$1.3 million by the National Science Foundation (NSF) (Chen et al., n.d.). This is a transformative accomplishment in my career because it funds extensive interdisciplinary research that will in turn produce many tangible outcomes. I discuss it briefly in the section on Phase 3, due to the project’s starting date. But other work was being completed concurrently with our successful proposal to NSF, which is a further culmination of my work conducted at the beginning of Phase 1.

My scale cognition collaborator and I extended my earlier work on image function with additional collaborators, completing an analysis of science textbooks and a resulting extension of my image function typology into what we now consider a taxonomy (Peterson et al., 2021). We reported on a basic qualitative research design using a constant comparison method (Corbin & Strauss, 2008) to achieve agreement between two coders when assigning specific image functions to visual displays in science textbooks. This process resulted in an expanded and actionable taxonomy that is both attuned to science visualization practices and significantly more extensive than the earlier picture function typologies. Our taxonomy includes a processing model that may facilitate future experimental work on image function. It also includes a structural framework (Figure 6), which permits the deconstruction of complex visual displays into constituent semiotic elements. This structural framework was realized as an extension of visual structure in visual metaphor (Peterson, 2019b; Phillips & McQuarrie, 2004), and thus my exploration of metaphor in advertising ultimately helped me return to image function—my earliest work in Phase 1—and apply it to my primary interest area. Thus, our expanded image function taxonomy sits at the far end of a 10-year strategic process. My collaborator and I have conceived of further work to follow this publication, which we believe is

Theory "Rabbit Hole" Document



Scale Worlds Prototype

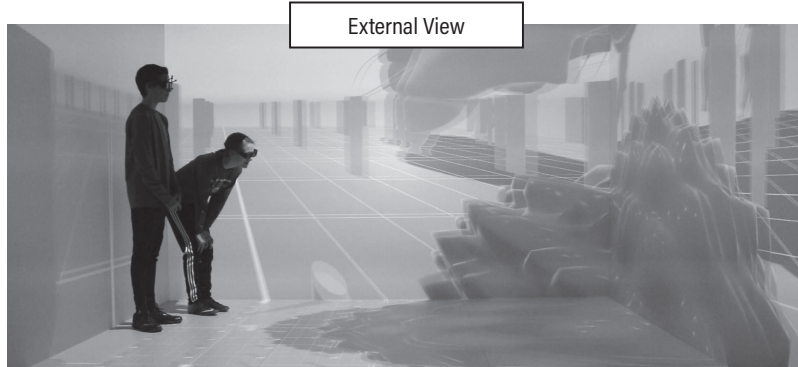
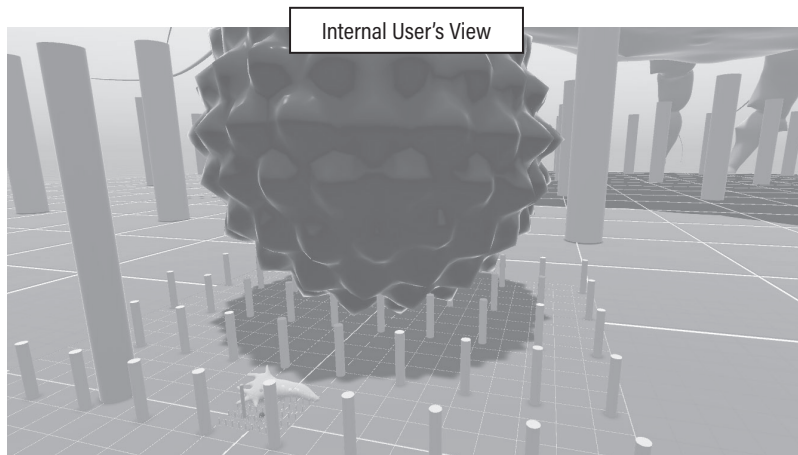


Figure 5. (opposite)

Early involvement in scale cognition. I created a document that I ultimately labeled a "rabbit hole" (top), in which I utilized a notation system to try to understand scale cognitive processes (Magaña et al., 2012). Like the visual metaphor notation system seen in Figure

3, this is an example of my use of diagramming to engage with theory—though in retrospect I do not understand this particular documentation, and it was a dead end. Further work with collaborators led to the prototype version of Scale Worlds (bottom). Two views are shown here. One

immerses the user in the environment. The other reveals the technology employed. Karen Chen's lab has a CAVE (Cave Automatic Virtual Environment), which is a projection system with tracked glasses. Users see projected imagery that is distorted to match their vantage point. The Scale Worlds prototype was created by Grace

Wonaphotimuke (development), Matthew Peterson (design specifications), Karen Chen (technical consultation and additional programming), and Cesar Delgado (consultation). It was supported by a Faculty Research and Professional Development Grant from N.C. State University (PI Peterson).

fundable, and we are actively pursuing related opportunities. These efforts will involve the development of new visual displays for science education, and the evaluation of their efficacy for learning.

Phase 3

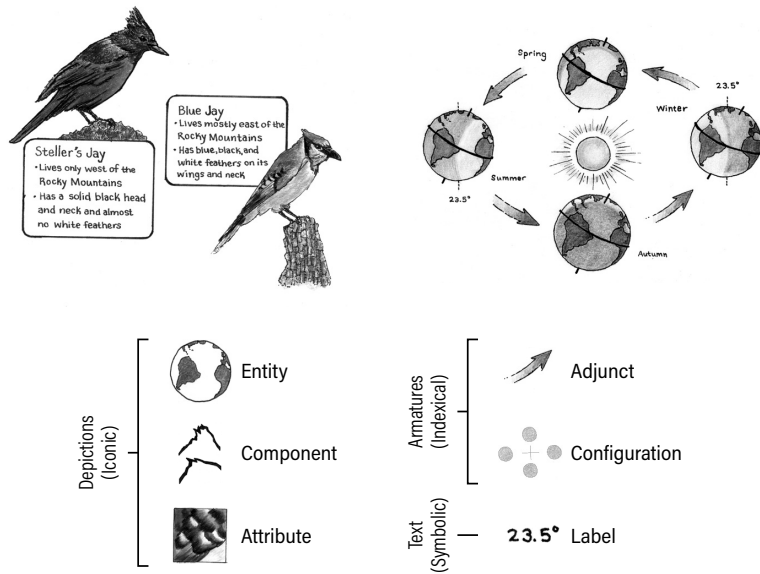
The third phase of my research program is ongoing (I write this in spring 2022), beginning with the submission of my tenure dossier in May 2021. Our NSF-funded project allowed me to reduce my teaching load at the start of Phase 3, and I am using the increased flexibility that comes with fewer scheduled classes to increase my productivity. I have two external grant proposals underway, which will be submitted soon. I have a few co-authored manuscripts in varying degrees of development and peer review.

My personal responsibilities on our funded project include front-end development of two versions of an immersive environment, called Scale Worlds, that permits users to scale themselves up or down by powers of ten when manipulating numeric representations. I am also involved in our development of manuscripts for publication and data analysis on studies with human subjects, which has already begun and will intensify in the second year of activity. In the interest of brevity, I will not describe our project in more detail than is supplied in Figure 7. But I do want to emphasize some of the implications Scale Worlds has for my own experience as junior faculty.

My earliest Phase 1 efforts were entirely isolated, and they felt rudimentary at the time. I did begin working with some collaborators during Phase 1, however, and this suggested a new reality. In Phase 2, I became more deliberate in seeking collaboration. However, I was still frequently working on sole-authored manuscripts, and meetings with collaborators were brief interactions that occurred following long periods working alone. In Phase 3, because of Scale Worlds, I am far more connected to colleagues, and there is greater variety in my efforts.

The Scale Worlds project team consists of three principal investigators (PIs), each of whom has a dedicated research assistant (RA), in three disciplines: engineering, education, and design. All PIs and RAs meet together for two hours every week. I have additional extended weekly meetings with the design RA, and have had as many as two other design students working hourly. This environment is consistent with other

Internal Structure of Imagery



Function Relationships

APPROACH FUNCTIONS	ACTIVITY FUNCTIONS	OUTCOME FUNCTION
	7 ... 14 →	8 Constitutive
5 6 10 →	1 Metaphorical C	8 U
5 10 →	2 Categorical W	8 U
5 8 10 →	3 Integrative W	8 U
5 10 →	4 Narrative CW	8 U
5 6 →	5 Distinctive W	11 ... 13 U
5 →	6 Computational W	8 U
5 →	7 Creative C	12 13 U
5 6 →	8 Linguistic C	8 U
5 →	9 Problematic C	7 11 14 17
5 Relational	→ 6 ... 14	
6 Definitive	→ U	
8 Incidental	→ U	
2 Reiterative	→ N	
1 Decorative	→ N	

Key

- [] : Initiation of a function
- [#] → : Resolution of a function
- U : Used (i.e., as external cognition) w/ no long-term memory change
- N : No active use
- F : Failure to resolve
- C : Challenge function
- W : Workspace function

Figure 6.

Refinement of theory on image function. The structural framework (top) permits the deconstruction of visual displays into their constituent semiotic elements, as reported in Peterson

(2022b)—icon, index, and symbol are references to Charles Sanders Peirce's work (Burks, 1949). Relationships among entities in a visual display can be described as functions. The arrangement of

functions (bottom) represents a refinement of "function relationships" in Figure 2, and this was refined further with collaborators in Peterson et al. (2021). Illustration by Micaelah Scott.

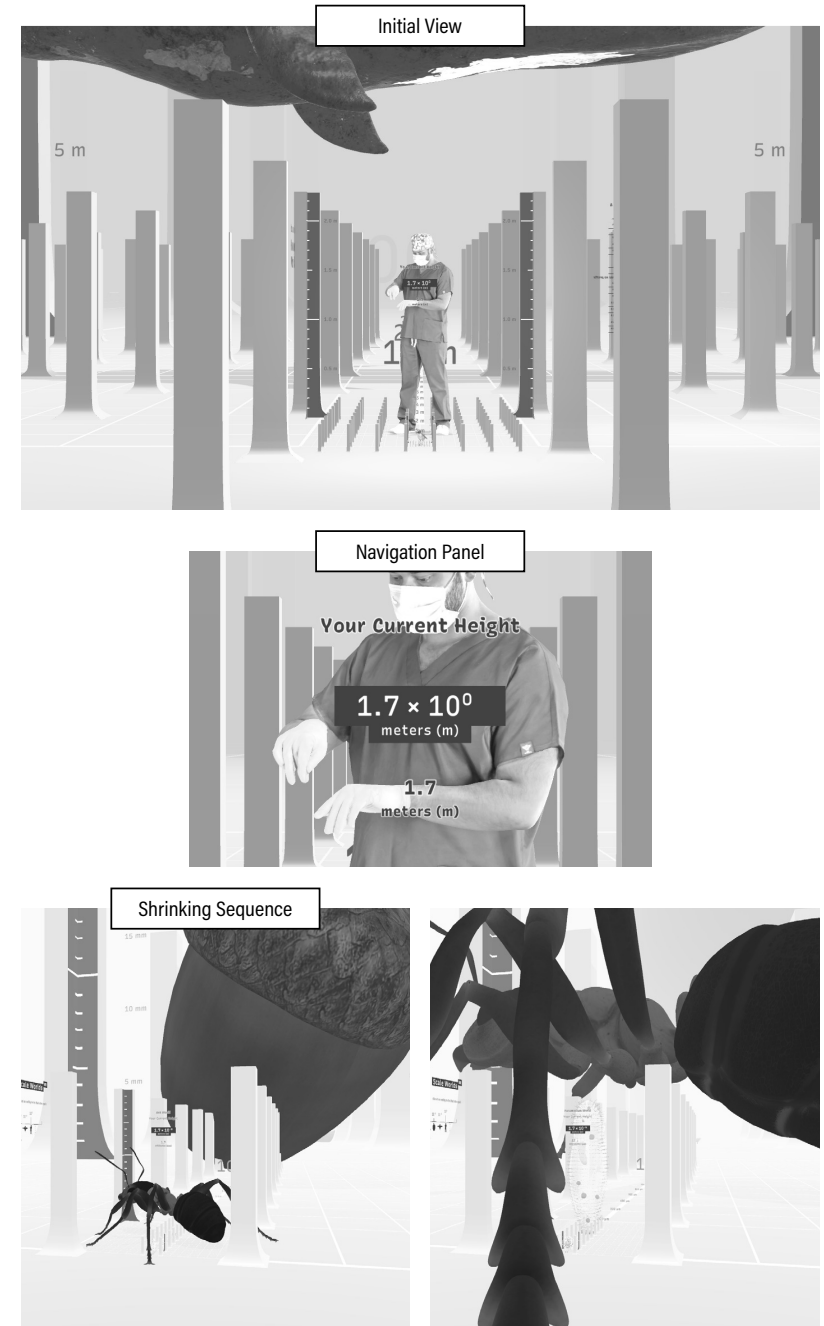


Figure 7.

A recent version of Scale Worlds. Users can flip the exponent in scientific notation, or move the decimal in standard notation, to grow or shrink by powers of ten. Each power of ten is represented by a distinct entity (e.g., human,

robin, acorn, ant). Scale Worlds is actively under development by an extensive team of collaborators, listed here in alphabetical order: Karen Chen (PI), Cesar Delgado (Co-PI), Tyler Gamp (RA), Meghan Jack (technician),

Matthew Peterson (Co-PI), Brian Sekelsky (RA), and Linfeng Wu (RA). This work is supported by the National Science Foundation (DRL-2055680).

more established research disciplines. The design RA, who is currently a master's student, is gaining experience not only in design development in an academic context, but in research with human subjects, data analysis, manuscript preparation, and grant writing, and will graduate with a publication record—a rarity in design in the United States at the master's level. But this situation is only possible because of years of dedicated preliminary work, which required strategy, discipline, perseverance, and support. I had to create the necessary momentum over time, though I hope that my own students—if I can continue to be successful in securing external funding—will begin their junior faculty positions with significant momentum.

Trends Within the Phases

Figure 8 charts five kinds of outcomes through Phase 1 and Phase 2: refereed conference presentations, conference proceedings papers, book chapters, peer-reviewed journal articles, and grants, each of which represents one line on a CV. But Figure 8 quantifies scholarly outcomes equivalently—i.e., at equal height units—which is misleading. CVs are evaluated not simply according to the number of lines present, but the perceived quality of those lines. This evaluation will vary from individual to individual, especially because design is not a mature research discipline, and faculty and even administrators have varying knowledge levels, assumptions, and values—especially when design programs are placed within art units.

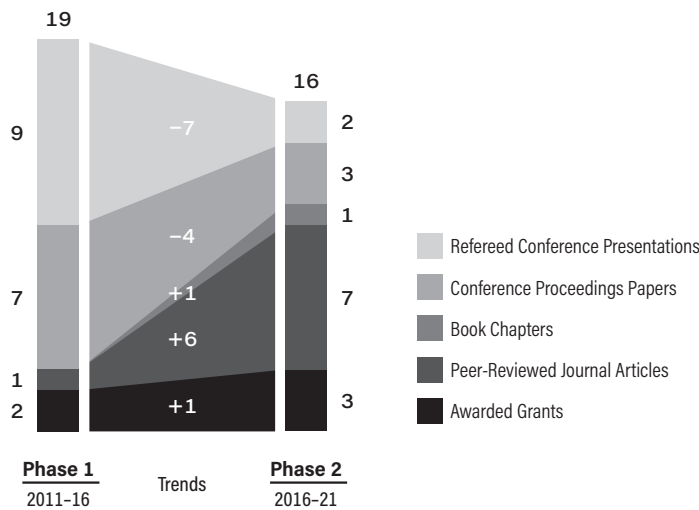


Figure 8. Scholarly outcomes through two phases of a research program.

Particularly misleading in Figure 8 is the increase in awarded grants from two total in Phase 1 to three total in Phase 2, or

an increase of 50% by count. Unlike publications, grants are easily quantified by total funding. In fact, my Phase 1 awarded grants in research were \$11,000 total, while my Phase 2 grants were \$1,360,070 total, or an increase of 12,264% by dollar. This is an extreme example that illustrates the need to evaluate CVs carefully.

Figure 8 does not report all activity. I have excluded outcomes that do not fit into these stated categories, such as invited presentations. Outcomes shift dramatically from Phase 1 to Phase 2. In Phase 1, more than half of my conference proceedings papers were focused on design education, which is not considered research. Furthermore, conference outcomes dominate Phase 1, while more highly valued journal articles dominate Phase 2. My journal articles represent a greater accomplishment than my conference proceedings papers, and required much more work. However, as described above, some Phase 2 journal articles were largely products of Phase 1 efforts. Likewise, two more journal articles were ultimately published in the first year of Phase 3, though they were largely products of Phase 2 efforts.

Figure 9 plots the scholarly outcomes of Figure 8 on a timeline, and includes grant proposals that were declined in Phase 2 (I have inadequate records to supply the same for Phase 1, though I only

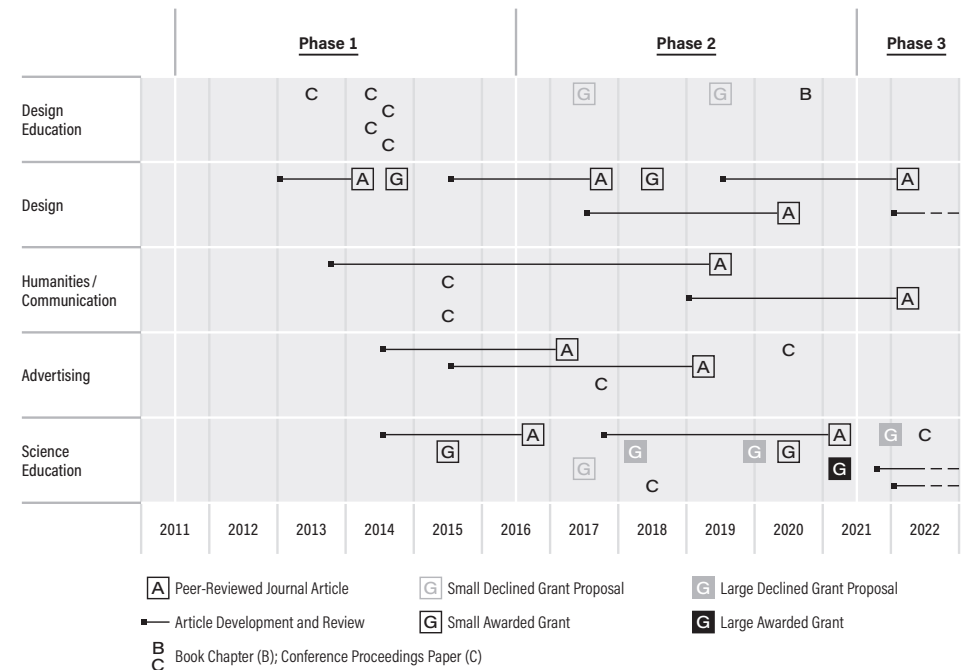


Figure 9. Scholarly outcomes timeline by venue discipline. Large grant proposals are over \$1 million, and small grant proposals are below \$25,000.

submitted a few small internal grants). For journal articles—which take time to develop, complete the peer review process (including rejections and revisions), and go from “in press” status to publication—I have drawn lines that indicate the full development and review process. In this case, development may begin for a theoretical paper when an outline is created, or for a report on an empirical study when a research design is drafted.

Figure 9 suggests a fallow period at the beginning of my initial academic appointment. I was actually completing my PhD in fall 2011 (my first semester of employment), writing the remainder of my dissertation, and defending it (I already had a terminal master’s degree). Thus, my sole outcome that semester was the dissertation itself, which does not count toward the publication record. Doing this while starting my first full-time teaching position was, as could be expected, overwhelming. But no scholarly outcomes appear the following calendar year, either. I was certainly preoccupied with teaching and curriculum design, recovering from the PhD process, and having to strategize a new research program. Some of my time was spent studying visual metaphor, and it took a great deal of study for me to be capable of making a contribution of my own. The earliest journal article in Figure 9 (Peterson, 2014b) was in development no later than early 2013 (my records are incomplete), and this article “hit” during Phase 1. But the main story of Phase 1 is that other publication efforts were underway, with five additional manuscripts targeting peer-reviewed journals either in early development, under review, or in press. However, such delays must be appreciated by administrators reviewing a tenure dossier, and though each of the five manuscripts was ultimately published, this was not a given. The picture of Phase 1 may suggest a position of weakness, depending upon interpretation and review criteria, while Phase 2 suggests a position of strength (though it may not in many other more established research disciplines).

Phase 2 in Figure 9 reveals a concentration of efforts related to science education, particularly in grants submitted (all four large grant proposals were submitted to the NSF). Each of the large grant proposals was a massive undertaking. And these grants are highly competitive—with success rates as low as 8–12%—so pursuing one means sacrificing other possible endeavors. I was only able to pursue these grants for three reasons. First, my work had matured to the point that I could argue for my expertise based on a publication record, and in pursuing that publication record I had become more capable of contributing to a competitive proposal. I could not have made a respectable contribution to an NSF grant proposal in Phase 1. Second, my Phase 1 efforts were slowly becoming Phase 2 outcomes, which allowed me to appear reasonably productive in Phase 2 while “stealing” time away for grant writing. Third, I was leading a multi-year accreditation effort for our undergraduate and graduate programs, and for this my department head granted me course releases in multiple years,

slightly reducing my teaching load. While the course releases were fair to the department and did not give me more time than I otherwise would have had overall—that is, the amount of time I put into accreditation was equal to the teaching I would have done instead—the flexibility I gained in scheduling activities was transformative. I could ignore accreditation work for weeks before devoting heavy hours to it over a shorter period of time, and in doing so I was able to schedule devoted periods of grant writing. Writing complicated grant proposals, like preparing complicated manuscripts, cannot be done well in small blocks of time. I have found that for these activities, I need to occasionally devote three or so full consecutive days, and enter something like a fugue state while engrossed in the problem.

These three supports for my grant writing have important implications for junior faculty in design. The first support, *personal research maturity*, will not usually develop for design faculty until late in a tenure track position or even after the tenure clock has run out—I was simply more capable in my second consecutive assistant professor position. The second support, *benefitting from earlier delayed efforts*, would normally only be available for the rare design faculty member who worked in a productive lab during their studies. I had this benefit instead because I was in a second assistant professor position. The third support, *reduced teaching load*, is normally only available on the rare occasion that a design faculty member is awarded a large external grant that pays for release time, which presents a catch-22 (or a chicken-and-egg paradox). The three supports I utilized are typically absent.

Challenges for Junior Design Faculty in Interdisciplinary and Evidence-Based Research

Challenges Particular to Design Faculty

A challenge endemic to design units at research universities is the disproportionately heavy teaching load for design faculty, which puts them at a disadvantage in relation to their colleagues elsewhere in the university. Corresponding to heavy teaching loads is reduced infrastructure that supports research: the more faculty in design teach, the less they collectively produce in research activity, and the less justification design units have for investing limited funds in research support.

Many of the most impactful endeavors at research universities are interdisciplinary collaborations. Engaging as equals with collaborators in mature research disciplines is challenging for junior design faculty. Many design faculty start at a disadvantage because their highest degree is a professional master’s degree, which is the field’s terminal degree in the United States, and they must gradually integrate with other colleagues’ research practices by familiarizing themselves with those practices on the job. (To be clear, this is not a criticism. Because the professional master’s degree—e.g., MFA, MDes, MGD—is indeed the terminal degree, the field would be remiss to erect barriers for design faculty who rightfully hold one.) Other design faculty have a professional doctoral degree, which does not always involve training in evidence-based research.

Interdisciplinary collaboration requires publication and grant writing in non-design venues. Writing for another discipline’s audience is exceptionally difficult, as disciplines have tacit schemas by which members operate. Members of these disciplines grow into their schemas both consciously and unconsciously as students engaged in research degrees. Outsiders have difficulty perceiving unwritten standards.

For large external grants, design faculty must collaborate with other disciplines. The more prestigious and lucrative the grant, the more rigorous the review, and the lower the success rate. In highly competitive reviews, a single weakness can be enough to doom a proposal, since program officers and reviewers need to differentiate among a set of strong proposals. There is also luck involved—luck of the draw of reviewers, luck of the pool of proposals in which a proposal falls, and luck of other kinds. Evonne Miller (2021) recounted receiving successive declined proposals in what made the process feel like a “lottery” (p. 180). Her proposal was rated in the top 10% in one year but did not quite get the award. The following year she tried again with the same proposal, but it was then rated in the bottom 50%.

The comments received from grant reviewers can be disheartening. But they are also invaluable in interrogating both one’s assumptions and the quality of a concept that a grant writer is predisposed to rate highly themselves. A senior faculty member explained to me the benefit of unfiltered reviewer comments:

— When I first started writing grant proposals, I was surprised and pleased (in a perverse way) to have the critical feedback. It alone almost made the [grant]-writing worth the effort (almost). Insightful, honest feedback is a rare commodity. I think professors, who can become little lords in their classrooms—always right—always surrounded by inferiors as far as knowledge goes [as opposed to “superiors” in terms of classroom hierarchy], particularly benefit from a little critical feedback on their ideas.

Targeting and Appraising Publications

A successful publication record is dependent upon the publication venues themselves. Junior design faculty are at a disadvantage in targeting and appraising publication venues due to the heterogeneous nature of research and creative work in design. Other, more established disciplines have unwritten standards that are internally reinforced through continuous within-member interactions. In design, faculty are more often isolated by their particular kinds of research engagement. Design faculty can draw parallels between their work and another discipline, but no parallel is complete, and thus there will inevitably be some sense of uncertainty.

When a scholar has the earliest inkling of a concept for a project, they should begin considering what venue might be appropriate for it, as well as how publishing in that venue will be valued. Table 1 presents my general sense of publication values in a fuzzy area that combines related disciplines in the social sciences. It is my own aggregate impression, drawn from observing conversations (online and in-person)

Relative Ranking	Publication Venue	Source of Merit
Highest value	Authored book	Scholarship’s merit and scholar’s reputation—dependent upon publisher’s credibility
	Journal article	Scholarship’s merit—dependent upon journal’s credibility
High value	Conference keynote	Scholar’s reputation—dependent upon conference’s credibility
	Book chapter	Often scholar’s reputation and sometimes scholarship’s merit—dependent upon invitation or open call, and in the latter case, the model of peer review
	Conference proceedings paper	Scholarship’s merit
Moderate value	Conference poster or presentation	Scholarship’s merit
Inconsistently valued	Book review	Scholar’s reputation
Devalued	External blog post	Scholar’s reputation
	Self-published book	<i>Not applicable</i>
	Personal blog post	<i>Not applicable</i>

Table 1.

A “reasonable” rank ordering of publication types, not an absolute one, and not one applicable across all disciplines. The edited book is purposely excluded, as it is particularly difficult to assess without declaring a discipline.

among members of other disciplines (e.g., science education, psychology) about the rank-ordering of publication types. Even if it is a fair aggregate impression, it may not accurately describe any single discipline.

While there can be a mystique to books, journal articles are almost universally valued over book chapters (with the caveat that “always” is almost never true). I offer a partial explanation for this in Table 1: book chapters are sometimes invited, which is a matter of reputation, whereas an academic journal usually evaluates scholarship directly, with anonymous versions of submitted manuscripts placed under the scrutiny of peer review. Some scholars devalue book chapters because of delayed publication, limited access, and the investment costs in pursuing them over other outcomes (Blattman, 2014a, 2014b; Pacheco-Vega, 2014); or characterize book chapters as an appropriate career outcome for senior faculty specifically (Mathieson, 2013). But this valuation does not apply across all disciplines, and such bias may not apply to many design faculty. It is also important to recognize that some important work only has a home in books, as academic journals select articles according to their respective missions, which may be limited.

In contrast to varying opinions on the book chapter, the journal article is consistently considered the height of peer review. Thus in a post on advice for junior faculty, Greg Mankiw (2007) wrote: “Your focus should be on getting papers published in refereed journals. Everything else is secondary.” But recommendations change dramatically over the course of a career, as reflected in Manya Whitaker’s (2019) advice:

— After 25 years on the job, many academics take a step back from the publishing rat race and focus on scholarly mentoring. I don’t mean guiding a handful of people through their careers. Rather, I mean creating opportunities for younger scholars to publish—for example, editing a book series, directing institutes and centers, or curating performances, exhibitions, and productions.

Note that in Table 1, I make no mention of faculty effort—that is, how much time was put into a publication. Some junior design faculty may assume that their effort is being evaluated. But the merit of their scholarship or their reputation is another matter. This is why self-publication does not even register in established disciplines—a self-publication has not been validated. It is also important to note that “peer review” is a specialized term. It does not refer to just any kind of review offered by anybody like a peer. As Whitaker (2019) stated:

— Other permutations of peer review won’t count as much [as the double-blind review by an academic journal]: for example, when academics in an edited collection give feedback on your chapter or when press editors offer revision suggestions. Sure,

there is an element of peer review in both cases, but that’s not what the term means when it comes to high quality, rigorous publishing on your way to tenure and/or promotion.

Even when junior faculty in design feel relatively certain that they have a viable publication strategy, and that their administration will view their choice of publication types fairly, they must be able to differentiate publication venues themselves. Publication in a conference’s proceedings will be valued in accordance with the conference’s credibility, and a more exclusive conference will carry more weight, as measured in a lower percentage of papers accepted. Likewise, a journal article’s value is dependent upon its journal’s credibility. Junior faculty may be unaware of how a given journal is viewed by more experienced scholars.

There are predatory journals that reach out to faculty, offering easy publication, often with a publication fee. I have found it easy to vet unfamiliar journals by simply conducting an online search for the journal name appended with “predatory,” which will reveal online conversations between scholars. A single conversation is not definitive, but it is a starting point. Some venues—journal, conference, or otherwise—are not predatory, but still have lower value in the eyes of more experienced scholars. Even in this gray area, online conversations can give the junior faculty member some understanding of a venue’s credibility by “overhearing” senior faculty. For instance, one publisher was discussed on a “PhD in Design” discussion list in relation to its general quality as a venue for publication:

— With respect to the journals from [the publisher], it is worth noting that [they are] not a predatory publisher. Rather, they have developed a dicey business model that manages to mimic some of the attributes of serious publishing without doing the real work of editing journals or managing serious conferences.

— As a result, they produce apparently real journals of low quality. Because the quality is low, nearly nothing they publish is cited. The special trick of their business model is to arrange swift conversion from conference paper to journal article while inviting authors to review other papers for a credit as an “associate editor” of the journal. This means three ticks on an author’s CV. Conference participants who become journal reviewers and authors present a conference paper, publish a journal article, and attain an “associate editor” designation, all for the same price. The problem is that none of these credits is meaningful.

— ...The [corresponding] conference series is linked to the [publisher’s] journals. There have been two main changes to

the journals since my first posts. Instead of the 17 journals that they published with the same two editors, they now publish something like 77 (!) journals. Their pitch is a bit more clever than it once was, and they have added new editors. The same two editors no longer edit every... journal. The single design journal they once published has grown to become a collection of six journals and a yearbook — seven (7!) publications. (Friedman, 2017)

I provide the above excerpt (cf. Cope, 2017) without having ever interacted with the publisher in question, and so I have withheld the publisher's name. I include the excerpt because it is a good example of an experienced scholar parsing out factors that lead to disciplinary judgments, and the post is in fact publicly available online. It demonstrates that targeting and appraising publication venues is a problematic enterprise, and should be done with care.

Temporal and Emotional Dimensions of the Publication Cycle

Publication is its own challenge, for all faculty. What is unique about design faculty is that their administrators may not appreciate how difficult and time consuming publication in competitive peer-reviewed academic journals can be. Figure 9 plots lines for journal articles that indicate the full duration of manuscript development to publication for my own articles. In some cases delays occurred because I could not find the time to return to a revision. In other cases a manuscript was locked in a single round of peer review for over a year. Table 2 offers more detail on four publications, though I am identifying neither the publications nor the journals by name (some publications are co-authored, and my co-authors may not be as comfortable revealing these details as I am). Table 3 provides a more granular timeline of one manuscript's development, review cycle, and accumulation of citations (according to Google Scholar, which in its automation can slightly inflate citations). Citation count is a useful indicator of a publication's impact, though there are disciplinary bounds that must be considered. Because design is an immature discipline, publications receive a small fraction of the citations compared to those in some other disciplines, especially in medicine and science. And because publication can take so long, citations accumulate slowly; they are the result of other publications, after all, which are subject to the same publication cycle.

The manuscripts documented in Table 2 are fairly representative. Though I have had a manuscript accepted for publication on the first attempt, I am more accustomed to receiving two rejections before acceptance. In most cases, a rejection comes with comments, either from

Manuscript	Journal	Result	Review Cycle Duration
Manuscript A: visual communication or design	Journal A	Publication suspended, unable to review	2 years and 10 months from initial submission to indexed publication, with 6 submitted drafts
	Journal B	Desk rejection	
	Journal C	Revise and resubmit	
		Rejection	
	Journal D	Minor revision	
Accepted			
Manuscript B: design	Journal E	Revise and resubmit	2 years and 2 months, with 7 submitted drafts
		Rejection (by editorial board review)	
	Journal F	Rejection	
	Journal C	Revise and resubmit	
		Rejection	
	Journal A	Minor revision	
Accepted			
Manuscript C: advertising	Journal G	Desk rejection	2 years and 6 months, with 4 submitted drafts
	Journal H	Desk rejection	
	Journal I	Revise and resubmit	
Accepted			
Manuscript D: design	Journal C	Rejection	2 years and 6 months, with 4 submitted drafts
	Journal J	Rejection	
	Journal K	Minor revision	
Accepted			

Table 2.

Results of submitted drafts leading to publication.

the editor alone (in the case of a desk rejection), or from two or three peer reviewers. In the case of a revise-and-resubmit, in which the journal does not accept the paper but encourages a revision, comments become available while the possibility of publication in that journal remains. Reviewer and editor comments can be invaluable, drastically improving the quality of a manuscript. For this reason, it should not be assumed that the journals that accepted a manuscript in Table 2 are lesser than those that rejected it.

Year	Month	Event	Status
2015	January	Internal document on notation for visual metaphor created (general work becomes particular project)	—
	June	Notes for manuscript development created	
2016	January	Document outlining begun	In development
	February	Commissioned illustration for the article begun	
	April 3	Writing begun	
	June 12	First draft completed	
	June 15	Second draft completed	
	June 15	Submitted to the <i>Journal of Advertising</i>	Under review
	June 22	Desk rejection	In development
	July	Submitted to <i>Marketing Theory</i>	Under review
	July 20	Desk rejection	In development
	July 28	Submitted to the <i>International Journal of Advertising</i>	Under review
	October 9	Rejected with request to revise and resubmit	In development
2017	December 16	Revision resubmitted	Under review
2018	February 25	Accepted	In press
	April	Pre-published online (but absent in some search results)	Early view
	End-of-year	Citation count: 1	
2019	January	Published and indexed (38.1: 67–96)	2019
	End-of-year	Citation count: 1 (+0)	
2020	End-of-year	Citation count: 10 (+9)	
2021	As of April	Citation count: 13 (+3)	
2022	As of April	Citation count: 25 (+12)	

Table 3. Development and publication timeline for one manuscript.

In many cases a third or fourth submission is profoundly superior to the initial one.

However helpful reviewer and editor comments can be, they must be parsed and addressed selectively. And on a personal level, comments can be difficult to process, especially when they come with

a rejection. Most top journals employ a double-blind review process, meaning that the peer reviewers do not know who submitted the anonymized version of the manuscript they are reviewing, and the authors do not know the identity of the reviewers. Consequently, reviewers are famously brusque. Editors, in contrast, are most often courteous. Though I am accustomed to rejections, and the copious critical comments that accompany them, I found the following editor's comments upon one rejection to be insulting:

— This article makes the world more difficult to understand because it uses a seemingly theoretical language disconnected from the world it attempts to describe. I suspect that this is a writing problem rather than a thinking problem, but we can't do the paragraph-by-paragraph editorial work with you that we'd need to do to clarify this. Only when the article becomes clear, will it be easy to understand the conceptual content. I have two suggestions for you, one short term and one long term. The long term suggestion involves learning to write more effectively. I recommend that you make use of three books — *Elements of Style* by Strunk and White, *Clear and Simple as the Truth: Writing Classic Prose* by Thomas and Turner, and *Stylish Academic Writing* by Sword. This will take some time, but you have a long career ahead of you, and learning to write well is a worth while investment. My short term suggestion is that you ask an experienced author to join you as second author of this article. . . . As it is, we are rejecting the article. We hope that you can work with a skilled co-author to clarify and improve it for another journal.

This editor knew my identity, and had access to my publication record, and so the suggestion to work with a "skilled co-author" felt different than it would coming from a peer reviewer. Of course, each editor is a particular person, and each journal is a particular institution, and authors must decide what to make of commentary. It is good for junior faculty to occasionally seek feedback (and possibly support) from senior faculty, to help them interpret comments and cope with failure. In response to another rejection of the same manuscript in another journal, a senior faculty member wrote to me and conveyed knowledge of that journal's particular tendencies that helped me interpret negative commentary, and said: "Keep at it—you'll break through." I did eventually.

Both negative and positive comments are likely in any peer review, irrespective of the quality of the manuscript and even the outcome of its evaluation. For instance, the following reviewer comment accompanied a journal's *rejection* of one of my manuscripts:

— A fantastic paper. Articulate with a streamlined flow. I did not see anything that needed modification.

Ironically, the same manuscript received the following comment from a reviewer when an improved version was *accepted* by another journal, which requested only minor revisions for publication:

— I'm just scrolling hoping in your conclusion you make this effort useful. So far, the work is exceedingly dull.... I appreciate the use of outside sources as models for a cognitive reading of images, but does the work need to be so strikingly dull?

This comment is not very helpful. But in cases where a review is ongoing (e.g., minor or major revision; revise and resubmit), the author must respond to reviewers. In some cases this entails explaining elements of a revision, and in other cases it is a justification for not addressing a specific comment. For instance, my response to the above "dull" comment was:

— The writing or the figures used as examples? If the writing, I believe these concepts need to be explained plainly and (technically) with careful terminology. If the figures: I am focusing on what are not necessarily "remarkable" works precisely because I discuss conventional practices. Indeed, at least as this work matures, it should describe the mundane as well as the exquisite. It is not a means to make such a judgment. A narrative picture can be exciting or disappointing.... But the important thing here is the internal structure of the picture.

Addressing reviewer comments often requires additional work, as in this example:

— As presented, the paper is well argued but theoretical. Including more description of the evidence that led to this picture/image typology would give necessary weight and credibility to the typology put forward in the paper.

I addressed this comment directly. It reveals a bias against purely theoretical manuscripts—a bias that I consider fair. Theoretical papers are necessary, but disciplinary knowledge must be built up from evidence, and a discipline should only accumulate so much untested theory.

Table 4 collects reviewer comments along with portions of my responses, arranged according to the workload required. (All comments come from peer review for the manuscript documented in Table 3.) Structural changes to manuscripts can be extremely time-consuming, often more so than significant additions. What unifies all the reviewer comments in Table 4 is how insightful they are.

Perhaps the most common type of comment from peer reviewers is to address literature that the reviewer assumes the author has overlooked. In at least one case, I have been profoundly embarrassed that I was unaware of literature that was essential to my manuscript's argument. In many cases, the literature that is referenced can be incorporated

Reviewer Comment	Relative Workload and Author Response
"On page 23, I am not sure what you mean by 'illustration style'? How is this distinct from other factors, such as distractor presence, environmental apportions, etc.?"	Very light workload. This required a single expanded explanation in a single location. "The bullet point on illustration style now includes a brief list of possibilities to make it clear to the reader what kind of variation is envisioned here."
"The paper sets its foundation on the work of Phillips and McQuarrie (2004), but these authors were trying to explain all visual rhetoric, not just visual metaphor. I think this is a distinction worth explaining near the beginning of your paper,... It is fine that you draw on only part of Phillips and McQuarrie's work, as metaphor is complex enough for its own paper, but you tend to blur the differences between the goals of the two typologies."	Light workload. This required tracking terminology throughout the entire manuscript, but changes were relatively simple. "Thank you for noticing this issue, where I had oversimplified. I have addressed this comment through a number of mentions of 'visual rhetoric' where appropriate (instead of 'visual metaphor'). There are also new passages that attempt to be more explicit."
"Your new typology has implications for advertising practitioners who are trying to encourage consumers to process their metaphorical ads toward a positive outcome. I think you should mention this in the conclusion, as [the journal] has both a theoretical and managerial focus."	Moderate workload. This required writing a new subsection, but did not require editing other text elsewhere. "This has become a new subsection under Discussion. That subsection introduces a few new sources."
"I think you cannot create an example of (7) fusion for the grape juice ad because (7) is not a valid structural category. The corn example also fits into (6), as you explain. For a consumer to recognize fusion, some visual aspect of each of the two objects must be present, so fusion is always replacement fusion (6), with one part of object A replacing a part of object B. Or provide a real-world example of (7)."	Heavy workload. This required illustrating additional ads, and adding new explanations for them. "A new figure has been added that gives examples of fusion and replacing fusion. This figure uses examples with different source–target pairs. There is a corresponding explanation in the text. In addressing this and the previous issues the manuscript increased in word count following the list of types."
"...the main body of the manuscript (from 'Formal dimensions of visual metaphor' to 'Other critical variables: Towards a profile of visual metaphor' sections) needs to be re-structured to help readers better understand the essence of the current study. It should be clear on which parts are the review of previous work, and what are the expanded typology developed by the authors."	Very heavy workload. This required fundamentally restructuring a lengthy manuscript—with an investment in time simply planning a new structure, and possibly the editing of more sentences than those left unaltered. "The paper has been reordered to more clearly delineate lit review from the authors contributions. There are now two top level sections that have parallel internal structures. The top-level sections differentiate visual metaphor form and visual metaphor processing. In each case sub-sections begin in lit review with a final sub-section on proposed changes. Furthermore, the verbiage 'a proposed...' is used in both cases to clearly indicate the authors contributions."

Table 4. Reviewer comments, workload required to process, and author responses. Peer review of one manuscript.

with only minor edits, without fundamentally changing the manuscript. In other cases, the literature is not particularly relevant to the manuscript, and the author must make the case to the editor that it should not be incorporated, despite a reviewer's suggestion.

Ultimately, manuscripts will be rejected frequently. One way to view Table 2 is as a story of my personal failures. Each manuscript was rejected by two or three journals before being accepted to a third or fourth. But failure has utility (Young, 2019). Melanie Stefane (2010) noted that:

— As scientists, we construct a narrative of success that renders our setbacks invisible both to ourselves and to others. Often, other scientists' careers seem to be a constant, streamlined series of triumphs. Therefore, whenever we experience an individual failure, we feel alone and dejected. (p. 467)

Stefane suggested that scholars keep a "CV of failures," which catalogs each rejected manuscript and declined grant proposal. Table 2 is a small version of what would be my own CV of failures.

Benefits for Design Units Within Research Universities

It is well established that design remains immature as a research discipline (Cash, 2018; Corazzo et al., 2020; Davis, 2008, 2020; Fisher et al., 2018; Littlejohn, 2017). Fisher and colleagues (2018) found discrepancies in conceptions of research between design academics and design practitioners, and one is particularly emblematic of the state of research in design: practitioners did not consider "being explicitly systematic or formal" in research to be "a high priority," and even academics felt some ambivalence about systematicity in research being relevant to designers (pp. 68–71). One thing that distinguishes scientific knowledge among types of knowledge is "being more systematic" (Hoyningen-Huene, 2020, p. 85), but even absent an emphasis on science, any proper research activity (e.g., by a trained historian) seeks knowledge that is systematically rooted. Systematicity is such a fundamental aspect of true research that demonstrating this would seem unnecessary—even ridiculous. Addressing the nature of research from a design perspective, Friedman (2003) connected the most practical forms of research—applied and clinical—to basic research, situating basic research as a foundation. Basic research is the search for general principles that are "abstracted and generalized to cover a variety of situations and cases" (p. 510), with those situations and cases coming to the surface to increasing degrees in applied and clinical research.

What is considered scholarship in design—and especially what is routinely counted as a form of research productivity for design faculty—is remarkably heterogeneous, in stark contrast to the strict

(but distinct) disciplinary standards upheld in most non-art and non-design units at universities. Davis (2016) outlined the challenges faculty face in an environment where definitions of scholarship are murky. She argued that design units weaken their positions and opt out of university agendas when they ask for too much special treatment (p. 125), and that "it is through research that design demonstrates its value to other fields with scholarly interest in its domain" (p. 126). Research, and thus the generation of new knowledge, is inseparable from the basic concept and mission of the research university. While there are certainly many institutions of higher education with an exclusively vocational focus, research universities represent another area of great impact and opportunity. And there are nearly 150 research universities in the United States at the highest level of activity (R1, "very high research activity") according to the Carnegie Classification, with an additional 120 at the next highest level (R2, "high research activity").

A major factor distinguishing the research university is the degree of external funding secured by its faculty. The sources of the greatest external funding require extensive empirical research that is incompatible with many of the models of scholarship tacitly recognized in design. This means that opportunities for design units to benefit from these sources of funding—and the prestige within the broader university community that accompanies them—are limited.

A large external grant channels indirect costs (or overhead) into a university as finances that can be allocated anywhere to further the university's agenda. These indirect costs are negotiated between the university and the sponsor. For instance, at my university, indirect costs for NSF projects are calculated at 52% over expenditures (direct costs), though certain expenditures are exempt from indirect costs (e.g., tuition for research assistants, equipment over \$5,000). Thus, a project with \$1 million in expenditures will require a total award to the university of up to \$1,520,000. There is usually a trickle-down effect for indirect costs. The university likely diverts a significant portion of funds generated by these costs to fund internal grants. Therefore, a faculty member responsible for generating indirect costs for an external grant is contributing to the internal grants that will support other faculty, often for preliminary research that may in turn lead to other external grants. The university then likely diverts some of the remaining generated funds to the colleges of the principal investigator (PI) and Co-PIs, commensurate with their portions of the award as reflected in budget segments. Colleges may use these funds in any number of ways, but regardless, the faculty member has reversed the normal direction of support in financially contributing to their college. The college may further divert some of the funds to the faculty member themselves, as a discretionary fund to support further preliminary research and perpetuate the funding cycle—though this is less likely in colleges unaccustomed to faculty generating indirect costs. It is important to note that, in many cases where

a design faculty member is a “collaborator” on a grant but not a PI or Co-PI, the chain of funds generated by indirect costs does not pass through their college. It is often the case that design faculty are invited to join established research teams as collaborators, and this has financial implications.

Aside from the money, external grants support highly impactful and visible work that matters both to universities and—though it sounds grandiose—to humanity and the world. The largest sponsors have high standards to ensure this. For instance, the NSF has two core criteria applied to all proposal evaluations: intellectual merit and broader impacts. *Intellectual merit* concerns the contribution of knowledge generation. *Broader impacts* concerns the direct benefit of research to society—for instance, a project may include outreach activities to broaden participation in STEM by creating career pathways for underrepresented students.

It is noteworthy that the largest sponsors of research do not have singular design missions. Instead, their missions are in areas for which design may be *relevant*, such as medicine (NIH), science (NSF), or defense (DOD). Thus, it is through interdisciplinary engagement that design finds a path toward more lucrative research activities, and elevation within research universities.

Even absent large external grants, design faculty can collaborate with faculty in other colleges to produce meaningful research that situates or integrates design within the broader university community. If this is the case, deans of design colleges will likely find increased success when advocating to university administration for resources.

Recommendations for Administrators in Design

The research production expectations of design faculty are increasing over time in established design units within universities. This means that the junior faculty of today are usually held to higher standards for promotion than those the senior faculty reviewing them had to meet. The support of faculty in design units must evolve in kind. Unfortunately, junior design faculty are too frequently expected to elevate a design unit’s research profile without adequate infrastructure in the form of administrative support.

The recent proliferation of teaching assistant and clinical assistant professor positions in design units, which may entirely remove scholarship as an area of responsibility in favor of a higher teaching load for individual faculty members, is an unnecessary impediment to design’s maturation as a research discipline. Faculty lines are limited and thus precious. A faculty member who, by the stated requirements of their

position, rightly does not engage in scholarship decreases a design unit’s collective potential for research production. This is no fault of the faculty in question; rather, it is a direct result of administrative strategy that sacrifices scholarship for what is only a slight increase in a program’s total teaching capacity. Often, the faculty in these positions are as qualified in research as those whose duties explicitly include scholarship, and they could produce equally impactful work.

Though these positions exchange teaching loads for research productivity in quantifications of faculty academic year effort, such exchanges are too infrequently used to differentiate scholarly production among other faculty. One way administrators can promote research productivity among traditional tenure-track and tenured faculty is to decrease teaching loads only for faculty more deeply engaged in scholarship. This is politically fraught. But absent such adjustments, should a design unit have aspirations of better integration within its university, the incentivization of faculty pursuits is diametrically opposed to an ambitious research agenda. Teaching loads for design faculty are famously heavy. This is a historical problem that is as familiar to administrators as it is seemingly intractable. Any college-wide reduction in teaching loads has profound financial implications. But administrators in design must find a way to change the standard teaching load in the field. It is a matter of equity within the broader university community.

Administrators should provide course releases for junior faculty in their first year of employment. It is difficult to build momentum on a research program, and adjusting to a new environment and a distinct student population is overwhelming. A junior faculty member can easily “come up for air” at the end of their first year of teaching and realize that they have made no progress on their research program, or worse, that they still have no discernible plan—with a full fifth of the time available for productivity exhausted. Classes are hard-scheduled, which reduces the flexibility for producing scholarship. Being productive in scholarship while managing a teaching load is an advanced skill that faculty need to develop. An early course release or two can be helpful in that regard.

Junior faculty must not simply find the time to engage in scholarship, but they need to understand the scope of engagement required of them. To that end, administrators should provide clear articulation of research requirements for junior faculty. In some design units, only vague notions of “research” are mentioned, and annual reports are informal exercises. In contrast, my current university maintains a statement of faculty responsibilities (SFR), which divides 100% of academic year effort into categories of activity. The SFR suggests specific outcomes, and even quantifies production. It provides the structure for the annual report, in which each faculty member lists the year’s accomplishments under a given category. For instance, my current SFR quantifies my academic year effort as such:

- Teaching and mentoring undergraduate and graduate students: 60%
- Discovery of knowledge through discipline-guided inquiry: 25%
- Service in professional societies, and service and engagement within the university: 15%

Thus, I do not need to engage in outreach activities to “meet expectations” (though I can report on any outreach in an “other achievements” category).

Due to the heterogeneous nature of design research and what is considered equivalent to research in design, expectations of scholarship should be stated explicitly. (In other disciplines this is unnecessary, because expectations are more universal and are tacitly agreed upon and continually reinforced.) My SFR recently articulated my research requirement as such:

- Make original and valuable contributions to the body of knowledge about design or design education with funded research and scholarly publication. Two peer-reviewed papers or outcomes of equivalent significance (such as funded research projects, scholarly books/book chapters by publishers, peer reviewed conference papers, curated exhibitions, patented inventions, and sponsored studio projects) are expected to be accomplished every academic year.

I requested an addition to the list of “outcomes of equivalent significance,” and my department head thankfully updated my SFR in kind. The parenthetical list of outcomes now includes a second outcome related to grants, as italicized here:

- ...or outcomes of equivalent significance (such as funded research projects, *external grant proposals over \$500,000 as PI or Co-PI,...*

This addition acknowledges the heavy workload associated with large external grant proposals, even when they are ultimately unsuccessful, and incentivizes pursuit of external grants. In the absence of this, it would be a reasonable strategic calculation for junior faculty to forego the most competitive grants because success, however lucrative, is so unlikely. Administrators should be careful to incentivize the activities they are most interested in seeing their faculty pursue. And they should, as in the above example, support junior faculty by defining expectations in a reasonable way. However, if design units intend to increase their overall engagement in high-impact research, administrators should be careful not to accommodate all possible activities under the guise of research. Otherwise, junior faculty are not likely to further the unit’s research agenda. *Something* is always being incentivized—be it the most impactful,

most comfortable, or least difficult activity—and administrators should recognize this and be purposeful in creating incentives.

Mentorship can help junior faculty align their activities with an incentivized research agenda. Administrators should thus provide junior faculty with senior faculty mentors whose scholarship is similar to what they will likely produce. They should also follow up on mentorship to ensure that mentors are actively involved, and assign new mentors if they are not.

In reappointment, promotion, and tenure reviews, as well as in the articulation of expectations, administrators should not expect the same scholarly products—either in quality or quantity—in the periods preceding reappointment, between reappointment and promotion, and following promotion. The highest impact scholarship is predicated on earlier activity that is far less impressive (Figure 8 and Figure 9 together are a stark example of this). Thus, expectations should not only be stated clearly, they should also be dynamic. Junior faculty should know what is expected of them, and how they will be evaluated, in each period of reappointment, promotion, and tenure.

These expectations should also be communicated to members of tenure review committees at the university level. In other disciplines, students engage in disciplinary research even at the undergraduate level, and when they earn their PhDs—for them, the terminal degree—they are often embedded in a lab and producing the same kinds of outcomes they will continue to produce as junior faculty. But in design, junior faculty typically arrive with a professional master’s degree, and have no sense of continuity in research, nor momentum. Administrators in design should make this reality clear to others—and not assume that it is evident—so that design faculty are evaluated fairly.

Recommendations for Junior Faculty in Design

Sustained research by junior faculty in design requires: a long-term strategy to guide activity in the short term; the discipline to initiate years-long projects in a timely manner despite ever-present teaching demands; and the resilience to overcome frequent failure in high-leverage, highly competitive endeavors. Regarding resilience, I have occasionally had difficulty handling failures, by losing sight of their inevitability (and their hidden utility), even in cases of competitions with well-documented low success rates. It is important to contextualize failures—e.g., a rejected manuscript with reviewer comments is an opportunity to improve the work—but faculty also need support systems.

Regarding strategy, prospective faculty should articulate a research plan in the job application process. This can be embedded within a required research statement. A research plan should be explicit about an interest area, its outcomes, how those outcomes will change over time, and connections that can be made across the university. In the latter case, institutional resources must be readily available for enactment of a research program—faculty cannot act in isolation and expect to generate high-impact outcomes. The research plan should connect early outcomes to the later outcomes they will enable, ideally envisioning productivity following promotion. This will reveal the value of early outcomes.

Junior faculty in design should seek out any tenure guidelines published internally or externally by their university and unit. They should discuss their research plans with their department heads, and request direct feedback on how their planned outcomes are likely to be viewed by administrators and senior faculty in their units during reappointment, promotion, and tenure reviews. But junior faculty also need to advocate for their own productivity by ensuring that most of their efforts fit a coherent narrative. An effective narrative is not concocted retroactively following disconnected activities. It should guide the activities themselves, and it will likely suggest the avoidance of certain activities to maximize the productivity that will prove most compelling.

In the first year of employment, junior faculty should make use of their previous work to begin delivering short-term outcomes. A thesis project from graduate school likely has some receptive venue available for presenting or extending it. With a robust strategy, junior faculty can embed minor outcomes into the early stages of major endeavors. A workshop for a class can lead to a conference presentation with proceedings, which can lead to a small internal grant, which can produce preliminary work that makes an article in a respected academic journal more feasible. That article can serve as the basis of a large external grant.

Junior faculty should take the first steps on years-long projects as early as possible. They should reach out to colleagues at other colleges whose work is adjacent to their interest areas (I have found that other junior faculty are more receptive). I have facilitated initial one-hour meetings with university colleagues to share work, with roughly a third of these meetings resulting in long-term collaborations with multiple scholarly outcomes—my own most significant successes all began this way. (And the meetings that proved fruitless only cost an hour of my time apiece.)

Junior faculty should avail themselves of institutional workshops and colloquia related to research, and they should pursue small internal grants. They should expect to reapply for any grant multiple times, and not be overly discouraged upon the first rejection.

Everything should be produced with an ideal venue in mind. A grant proposal needs to be written in response to the

specifics of a call for proposals, and a manuscript must advance the mission of the journal to which it is being submitted. Junior faculty should recognize the importance of peer review and prioritize venues that will carry weight, instead of favoring what is easy or familiar. Junior faculty, especially in design, are doing something that is new to them, and should not expect to feel entirely comfortable doing it. There must be some faith that investment will ultimately lead to success, with a considerable delay of gratification.

In a single week late in a recent summer, I received three rejections from academic journals. Most of my active scholarly work was temporarily shut down as of that moment, as these three projects had dominated my efforts for many months. More recently, having a single large external grant proposal declined weighed heavily—not because rejection was a new experience, but because I spent too much time ideating on the new professional reality that would await me should I be successful. Perhaps one way to persevere through such inevitable setbacks is to adopt the mindset of the *hedonistic scholar*, and this is my final recommendation for junior faculty in design.

The hedonistic scholar may believe in the destination, but they are focused on the journey. And once a journey is complete, they obsess over the next one and do not look back, as the source of pleasure is now exhausted. To the hedonistic scholar, a journey is complete when a proposal or a manuscript is submitted—that is, the destination is *submission*, not *success*. If the grant is awarded, or the article is published, a new journey begins. For an article, the process of making edits and checking proofs is its own journey, with its own pleasures. For a funded project, an entire series of journeys awaits.

The hedonistic scholar finds joy in the seemingly mundane details of research activity. They have a perverse aesthetic sense. A grant proposal can be beautiful in its taut logic. A manuscript can be tantalizing in the accessibility its organization bestows upon difficult concepts—and the hedonistic scholar recognizes this, even if somebody else might find it “exceedingly” or “strikingly dull.” The hedonistic scholar does not wait until a manuscript is complete before creating its figures, but works on the figures early in the process so that their presence may emotionally enhance the writing process. The hedonistic scholar seeks out collaborators whose joy matches their own, and whose specialized knowledge is intimidating but promises new experiences that would otherwise be inaccessible.

The hedonistic scholar values personal growth, and is eager to undergo the discomfort necessary for it. They do so selfishly. They are rewarded by developing and expressing their own expertise. They are motivated by the prospect of “moving easy in harness,” which was Robert Frost’s way of describing the “unstrained fulfillment of one’s difficulties” (Ciardi & Williams, 1975, p. 11). John Ciardi reported on the sense of fulfillment in poetry (using gendered pronouns I retain from the original):

W. H. Auden was once asked what advice he would give a young man who wished to become a poet. Auden replied that he would ask the young man why he wanted to write poetry. If the answer was “because I have something to say,” Auden would conclude that there was no hope for the young man as a poet. If on the other hand the answer was something like “because I like to hang around words and overhear them talking to one another,” then that young man was at least interested in a fundamental part of the poetic process and there was hope for him. (Ciardi & Williams, 1975, p. 3)

So too is it in research. The hedonistic scholar likes to *hang around knowledge and overhear categories, concepts, and principles talking to one another*. There is, indeed, hope for them. Where others see a 200-word abstract that encapsulates a project of great complexity, the hedonistic scholar sees poetry.

Conclusion

Design units at universities are under increasing institutional pressure to collaborate with non-design units and produce high-impact research outcomes. Design, with or without designers, is relevant to so many worthwhile endeavors that the question is not whether design has value to more established research disciplines, but rather how design units in universities can make this truth evident. I have used my own experience in developing and maintaining a strategic research program to reveal some of the challenges that junior design faculty face in this environment. Especially concerning is the disconnect between the increasing expectations for their scholarship without a corresponding reduction in teaching loads or, in some units, a robust support infrastructure. I have also provided specific recommendations for junior design faculty and their administrators.

I have written a paper here that emphasizes problems. But I would be remiss not to counterbalance that, in some small way, with an affirmation that pursuing scholarship in design is both important and rewarding work. I finished with my recommendation for junior design faculty to be hedonistic scholars, which is another way of saying that there is *craft* in everything—scholarship is no exception—and all designers should recognize that there is real pleasure in developing and expressing good craft. But more directly, a faculty position in design is a special opportunity to develop one’s own particular research program and to argue for its significance, away from the industry pressure to provide immediate value to a single corporation. We design faculty can instead pursue the meaningful contribution to human knowledge that we can best justify and that we personally find most compelling. And that is a privilege, but not a self-serving one.

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Graphic Design in Public Health Research

**A Multiyear
Pictorial Health
Warning Label
Initiative and
Recommendations
for Sustained
Interdisciplinary
Collaboration**

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Introduction

Graphic design is often deployed in public health research, intervention, and dissemination of information. In some cases, such as the studies shared in this article, graphic design artifacts are the public health intervention, developed and tested within a series of scientific study designs involving research teams with wide-ranging expertise. Relatively little attention has been paid, however, to the role graphic design plays in public health research or how graphic designers may contribute to the conduct of research beyond a production services role. Even within the health communication field, the benefits for scientific knowledge and public health emerging from interactions with graphic designers remain understudied. Furthermore, graphic designers have yet to make a substantive case to public health researchers that there is more to graphic design than the artifacts it produces. Therefore, the goals of this paper are to 1) provide an overview of methods employed to integrate graphic design into a multiyear series of public health research studies, 2) share key results from these studies relevant to graphic design, and 3) discuss the requirements for sustaining research collaborations between graphic designers and public health researchers in ways that effectively combine their fields of expertise and produce more genuine collaboration for the greater benefit of public health.

Keywords

*health warning label;
smoking;
hookah;
prevention;
graphic design*

Background

We (MS, TA, and WM) began working together in 2017, when a research team led by TA and WM secured five-year National Institutes of Health (NIH) grants from the Fogarty International Center and the National Institute on Drug Abuse (NIDA) to develop and test pictorial health warning labels (HWLs) for hookah (or waterpipe) smoking devices and products in two countries in the Eastern Mediterranean Region (EMR): Lebanon and Tunisia. A subsequent grant from the Florida Department of Health extended the work to the United States, where hookah smoking continues to grow in popularity (Jamal et al., 2017). This project is ongoing, and the team has since expanded its pictorial HWL work to electronic nicotine delivery systems (ENDS), or vaping devices and liquids, with a new five-year NIH grant from NIDA. Sustaining collaboration among the team's members, therefore, has been essential to conducting and expanding this research initiative and disseminating its results.

Our team members hail from a range of backgrounds, including medical science, epidemiology, the social and behavioral sciences, health communication, biostatistics, law (i.e., tobacco policy and regulation), social marketing, and graphic design. Most team members work at universities, including Florida International University, University of Miami, American University of Beirut, Université de Tunis El Manar, and The University of Memphis. Much of the prior experience and influence for this initiative grew out of the Syrian Center for Tobacco Studies, a pioneering research and capacity-building collaboration that was established with funding from the NIH's Fogarty International Center (Maziak et al., 2004). More recently, partners from Virginia Commonwealth University, University of North Carolina, and Georgetown University joined the team, which we named The Hookah and E-cigarettes Health Communication Group (2022).

As our team has grown, so has the public health field's interest in hookah smoking cessation and prevention, due to increasing hookah smoking rates around the world. Recent estimates place hookah prevalence among youths from 2.5% to 37.2% in EMR countries, 2.2% to 22.7% in Europe, and 1.0% to 11.4% in the US (Jawad et al., 2018). Any increase in hookah smoking is worrisome, considering its potential to increase the risk for lung cancer (Awan et al., 2017; Montazeri et al., 2017; Waziry et al., 2016), heart disease (Wu et al., 2013), respiratory disease (Waziry et al., 2016), esophageal cancer (Awan et al., 2017; Mamtani et al., 2017; Montazeri et al., 2017), and many other illnesses (Asfar et al., 2019; Bhatnagar et al., 2019).

Hookah smoking has grown in popularity partly due to the misperception that water, which is poured into the device's base (or vase), filters the tobacco smoke and makes hookah safer than cigarette smoking (Maziak, 2015; World Health Organization, & WHO Study Group on Tobacco Product Regulation, 2015). This misperception is understandable,

given how the hookah device works. As the hookah smoker takes a draw, the tobacco smoke is pulled into the base and cooled as it bubbles through the water, giving the false impression that the water is filtering out harmful chemicals from the tobacco smoke. The smoke is produced by the coal-heated tobacco residing in the head of the device (see Figure 1). This operation is easily visible in hookahs with bases made from translucent glass, which dominate the market. Unlike prior hookah HWL research, which focused on tobacco package HWLs, our studies include the placement of an HWL directly over a large portion of the base since this position offers more visibility and extended contact with the user.

Prior studies involving cigarette packaging have demonstrated that HWLs using text and images—variously termed pictorial warning labels, graphic warning labels, and graphic picture warnings—more effectively communicate health risks than HWLs employing text only (Brewer et al., 2016; Fong et al., 2009; Hammond, 2009; Noar, Francis, et al., 2016). Pictorial HWLs were recommended for use on cigarette packaging by the World Health Organization (World Health Organization, 2003). Canada was the first country to implement their use, and now 134 countries and territories require pictorial HWLs on cigarette packaging (Canadian Cancer Society, 2021). Meanwhile in the US, the Food and Drug Administration (FDA) created a rule to implement nine pictorial warning labels on cigarette packaging, using the authority of the Family Smoking Prevention and Tobacco Control Act of 2009. Five tobacco companies then sued the FDA to revoke the rule (*R.J. Reynolds Tobacco Co. v. Food & Drug Admin.*, 2012). Appeals proceeded, and at the date of this writing, pictorial HWLs on cigarette packages will be required in the US beginning April 9, 2023 (U.S. Food & Drug Administration, 2022a).

Presently, the FDA requirement for hookah tobacco packaging is a text-only label stating, "WARNING: This product contains nicotine. Nicotine is an addictive chemical." Charcoal and hookah device components are regulated by the FDA, but the agency only requires a verbal warning label on the tobacco packaging (U.S. Food & Drug Administration, 2022b). Bringing pictorial HWLs to hookah tobacco packaging, charcoal packaging, and devices will require more time and effort. Unfortunately, compared to cigarette packaging, little research and policy attention have been given to hookah tobacco and related product packaging, and no prior team has systematically researched the use of pictorial HWLs placed on hookah devices (Asfar et al., 2019). Where studies have tested the use of pictorial HWLs on hookah tobacco packaging and related products, labels were either adapted from pre-existing cigarette packaging HWLs or unscientifically developed (Jawad et al., 2015; Mostafa et al., 2019; Salloum et al., 2015). Our work addresses this gap by designing and testing pictorial HWLs—specifically for hookah tobacco packaging, charcoal packaging, and hookah devices—through a series of rigorous scientific studies.

Methods

Our study employed mixed-method approaches combining quantitative and qualitative assessments with members of the target population (Hammond, 2008). Quantitative methods were used to test for significant differences on label effectiveness criteria and label placement, as well as differences between groups of participants (i.e., males versus females, smokers versus nonsmokers). Qualitative methods helped us understand why participants ranked certain labels over others and how they thought visual and textual messages could be improved.

To rigorously develop and test the hookah HWLs according to a set of messaging effectiveness criteria derived from the literature, we conducted multiple quantitative and qualitative studies, intentionally ordered to progress from exploration and observation (devising, assessing, and revising possible design solutions) to experimentation (testing possible design solutions). Exploration refers primarily to the use of qualitative research methods, while observation refers to the use of quantitative methods. Experimentation refers strictly to those studies involving random selection, random assignment, and a control group/condition. For clarity, we have organized the explanations of our studies, and the integration of graphic design within those studies, into two phases: preparation for experimentation (the exploration & observation phase) and experimentation (the experimentation phase).

Exploration & Observation Phase

Literature Review

Consistent with scientific research studies, we began our process with an examination of the literature (see Asfar et al., 2019). As with most scientific literature reviews, ours was concerned with three main areas: content, theory, and methods. Content-related literature included studies on the harmful chemicals in smoke, tobacco, and charcoal products; chronic and communicable disease risk; nicotine addiction; passive smoking harms; and more. This state-of-the-art knowledge on health risks informed what we could and should say on the HWLs without over- or understatement of severity, prevalence, or risk, for example. Content areas covered in our literature review informed our choice of messaging themes.

Theory-related literature informed our understanding of how HWL messaging influences smokers' behavioral intentions (i.e., to quit smoking) and nonsmokers' behavioral intentions (i.e., to initiate smoking). This literature informed our selection of messaging effectiveness criteria, which we employed in survey measures to test our pictorial HWLs. These

measures helped us understand the extent to which our warning label designs conveyed the health risk messaging themes on multiple indicators of effectiveness. We adopted the message impact framework, which is based on communication (McGuire, 1989; Petty & Cacioppo, 1986) and health behavior theories (Ajzen & Fishbein, 1980; Ajzen & Madden, 1986), and has been applied successfully in cigarette HWL research (Noar, Hall, et al., 2016). This model assumes that features of the HWLs will lead to behavioral change through a chain of psychological events including 1) attracting users, 2) influencing emotions (e.g., attention, fear), 3) affecting cognitive reactions such as thinking about the risk (harm perception), 4) inducing intention to change the behavior (intention to quit), and ultimately 5) behavior change (e.g., reducing or quitting use) (see Figure 2).

With respect to methods, the team assessed each reviewed study for steps taken to reduce random and systematic error, and threats to reliability and validity, respectively. Even highly reliable and valid studies have their limitations, particularly if those studies are cross-sectional (measuring exposure and outcome at a single time point) as opposed to longitudinal, or if they are observational (nonexperimental) compared to randomized controlled trials. Study characteristics sometimes limited how strongly we could word a given claim or how explicitly we could depict a health risk in an image.

Together, content, theory, and methods established the initial basis for what we could state and depict in the HWLs, how conclusively a message could be conveyed, the messaging themes we should include, and how to design measures (e.g., survey questions) to elicit and assess participant responses regarding the effectiveness of the HWLs' messages in each theme. The literature review also informed the initial design, providing guidance for image choices, copywriting, and even tentative impressions for aggressive use of color, shape, contrast, and image cropping.

Initial Text, Image, and Layout Decisions

Specific verbal messages were informed by the literature reviews' investigation of content. From these reviews, five messaging themes were selected: health risks associated with hookah smoking, addiction, harm to others, waterpipe (WP)-specific harm, and WP harm compared with cigarettes. Text statements for each theme were paired in tables with prospective images, mainly drawn from copyright-free medical image repositories and existing pictorial HWLs from the FDA and other available sources. The statements and images were then shared with the team. Team members completed several rounds of copywriting to arrive at the initial set of verbal messages. Establishing the wording became a negotiation among accurately representing the science, translating the science into easily comprehensible and succinct statements, logically connecting the statements to

their corresponding images, and copyfitting the text to the space available for each HWL.

Visual elements of the layout design were influenced by current FDA warning label requirements (see U.S. Food & Drug Administration, 2022b) specifically the use of Helvetica (we chose Helvetica Neue) and maximal use of packaging surface area, which led to our choice of a horizontal orientation. These influences, though subtly applied, were intended to create uncomplicated comparisons between our experimental labels and the FDA textual HWL (our control). We also required a clear delineation between the verbal and visual messages since these were to be assessed separately and in conjunction. For this reason, we decided not to superimpose text over image or place text in the image area. Furthermore, practicality dictated a standardized format that allowed us to explore the use of varying lengths of text across an initial set of 80 messages/layouts.

Various font colors and backgrounds were explored. The graphic designer recommended black text on a white background for readability—a recommendation employed in the first years of the study. Later, however, viewer expectations became an overriding consideration: many visual warning labels on cigarette packages, including those implemented in our project’s study regions, used black backgrounds (see Hammond, 2009). We decided to take advantage of existing conventions to grab viewers’ attention and avoid confusion. The penultimate format of the warning label was based on the root 2 rectangle and used a black background in the text area. We eventually allocated the larger portion of space to the image area since the key difference of interest between our labels and the current hookah FDA HWL was the use of imagery. We subsequently widened the rectangle when broadening the text area to increase point size and improve readability. As an additional prompt, we used white text against a red field for the word, “warning.” We decided to set “warning” off from the text block and the image area to improve visual hierarchy with the use of triangulation (see Figure 3).

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Vetting the Initial Labels

Team members engaged in regular meetings to review HWL designs. These meetings were not unlike design critiques. Concepts, image usage, and overall layout choices were discussed. Revisions continued over a three- to four-month period, generating numerous layout options and over 80 HWLs. After further vetting by the team, a set of 28 HWLs was deployed in a Delphi study with experts in tobacco control, health communication, and tobacco policies and regulations.

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*Delphi Study with
Subject Matter Experts*

Though a great deal of expert knowledge had already gone into the HWLs’ development, thanks to the literature reviews and the team’s prior experience, our modified Delphi study served to assess how effectively other experts thought the current scientific knowledge was being communicated and which labels they agreed best conveyed health risks in each theme. In the first round of our modified Delphi study, 30 experts rated each label on a set of effectiveness criteria derived from our theoretical framework: attention, relevance, communication, harm perception, and intention to quit. Labels were presented by theme, and rankings were conducted using a 10-point Likert scale. In the second round, participants viewed the results from the first round, now ranked in order of importance according to mean effectiveness scores of all participants, and then were asked to provide their own ranking on a five-point Likert scale (1 = most important to 5 = least important). In the third round, participants viewed the overall rankings from round 2 compared to their individual rankings and were given the chance to change their rankings (for a full description of study rounds, see Asfar et al., 2019).

Additionally, the study participants suggested text and image changes. This qualitative feedback on surveys from each Delphi study round informed further design iterations. Recommendations were collected, translated by the team into design specifications, and implemented prior to each subsequent round.

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*Initial Quantitative Study
with Smokers and Nonsmokers*

The 12 HWLs selected by the Delphi study participants were then deployed in quantitative and qualitative studies with hookah smokers and nonsmokers. Initial data for quantitative analysis were collected via survey methodology. Survey respondents viewed each of the 12 HWLs, which were grouped into themes as previously mentioned. Respondents rated each HWL on measures of effectiveness using a four-point Likert scale, and then ranked the HWLs within each theme by order of perceived effectiveness (as shown in Figure 2). This study design enabled us to see how each label scored on specific and overall measures of effectiveness and how each HWL in a theme ranked in relation to other HWLs in the same theme. Additionally, we were able to compare ratings and rankings between hookah smokers and nonsmokers. Data analysis further revealed which labels in a theme scored significantly higher or lower compared to other labels in the same theme, as rated within the smoker and nonsmoker groups (see Nakkash et al., 2021). These results provided an initial empirical basis for identifying the final four labels to use in the second experimental study.

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*Qualitative Study with
Smokers and Nonsmokers*

We then conducted focus groups with these same participants to understand why they rated and ranked certain HWLs higher than others. Participants were asked to discuss the perceived effectiveness of each label’s text and image for encouraging smoking cessation and discouraging smoking initiation. Facilitated discussion followed a semi-structured format and focused on wording, image selection, word and image correspondence, and overall clarity of the HWL layout. Participants were encouraged to critically assess the HWLs and offer input for changes. The results informed text and image changes, as well as the need to tailor messages from the literature to a younger audience (see Asfar et al., 2022). Focus group results were used to make improvements to the 12 HWLs prior to their use in the first experimental study.

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Language Translations

The initial set of HWLs used in the Delphi study were designed in English, but their survey and focus group testing in Beirut and Tunis required translation to the local Arabic dialects. First, translations were conducted by team members fluent in English and Arabic. Then, translations were made to each HWL and backchecked. An important consideration was font choice. As stated, the English HWLs were set in Helvetica Neue. Arabic HWLs were found to vary considerably in font usage, from faces resembling script to sans serif. Recognizing we had yet to settle on Helvetica Neue regular or bold for the English HWLs, we searched for a typeface with multiple font choices, ranging from ultralight to black. We chose Shilia, which was designed to pair Arabic letters with Roman/Latin letters set in Univers—an interesting option should we need bilingual HWLs in the future.

Experimentation Phase

Our team conducted two separate experiments. The first experiment, conducted using a web-based survey application, involved comparisons among 13 HWLs (12 experimental and one control) across label placement conditions. Participants were exposed to HWLs displayed in three conditions: pictorial HWLs on the tobacco package, pictorial HWLs on three hookah parts (device, tobacco package, and charcoal package) and text-only HWLs on the tobacco package (control), in random and counterbalanced order. Participants rated each of the 12 experimental HWLs and the control HWL according to our five effectiveness criteria—attention, reaction, perceived harm, intention to quit (for smokers), and intent to initiate (for nonsmokers)—using a five-point Likert scale.

This design allowed us to test the following hypotheses: 1) pictorial HWLs on all three parts (device, tobacco, charcoal)

will be more effective than on one part (tobacco package); and (2) pictorial HWLs will be more effective than text-only HWLs on the tobacco package (Jebai et al., 2022). Furthermore, by recruiting male and female smokers and nonsmokers, this approach allowed us to compare smokers to nonsmokers, and males to females, on all rating measures. The result was a very rich dataset that informed warning label selection and placement and provided reliable, valid insights should we wish to target different subgroups, or audience segments, with different HWLs.

The second experiment is an ongoing lab-based study design comparing smoking behaviors and experiences between beginning and advanced smokers when they are exposed to HWLs vs. no-HWLs (control) in two separate sessions. Pre- and post-measurements were taken on smokers’ chemical exposure, their harm perception, their intention to quit, and their puff topography during two 45-minute sessions that differed by the presence (experiment) or absence (control) of one of four pictorial HWLs on the hookah device. This design also allows for multiple comparisons in one study, as we will be able to compare the control to each of the experimental HWLs (the four different HWLs) within each smoking group and between beginning and advanced smokers on each HWL exposure (for an example of our preceding pilot experiment, see Maziak et al., 2019).

Overall, our methods predominantly involved making numerous comparisons as efficiently as possible. Consequently, the graphic design of the labels required numerous permutations. The use of themes helped us group these permutations in ways relevant to motivating health behavior intentions while providing an organizational structure to manage complexity. The identification and adoption of specific effectiveness criteria provided clear messaging targets for the HWLs to meet, while the modified Delphi study, surveys, and focus groups helped inform which HWLs to prioritize and how to improve them. Therefore, the process of developing the permutations was iterative. These characteristics will likely sound familiar to graphic and other designers, given their similarities to design practices and curricula—particularly those influenced by the Hochschule für Gestaltung Ulm (Ulm School of Design) (see Brennan, 2015).

Dissemination Phase

While the first experiment tested 12 new HWLs, and the second experiment tested the top four, results from our exploratory studies yielded 24 HWLs for potential use in other studies. We are sharing these HWLs with other research teams. Informing and changing policy decisions, like the implementation of new types of warning labels or novel warning label placements (i.e., on smoking devices) requires a critical mass of evidence beyond the scope of any one study, team, or multiyear initiative.

Furthering this effort, each stage of the study, from literature review to randomized controlled trial, provides an important opportunity to disseminate results. Additionally, we are working with social marketing firm Golin to frame messages using our findings and disseminate these messages through public health campaigns.

Results

Many of the scientific results from our multinational initiative have been published elsewhere (see Asfar et al., 2019, 2022; Jebai et al., 2022; Maziak et al., 2019; Nakkash et al., 2021). Therefore, we wish to use this opportunity to briefly highlight and discuss results specific to the graphic design of the pictorial HWLs. For those readers interested in our scientific study results, we highly recommend consulting our published manuscripts.

Much of our data on participant responses to and feedback regarding the labels' graphic design arose from qualitative studies or qualitative components of studies, like the open questions on our modified Delphi study. Results were deemed pertinent to graphic design if they involved data on either formal or conceptual aspects of the HWLs. Formal aspects included color, font choice, image quality, placement, scale, orientation, and the like. Conceptual aspects included word–image correspondence, rhetorical device usage (i.e., metaphor, simile, index, synecdoche), denotation and connotation, tone of voice (e.g., respectful versus authoritative), and text and image choice. Since word–image juxtaposition was the key device employed, many participants focused their feedback on the relationships they perceived, or thought missing, between the words and their corresponding image.

Focus groups with smoking and nonsmoking males and females ages 18–34 took place in Beirut, Tunis, and Miami. Regardless of smoking status or sex, participants preferred “gross” images depicting people, particularly their mouths, severely impacted by disease (see Figure 3) compared to images that did not explicitly show people suffering severe disease outcomes (see Asfar et al., 2022). Clear depictions of harm to newborns and children, i.e., an intubated baby or a child surrounded by smoke, also resonated with emotional impact. Most participants stated or inferred that “gross” medical images were emotionally provocative. Furthermore, they believed this provocativeness would cause smokers and nonsmokers to take seriously the health risks shown and stated on the HWL. Many of these participants, in fact, advised making other images in the set more disgusting. Importantly, our participants' advice contradicts a key legal argument from major tobacco companies fighting pictorial HWLs, which purports that appeals to emotion fail to convey health risk information (see *R.J. Reynolds Tobacco Co. v. Food & Drug Admin.*, 2012). Participants

emphasized how our use of particularly graphic and disgusting images actually focused their attention on the health risks.

Notably, the gross images were literal representations of disease drawn from photographs of actual patients. In contrast, images showing a side-by-side, before-and-after comparison of skin wrinkles or premature aging were assumed to be manipulated photos, and were rejected by participants. Participants overwhelmingly recommended gross, literal representations, indicating they preferred both the emotional appeal of grossness and the factual appeal of literalness. This may help explain why participants rejected our use of rhetorical devices in other HWLs: the rhetorical images were neither gross nor literal. While our data show that participants understood rhetorical devices like metaphor, simile, and index, they often described such images as unrealistic. Even connotation seemed a bridge too far (e.g., darkening a photo to make the mood feel sad or depressing).

Further examination of focus group data revealed three meanings for “unrealistic.” Participants used that word to mean our use of Photoshop was short of photo-realistic (with some humorous criticisms), the scene depicted could not take place in actual physical space (e.g., a person cannot fit into a jar), or the scene depicted was not perceived true to their personal experience (e.g., not believing a health outcome is true or that it occurs with the severity depicted). These multiple meanings for one word made a careful analysis of the qualitative data critical to informing both image and text changes.

With respect to text, participants wanted the wording to be affirmative, which could also be interpreted as more assertive. For example, participants rejected words like “may” or “can” when preceding “cause.” They inferred we were weakening the impact of the message. It was apparent, then, that participants wanted the wording to be as provocative as the imagery. Science, however, rarely speaks in absolutes. This feedback reinforces the challenge we faced from the outset: to deliver a convincing message without over- or understating the health risk evidence.

Regarding text in combination with image, participants wanted the words to explicitly describe what was shown in the image, like captions, or the image to explicitly illustrate the words in the text. This was evident in the way participants discussed the relationship between text and image, stating the text and image did not “correlate” in those instances where we used words to indicate, rather than repeat, what was happening in the image. Our assumption that the words would direct participants' interpretations of the image proved faulty, despite this assumption's wide acceptance in graphic design education (see Meggs, 1989, pp. 41–43).

Additionally, we found a few images, including one previously used in a smoking cessation campaign, elicited responses counter to our intentions. In these rare but nonetheless relevant cases, what

we thought looked scary, some participants thought looked “cool”—like a music poster they would hang on their wall, as one participant shared. Specifically, apocalyptic imagery, e.g., gas masks, gritty environments, and decay or destruction elicited this response. In still other cases, a person we thought looked sad or in pain, some participants thought looked happy or like they were having a good time. These responses further indicated that participants thought literal images communicated more clearly than nonliteral images.

Key formal and conceptual takeaways from these results include literal representation of subject matter; text/image reiteration; limited Photoshop manipulation; realistic settings and scenarios; and shocking, gross, or otherwise disgust-inducing medical photos. Most participants did not have criticisms of the layout design, color choices, or fonts.

Discussion

Belying the ordered articulation of our research methods and results are the many complexities inherent in sustaining long-term collaborations between public health researchers and graphic designers. These challenges, we feel, are pertinent to research scientists and designers from many fields. We attempt next to share what we believe are the core challenges to sustained collaboration and solutions developed while planning and conducting our multiyear collaboration, discussed here.

Aligning Public Health and Design Outcomes

Obtaining data to inform design decisions can be stymied in a research science context by a research team’s understandable focus on the specific variables of scientific interest. Even when the intervention is a set of graphic design artifacts, questions asked on surveys and in interviews or focus groups may yield few answers applicable to formal and conceptual design decisions. In such cases, the variables of interest need to expand to include design variables, particularly the aesthetic, visual, rhetorical, and experiential preferences of participants, as well as their existing knowledge and attitudes regarding related visual communication encountered in similar contexts. Design readers will rightly argue for multiple considerations here, beyond the scope of this paper, likely stemming from design thinking, design anthropology, social and behavioral design, experience design, service design, systems design, transformation design, health communication, and, of course, human factors. Indeed, design has much to offer, and when this knowledge is overlooked or subordinated, collaborations between designers and research scientists can become strained, and public health research

is no exception. These strains are likely to emerge when design process activities are forced to operate in parallel, rather than in conjunction with, scientific data gathering and analysis protocols. Absent a parallel process, designers may find themselves in the awkward position of broadly extrapolating from the study’s evidence to guess at design requirements.

Including designers in survey and interview instrument design is one way to ensure needed data are obtained to inform design. Additionally, involving designers in data analysis can help identify data relevant to design, as well as interpret findings in a manner meaningful to changing or adapting to participant input. Inclusion of designers in qualitative data analysis is particularly important, because designers will likely bring an additional set of “sensitizing concepts” (knowledge of concepts from a given field) (Blumer, 1954; Bowen, 2006) to data analyses. We have found these approaches useful to sustaining our multiyear collaboration while generating outcomes that met or exceeded our research goals. This approach to including designers in the research for which they are designing also feeds back into grant writing, where the qualifications of each team member, as well as their prior collaborations with one another, are an important part of demonstrating our team’s capabilities to grant reviewers.

Bridging the Knowledge Divide

The present lack of a shared knowledge base for public health researchers and graphic designers poses serious issues for sustaining long-term collaborations between the two groups. Patience with each other can be worn thin as public health researchers focus on threats to internal, external, construct, and statistical validity while graphic designers are concerned with threats to ecological validity, e.g., whether warning label text will be readable in lower light, and at greater distances, outside the controlled environment of a lab experiment. Ecological validity, literally a footnote in research methods texts (see Shadish et al., 2002 p. 37), is not a form of scientific validity, per se. It is, however, a consideration not unlike those of user-centered design, where the needs, preferences, and characteristics of the user and the advantages and limitations of the user’s context guide design decisions (see Dumas & Redish, 1999; Norman, 2013). Meanwhile, threats to scientific validity are numerous and can arise at nearly every point of a study’s execution. Therefore, a great deal of attention is paid to monitoring each step of a study protocol.

Scientific validity is crucial to establishing whether exposure to the experimental conditions of an intervention result in statistically and clinically significant outcomes, whereas ecological validity is crucial to ensuring that the environmental conditions of an intervention’s implementation do not interfere with that intervention’s success. This inherent difference in validity concerns is a product of legitimate, albeit sometimes

competing, emphases stemming from the very different academic and professional training experiences of scientists and designers. These emphases do, however, complement one another. For example, we have found that concerns regarding word and image readability in a warning label's use context, if presented early enough in the study to influence initial data collection, appear to elicit participant feedback relevant to both scientific and ecological validity. Image pairings that would be too small to see, or too complex to decode, are called out, mitigating validity concerns while also prototyping a better fit to the eventual use context. These benefits would not have accrued to our project if we did not listen to each other's concerns and learn from each other's backgrounds.

One obvious limitation shared by many designers interested in interdisciplinary collaboration with public health researchers is the lack of training in both clinical and social and behavioral research methods. Quantitative and qualitative research methods can take years to master, as there are many threats to reliability and validity in the former (Grimes & Schulz, 2002) and trustworthiness in the latter (Lincoln & Guba, 1985; Rolfe, 2006). Yet, that very complexity is why public health research is overwhelmingly collaborative. After all, you can take a string of PhD courses in biostatistics, but unless you use that knowledge on a near-daily basis, you probably are not the right person to handle the team's statistical analyses. And that is fine; someone else will be happy to do it. Collaboration brings together different areas of expertise. It also helps catch oversights and mistakes before they compromise the research. Still, it can be challenging for graphic designers to share their insights without knowing how to frame their input in ways meaningful to public health researchers. Absent an understanding of social and behavioral theory, data collection and analysis methods, and threats to scientific validity, it can be difficult to convince other members of the team why specific design decisions should be made. This can also be disorienting for graphic designers accustomed to working with clients reliant on their advice.

The scope of this challenge to interdisciplinary collaboration is clearly bigger than our collaboration, and it will likely be many years before graphic design education incorporates scientific research methods to an extent sufficient to prepare students for opportunities in public health research. Financial pressure to develop doctoral programs and institutional demands to generate external funding may accelerate change, but that promise does not fill the current need. The way we bridged the knowledge divide was by recruiting a graphic designer who is also a public health researcher—a person with a PhD in social and behavioral sciences. In other words, we cheated.

While it has certainly proven helpful to have a graphic designer on the team who is also a public health researcher, bridging the knowledge divide may not require a PhD, or even a Master's in Public

Health, to bring graphic designers more fully into public health research. Public health already employs methods, like community organization/community building and participatory problem solving (see Bartholomew et al., 2011), to thoroughly involve stakeholders from other backgrounds in public health research. Conversely, most graphic designers involved in consumer research are already familiar with descriptive, and some inferential, statistics. Additionally, graphic designers do engage in interviewing and conducting focus groups, or at least using qualitative results to inform their work. In other words, many graphic designers already possess the basic skills, or can obtain them rather quickly, to participate in the interpretation of survey, interview, and focus group results. Some do this on a regular basis.

We do not wish, however, to understate the difficulty of conducting public health research. For example, when it comes to designing and conducting surveys, say to inform design decisions, numerous things can go wrong (see Fowler, Jr., 2014). And some of those things, like threats to validity from systematic error (bias), cannot be statistically corrected for later. Likewise, developing interview guides and conducting qualitative data analyses—particularly grounded theory methodology, directed qualitative content analysis, and phenomenological research—can lead to extremely misleading results if not handled expertly (see Charmaz, 2006; Starks & Brown Trinidad, 2007; Tolley et al., 2016). If our points sound contradictory, that's because there is no single way to design a research study any more than there is one single graphic design process. The extent to which any team member, from biostatistician to graphic designer, can effectively participate in multiple stages of scientific research depends on that person's knowledge and the fit between that knowledge and the methods required to conduct the research. That fit is going to vary with each project, dependent on the research aims, and between individuals, dependent on their training and experience.

Recognizing Graphic Design's Potential to Contribute

Public health researchers, typically, are not trained or experienced graphic designers. And, while it would be helpful, they do not need a BA, BFA, MFA, MGD, MDes, PhD, etc., to meaningfully contribute to design decisions. Just as graphic designers have some familiarity with research data, public health researchers have some familiarity with graphic design. In fact, many public health researchers have employed graphic designers at some point. For instance, prevention efforts rely heavily on visual communication. These products can be found in medical exam rooms, health department campaigns, employee health competitions, and at public health fairs. Public health researchers, working with graphic designers, among other partners,

developed those communications and programs. These activities generally involve the dissemination of existing public health knowledge.

When it comes to generating new knowledge, public health researchers again interact with graphic designers. However, public health researchers typically develop plans for the study before involving graphic designers. While graphic designers working just across campus could be involved in conceiving how design might aid prevention or intervention, they are often unaware the opportunity exists. Likewise, public health researchers are often unaware how graphic designers' insights can benefit problem identification and project planning.

While public health researchers have a degree of familiarity with graphic design and experience working with graphic designers, they, like much of the public, often define graphic design as the artifacts they see, missing the intellectual and creative processes behind the design of those artifacts. Therefore, despite the familiarity, graphic designers are at risk of being regarded by public health researchers as production specialists rather than research collaborators. For non-designers, graphic design is, understandably, considered a means to an end, but that conception truncates designers' roles in the means to get to that end and thereby limits the range of skills and insights they bring. The resultant collaboration, then, often positions the designer as a contractor, rather than a co-investigator.

This is not a case of familiarity breeding contempt, but familiarity breeding assumptions. One way we avoided assumptions about graphic design and the role of the graphic designer was to allow our collaboration to evolve through a mutual learning process. Though we had clearly specified roles and project leaders, we did not behave hierarchically with each other, which allowed team members from different disciplines, not just graphic design, the comfort they needed to share their opinions in team meetings and communications. Graphic design decisions were discussed frequently in team meetings, allowing all members the opportunity to experience how the warning label designs were developed.

Our solution may seem simplistic, even trite, but this flexibility to adapt and change as potentialities are identified is difficult to accommodate given that in order to conduct and obtain funding for research studies, every detail of every study protocol must be defined in advance. This extensive forethought is not only dedicated to ensuring scientific rigor, but is also essential to ensure human subjects' protection. Invariably, project leaders—principal investigators (PIs) and co-PIs—experience tremendous pressure, from their institutions and their funders, to execute their studies efficiently and as planned. Accommodating new perspectives can be overwhelming when under pressure to keep every component of a multi-year research initiative moving forward in a way consistent with the initial plans. Yet, we found the benefits for sustained collaboration outweighed the costs.

Positioning Design Within the Study

Our development and testing of graphic design artifacts—pictorial HWLs— took place inside a series of study designs, and each study design consisted of a protocol for executing that design with scientific reliability and validity. How well we ensured reliability and validity determined the rigor of our study, and thereby its likelihood of contributing to the literature and to public health. Interestingly, all these standards can be met while designing a failure. In other words, one can rigorously develop and test just about anything. By this we mean the graphic design outcome can fail at influencing participant behavior while the study outcomes can succeed at meeting scientific requirements for rigor. Why are we making this obvious point? Because this is perhaps the best place to illustrate the similarity between research science, public health or otherwise, and design, graphic or otherwise: neither wants to design failures. Moreover, research science and design agree that avoiding failure requires iterating (see Cross, 2011; Kuhn, 1996).

One important way we (TA and WM) have maintained our collaboration with our designer (MS) over several years is by developing a series of study designs that facilitate iteration. This structure serves both scientific and design requirements for success. It also facilitates the consistent engagement of our designer throughout the project, creating a more integrated team environment. Critically, iteration makes research science more like design and design more like research science. This shared ground fosters familiarity despite our many differences.

As our collaborations continued, procedures developed and evolved. One key change moved the designer from reading qualitative results to coding qualitative data and communicating the results. This change in role led to the generation of design briefs as an additional data analysis outcome. These briefs, which examined participant responses for data to inform changes to text and image, helped the team operate from a shared understanding of the visual and conceptual changes required to each HWL. In this fashion, a design process was integrated into a research study design. Moreover, the design briefs informed the final changes to the top four participant-ranked labels, which were subsequently used in the experimental lab study.

Positioning the Designer Within the Study

One easily overlooked point of collaboration is data collection with human subjects—particularly interviews, focus groups, and participant observation. These forms of data gathering require interaction with people, including protected populations. While many graphic and other designers prototype and test their designs with purposive or convenience samples of the

intended audience, their skills in this area may not be readily apparent to public health researchers. In our case, geographic distance prevented our graphic designer from participating in focus group facilitation. When feasible, however, involving the graphic designer in qualitative data collection can yield valuable benefits. For instance, designers are careful observers of personalities and preferences, experienced in ascertaining latent needs and priorities. They are also aware of what information they need from participants to inform design decisions. Much of this information can be obtained with the use of a good interview guide, but unexpected responses and conversational directions arise during semi-structured interviews and focus groups, requiring probing on the newly introduced experiences, ideas, or concepts.

Important too, however, is additional training for designers in human subjects research. Scientific studies like ours require certifications in biomedical and clinical trials research. These certifications are attainable for nonscientists. However, while the certification modules provide necessary training in bioethics, they are not sufficient preparation for the responsible conduct of qualitative study protocols, for example. This is where team building requires further collaboration between scientists and designers. While working as a graphic designer with a research team at St. Jude Children's Research Hospital, the first author (MS) was trained by a nursing researcher in focus group facilitation in a hospital setting. Each participant group (doctors, nurses, parents, and patients) required a different approach to questioning and listening.

Not only are the contexts of medical and public health studies uniquely challenging, but designing protocols for ensuring participant safety and mitigating emotional distress requires prior familiarization with the research context. For example, MS spent several months immersed in a domestic violence trauma recovery agency before designing a protocol to interview the agency's clients. That time allowed MS to observe best practices for securing participant safety, mitigating emotional distress, and establishing rapport.

Data gathering collaborations between public health researchers and graphic designers can further serve to integrate design considerations into early phases of research with downstream benefits. A graphic designer with firsthand experience of the target group will have a better sense of how to visually present information to that group. Some of the reasons why are admittedly difficult to explain, as they are products of empathy—tacit and impressionistic in nature.

Adjusting Where Possible

As the methods section demonstrated, our studies proceeded from pre-established protocols. This extensive amount of pre-contemplation and

planning can yield an inflexible plan and set of expectations that stifle creativity. Over time, we became more comfortable making room for design variables, like font choice and color, in our exploratory research phase. We adjusted plans to make time to consider the potential moderating role of formal design variables to attenuate the relationship between the exposure and outcome variables. In other words, making room for creative exploration enhanced our attention to scientific validity, particularly internal validity. Even so, our flexibility was modest, given the constraints of time and funding and the complexity of the preexisting plans.

Limitations

Research studies have their limitations, and ours are no exception. We employed methods, and sequenced and executed our studies, to minimize threats to reliability and validity. Our discussion also has its limitations—chiefly, hindsight. While we can look back on the past five years of collaboration, we are still engaged in an ongoing initiative. It is plausible that with additional hindsight, we may modify our insights or introduce new considerations. Additionally, we are just one team working on one initiative, albeit a very large project. Consequently, caution should be used when applying our insights; we did not attempt to provide generalizable knowledge, but rather endeavored to share our team's experiences.

Conclusion

Conducting a series of studies in three countries, our team developed and tested pictorial HWLs for hookah smoking prevention and cessation over several years. The HWLs, designed in local Arabic dialects of Tunisia and Lebanon, and English, continue to be disseminated through the medical, public health, and health communication literature, as well as shared with other research teams in the US and abroad, including the WHO's Jordanian office. Additional plans involve the development of hookah prevention and cessation campaigns in the US and the expansion of this research into HWLs for ENDS, or vaping devices, and vaping-related products.

Many factors influenced the sustainment of our interdisciplinary collaboration. Some of these factors apply to collaborative efforts in general: respect for each other's disciplines and perspectives, a shared vision, a clear understanding of goals and objectives at each stage, effective task management and, of course, funding. Other factors are specific to research science: rigorous but feasible study protocols, institutional review board approvals (and the biomedical and clinical studies certifications required for each team member), study participant recruitment, breadth and depth in quantitative and qualitative data analysis skills, and capacity to publish and obtain federal grants. The primary factors, in our view, are team

building and genuine collaboration, which are critical to obtaining funding and advancing scientific collaborations.

Securing funding from federal agencies, such as the NIH, increasingly requires interdisciplinary and multidisciplinary research teams. The competition for this funding is intense, and applicants must demonstrate, among many other things, breadth and depth in their team's capacity to conduct the proposed research. Likewise, disseminating research through medical and public health journals increasingly demands novel contributions. Many excellent manuscripts that would have been published just a few years ago are now being rejected. In publishing, too, the competition is intense. This is not necessarily a bad thing, but it may indicate that public health researchers need to combine rigor with new approaches and insights, perhaps from other fields, if they are to share findings they have worked so hard to obtain.

Medicine and public health need researchers who are curious about the processes, or formative work, behind the graphic design of artifacts they seek to utilize in their studies and interventions. Likewise, graphic design needs more educators, researchers, and practitioners interested in scientific research methods—both quantitative and qualitative. Excellent efforts have already been made to establish a shared vocabulary (see Muratovski, 2021). Through mutual interest and collaboration, our fields can continue to bridge the knowledge divide to build and sustain long-term interdisciplinary collaborations for the benefit of public health.

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Disclaimer

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Figures

Figure 1. hookah device

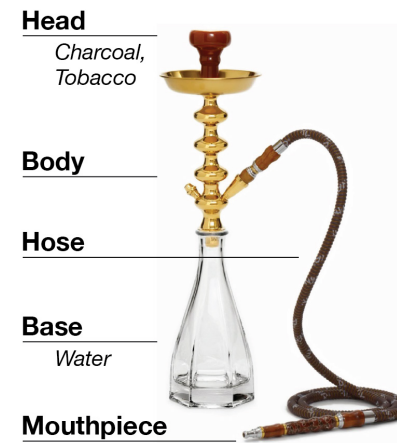


Figure 2.

The Message Impact Framework (Noar, Hall, et al., 2016).

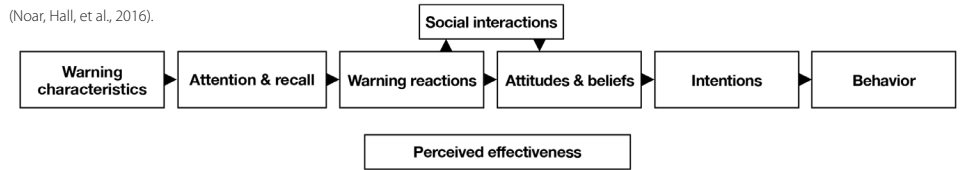
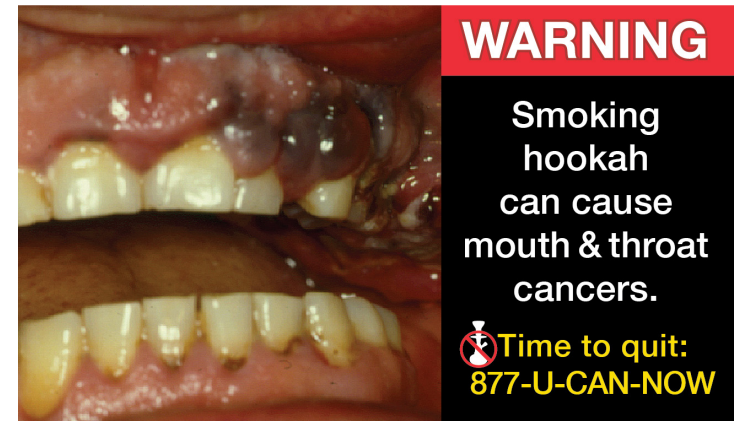


Figure 3.

example

Example of a pictorial HWL developed over the project’s exploratory through experimental research phases



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Dr. Michael Schmidt is a public health social and behavioral research scientist and graphic designer. He is a professor in the Department of Art and affiliate faculty member in the School of Public Health at The University of Memphis. His past work includes design-based interventions for pediatric informed consent in clinical trials, child development and health, and children's rights impact assessment in local, state, and national policy development. Currently, he is working with two research teams as a co-investigator on several federally funded research grants. His present areas of research include (1) design-as-intervention for smoking cessation and prevention; (2) social and behavioral determinants of substance use disorders, treatment access, and recovery; and (3) domestic violence prevention and intervention. Along with his research colleagues, he is a regular contributor to the scientific literature in public health, psychology, and medicine.

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Taghrid Asfar, MD, MPH

Dr. Taghrid Asfar has extensive experience in tobacco control research nationally and internationally. Since 2001, her tobacco control work has been funded continuously by the NIH and conducted both in the United States and the Eastern Mediterranean Region, including Syria, Lebanon, and Tunisia. This work involves epidemiological and qualitative studies of tobacco use, randomized clinical trials of smoking cessation interventions, and tobacco regulatory research in health communication approaches targeting emerging tobacco products such as e-cigarettes and hookahs. Her research aims are to improve smoking cessation treatment among socially disadvantaged and high-risk populations and to prevent tobacco use among youth and young adults by advancing health communication strategies. She has more than 60 peer-reviewed publications (Asfar T - Search Results - PubMed (nih.gov)) in high impact journals, including Tobacco Control, Nicotine and Tobacco Research, Addiction, and the Cochrane Tobacco Addiction Group.

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Dr. Wasim Maziak is a professor of Epidemiology, Director of the Clinical Research Lab for Tobacco Smoking at Florida International University, and Founder of the Syrian Center for Tobacco Studies. Dr. Maziak has extensive experience in tobacco control research and has published over 200 peer-reviewed scientific reports, including contributions in Science, Nature, Lancet, and British Medical Journal. His focus has been on emerging tobacco products such as e-cigarettes and hookah (Waterpipe), especially risk communication strategies targeting young users. He has been continuously funded by NIH since 2001 for tobacco control research.

typography

Academic
Research Into
Typographic
Design at the
Beginning of a
New Era

Ann Bessemans

In Europe, academic studies in design and the arts were regulated by the Bologna declarations in 1999. As a side effect of these declarations, architecture and art programs were linked to a university partner and a new field of research was born—namely, “research in the Arts.” This was a logical consequence of the new European educational model, and means that a professional bachelor degree directly addresses the labor market, whereas an academic master has the ambition to offer students a broader horizon not only by means of practice, but also of theory. An academic master enables the students to further explore and innovate within their own field alongside reflective thinking, critical awareness, and creation. In addition, students with a master’s degree were now able to start a third cycle—namely, to aspire toward earning a PhD. In turn, this—given the social role of the Arts—necessitated the development of an active and sustainable research environment.

Consequently, artistic and design research gained an equal place alongside the humanities, social sciences, natural sciences, and exact sciences. This position provides a complementary framework for exploring the complexity of reality in a pluralistic academic context. Yet, this does not mean that the integration within the academic context has by now become completely self-evident. Artistic and design research not only captures other forms of knowledge acquisition, but also knowledge transfer. The problem has always been and still is the concrete translation of this research into the established channels of scientific output. As a result, this “new” academic framework often manifests itself in debates about how “research in the arts” should or should not be conducted, how quantifiable output should or should not be communicated, whether through traditional and non-traditional channels, and all too often how it is different from the sciences.

During these developments, I was one of the first MA students with an ambition to continue her studies by enrolling in a PhD program to do research in typographic design at PXL/Hasselt University and Leiden University in 2006. This PhD was supervised by Dr. Gerard Unger and co-supervised by Dr. Bert Willems (experimental psychologist). The influence that Dr. Unger had in the establishment of the important role of typography in reading research, typography as an object of study, or in reference played an enormous role that is, in my belief, of inestimable value for the continuous growth of the academic development of typographic design (research). Dr. Unger’s research is presented in his book, *Typography as a Vehicle of Science*, which was published in 2007.

In 2006, Leiden University invited Dr. Unger to apply for the job of Professor of Typography at the Faculty of Arts. In May of the same year, he was awarded the title of first Professor of Typographic Design at the Faculty of Arts at Leiden University, a collaboration between the university and the Royal Academy of Art in The Hague—a chair established by the Dr. P.A. Tiele Foundation at the request of the Royal Library and the

Museum Meermanno. It seemed as if people were waiting for this, because as soon as he was assigned the position, candidates came forward to accomplish a PhD under his supervisorship. I was one of them.

I first wrote him an email in order to find out if he showed interest in acting as a supervisor of the inter- and multidisciplinary project *Type Design for Children with Visual Impairment*. In December 2006, Dr. Unger enthusiastically agreed to become the promoter of my legibility research, which he described as pioneering work within the typographic and scientific field. In order to test the legibility of typefaces, there would need to be a perfect balance between the typographic practice and scientific methods. Dr. Unger applauded the connection of the artistic reflective with the scientific analytical side. And this was not so obvious because conducting methodological-based legibility research was something that many designers were skeptical about. Previously, there had been a rather poor cooperation between the typographic practice on the one hand and scientific disciplines on the other. From a typographic point of view, over time, fundamental objections—rightly or wrongly processed—had arisen against scientific legibility and reading research. The main frustration for typographers was the limited typographical knowledge and the creative skills of the scientists in the experimental test set-up. Besides, there were many legibility experiments that did little more than confirm typographical practice. In addition, there was also a fear that results from these scientific studies would dictate rules and hinder the creativity of designers. But Dr. Unger never saw or experienced this in that way. He has numerous typefaces to his name and has always had an eye for the legibility of frequently used typefaces. Within this, he was fascinated by what details mattered to readers for the reading experience. Therefore, he was very eager to learn and curious to know more about the effects of the practical side of typography in relation to the reading behavior. In his opinion, this could be done through methodological-based legibility research.

The Birth of READSEARCH

A PhD track in typographic design research meant being exposed to various interdisciplinary facets that dealt, directly or indirectly, with social design and type design. At that time, I was not accustomed to dealing with and bringing interdisciplinary facets in relation to each other with the aim of developing theory and practice in the spirit of practical legibility research. So, the biggest challenge has been to evolve, from the formation of a graphic designer—yet with a huge interest in (questioning) legibility aspects—to a design researcher. *Type Design for Children with a Visual Impairment* was a design study that examined legibility and conducted methodological, practical legibility research in the interest (both in objective and subjective ways) of

the intended target audience (children ages 6–11). From this research, the need for a meaningful sense of legibility was determined in the context of visual impairment (and therefore, also indirectly within normal vision) and has verified which design parameters within a font can positively influence the reading of visually impaired children and those without impairments.

During my PhD program, I came across interdisciplinary aspects of typography and scientific legibility studies, which proved essential in order to further conduct this and coming research in this field in a thorough manner. Moreover, through the work completed during my PhD program, I established a theoretical framework that can derive intrinsic properties of typography that influence legibility and/or readability. These can be described and studied in terms of form, rhythm, and movement heterogeneity and give rise to new knowledge that can also be used to strive for innovative ways in designing and teaching, both within graphic design and typography and type design.

Furthermore, my PhD work also explored a novel “method” where typographic design is the engine in its component parts. All of this was such an eye-opener to me that I, during and after my PhD, decided to take my professional routes in an academic direction because I would no longer feel at home in the classic image of the (typo)graphic and type designer. The development of a hybrid profile in which design research assumes a full-fledged, intertwined place alongside the design practice is no longer a unique phenomenon. In general, the research conducted within such a profile focuses both on the discipline itself (for example, research in the Arts into new techniques, new materials, or concepts) and on other knowledge domains (Pint, Bessemans & Aerts, 2021). Research in the arts explores how specific methods, practices, and knowledge of artistic/design research can also be used within and studied further in other knowledge domains. In particular, a person can approach reading research not only from a cultural, scientific, or historical perspective, but also from the perspective of the typographic practice, or how novel typographic methods can be applied in, for example, exact sciences (and vice versa).

As a cumulation of the above, I founded the typographical research group READSEARCH in 2015. At the time, it was a risk to wriggle out of successfully running research groups in design research at my home institute and branch out as a loner. However, thanks to grants already received during my PhD and a future grant from Microsoft Advanced Reading Technologies, the conviction and confidence to push for an independent, yet sustainable, typographic research group dedicated to reading research and without a gap between the worlds of practice and science emerged. *Within all of this, it is important to mention the name Dr. Kevin Larson, who, similar to Dr. Unger, pushed this pioneering work in practical legibility research. As an experimental psychologist and researcher for Microsoft's Advanced Reading Technologies, he works closely with type designers,*

psychologist, pedagogues, and computer scientists to improve the reading experience. Over the course his career, he has been working on the theme of reading and is intrigued by the topic of legibility. This makes him, within this pioneering work, invaluable. There are only a few practical legibility studies in which he, as a supervisor, advisor and/or researcher, is not involved over the past 15 years.

The financial support, or “investment budget,” which is an enormous mental endorsement, together with the support of my home institute for giving a voice to practical legibility research in an academic context assured the birth of READSEARCH.

READSEARCH started small and was laborious, due in part to all kinds of teething problems (for growth). However, with the necessary perseverance, rigor, and courage to keep an eye on quality within every aspect practical legibility research aims to achieve, the foundations and intended quality of the group have been secured and established. Within one year, the first READSEARCH PhD candidates will have defended and published. For now, READSEARCH is still growing exponentially. It has a wonderful team with talented design researchers from different nationalities and genders (currently more female) within a hybrid profile. The team consists currently of one postdoctoral researcher, five PhD students (two of them in double degree), and three research assistants, some of whom are involved on a voluntary basis. Additionally, the team is enriched yearly by several students and graduates who enroll for an internship. As the research coordinator of this team, I am as proud as I could be.

Currently, READSEARCH is part of MAD (Media, Arts, Design)-Research at PXL University College and Hasselt University and since 2019, because of READSEARCH's data-driven design, part of the Data Science Institute (DSI) at Hasselt University. When the DSI was established, it was decided to involve specific research in the arts in the broad domain of data science. The main goal of the institute is to unite scientific data-bound research and prepare society for a data-driven future. DSI strives for committed and innovative research and achieves this by focusing on both fundamental and applied research on all components of the data science cycle. And within this cycle, applied practical legibility research cannot be missed.

**READSEARCH Dismantled:
Content, Context,
Methodology, and Goals
—General Approach**

READSEARCH explores in a practical way borders of legibility/readability for various target groups. We aim to develop practical/typographic legibility and readability studies within a new conceptual framework concerning

typographic design research on a micro, macro and/or micro-macro level.¹ Comprehensive legibility/readability research considers both the requirements of scientific methods and typographic practice. As a fundament, READSEARCH has derived intrinsic properties of typography that influence legibility and/or readability. These can be described and studied—as mentioned before within the establishment of a framework—in terms of form, rhythm, and movement heterogeneity and push innovation in the field. The current research lines are:

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Visual prosody

There is a great discrepancy between speech and reading. Humans speaking to each other have the disposal of a wide range of communication tools like expression and emotion in speech. Expressive oral reading can be quantified in terms of prosodic variation. These features in prosodic variations, like duration, intonation, or stress, can be of crucial importance in understanding exactly what the speaker or narrator is trying to tell us. Type is just not as expressive as our voices. Words composed in a sentence are completely uniform in weight and size, as if to convey a monotone. A monotone voice harms the reading fluency and reading comprehension. In addition, our letters represent several languages (and even dialects), and make use of different phonemes. Visualizing those phonemes more clearly benefits the learner who is studying a new language as it assists with pronunciation. Coming from a background in design and a passion for letters, we proved that type design has the ability to make prosody visual. This is called *visual prosody*. READSEARCH shows that visualizing expression, syntax, semantics, and phonemes leads to improve the skills of reading aloud and comprehension, both for regular and beginner, struggling, and Deaf and hard-of-hearing readers.

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¹ Macro level: Knowledge of the basic or complex structure of typographic layouts/systems and the choice and combination of letterforms, typefaces, shapes, and/or images that can be seen within an overall typographic work.* Also involves an understanding of how this knowledge can be used, depending on the tool, medium and target group. *Typographic work/layout is understood within reading on screen, paper, or any other medium that can transmit typography.

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Micro-macro level: Knowledge about typographic layout/system that covers a typographic work* and differentiates within the larger scope or creative artefact. This intermediate level mostly differentiates the typographic systems of a more complex work (i.e., book, website/app user interface (UI/UX)). *Typographic work/layout is understood within reading on screen, paper, or any other medium that can transmit typography.

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Micro level: Formal knowledge of the basic letterforms/shapes, typefaces and images (e.g., specific image/illustration usage, symbols, markings) and their smallest details, both in the light of conventional (disappearing letters) and non-conventional (remarkable/striking letters) letters. Also includes the understanding of how this knowledge can be used, depending on the tool, medium, and target group. If desired, the differentiations that the above might offer within a specific part of typographic structure can also be included.

Rhythm

How letters look and the rhythm of the font play a critical role in the acquisition of meaning while reading. Legibility is the ease with which visual symbols (like letters) are decoded. This all starts with how words are perceived. To learn more about legibility, more information is needed on how the visual system reacts to letters (within a word) in terms of spatial frequencies and visual comfort. The comparison between low and normally sighted people is indispensable to reach a better understanding of the peculiarities of the target group. Within Bessemans' PhD dissertation (2012), she systematically explored and revealed different design parameters to improve the decoding skills for children with low vision (and normal vision). The main goals of the new projects within this research line are to elaborate on the relation between rhythm heterogeneity influencing stripe patterns/spatial frequencies, (visual) comfort, and legibility. READSEARCH will open novel pathways to improve legibility in printed matter for regular readers, as well as those who are struggling or impaired.

Moving type & typography

The emergence of personal computing devices offers challenges and opportunities for improving reading on screens in comparison to reading on paper by means of typographic/type design. Animation has a lot of potential as support for the redefinition of legibility and reading on digital displays for specific readers. READSEARCH is setting guidelines for animation within letter forms and words themselves. In addition, technologies like the variable font technology are almost far enough along, and browsers are supporting this.

Navigation

With digital screens and technology becoming increasingly ubiquitous in our lives, the understanding of new ways of reading takes on great importance. Moreover, the complexity, trustworthiness, and growth of information and new media are not only changing the way we read, but also how we read, and how much. For navigation, the aim is to examine how advanced typography can shape and improve the reader's reading skills and development. READSEARCH is searching for improved ways of reading on both micro and macro levels, in order to provide new approaches of (influencing) typographic navigation in non-linear and linear reading with combined advantages of both reading on screen and on paper. The aim is to offer new insights in the design of publications by means of grid systems, reading text, typefaces, and images, as well as their relations in the era of digitization. More generally, we are aiming to improve reading skills and reading fluency,

which is an important factor in enhancing general literacy skills (within new ways of reading) and knowledge of specific topics and/or categories.

Researchers within READSEARCH are design researchers: typographic designers who combine scientific research with design and who base design decisions on means of empiric research. This means that they try to link the objectivity of scientific research with the sensitivities of design: creativity; intuition; visual judgement. Within READSEARCH's various projects, science always forms a great source of inspiration. On the one hand, this is because the research material demands well-founded scientific support; on the other hand, it is because this support induces valid practical applications in the design originating during and after the research. In other words, READSEARCH's design methodology keeps an eye on current literature from an interdisciplinary perspective that helps with establishing a framework for the design process.

Science plays a supporting role in defining independent design parameters to test. It also contributes to defining "legibility" for each specific research project, and setting up legibility experiments in an objective and subjective manner for the envisioned target audience. Further, science drives a methodology from a designer, as well as from a scientific point of view. This enables empiric design research into legibility born out of and resulting in accurate and traceable research and results. In that sense, data-driven design represents a unique approach to practical legibility research. Collecting and visualizing data (data science) define decision-making in the development of innovative tools. Through the interesting data acquired during empiric research, these studies provide a better scientific base for the subject of typographic design and its practical outcomes and applications. READSEARCH's design research can be extremely useful for society, because it can guarantee practical applications in the form of visually improved reading material.

The aims of READSEARCH are embedded within the creation of typographic tools (micro, macro, and micro-macro typography) to improve the reading performance of people in different communities and/or environments. With the results of our research, we want to provide considerable insight into the creation of typographic tools and even typographic guidelines, which would enhance reading performance in a diversity of contexts. Our tools aim to have a positive influence on the reading behavior of our envisioned target audiences and/or reading environments. They can be implemented to improve reading education, or improve digital and/or analog reading. Tools and/or guidelines are not only aimed at the end user, the reader, but also the industry. The latter is understood by means of stakeholders and designers.

READSEARCH's Praxis as an Example of a Sustained Research Program

The most essential component of a sustained research program is found in its connections. Being part of an academic institute (Hasselt University and University College PXL), and as an independent research lab herein, READSEARCH is established and valued as one of the three main research labs at PXL-MAD School of Arts: MAD-research. Regarding READSEARCH's core activities, connections can be developed between research lines and their subdivisions, and through collaborations on interdisciplinary levels.

Being able to work with multiple core research lines, each having its own subdivisions, allows us to create a long-term vision for our program. Furthermore, those research lines might interact with each other at a later stage, and new research questions/lines could be born out of this. Some of them hold longitudinal approaches that secure the sustainability of the research program. Having interdisciplinary collaborations also feeds back to our core research lines, and vice versa. In this way, a network is created, and dots are connected to ensure a more sustainable way of working—not only in our research program, but also in related fields of study.

In the specific case of READSEARCH, we are defining each research line with a main goal, a set of maximum 15 key words, key elements for research and target audiences. In that sense intrinsic legibility factors (and their according methods) are working bottom-up in which they can be applied for target groups. This allows for being surprised by correlating legibility factors and methodologies which would've been less easily encountered/discovered working in a top-down manner, where the target audience is the main goal or starting point.

In order to find and sustain funding and/or support, being embedded within an academic institute is of crucial importance. Therefore, continuous internal funding must be provided to make the research labs grow by means of PhDs, postdoctoral researchers, research projects, and project assistants.

We also try to find external financing to join forces on specific topics. An example is the collaboration with Microsoft Advanced Reading Technologies USA on visual prosody, which began in 2015. The research line of visual prosody has not been studied to this extent in the past, so this opportunity allows for a long-term collaboration arrangement, where each step in the research process leads to another. The shared wish of Microsoft and READSEARCH is to explore innovative ways to improve reading (digital and/or analog). Our first studies related to readers at the beginner level, and the results proved to be catalysts for other target groups like Deaf and hard-of-hearing people (but are not limited to those groups), which in turn resulted in new research questions. Our follow-up studies are

exploring other/new research approaches and methodologies to establish more profound evidence for the efficiency of visual prosody.

Another source of finding external support is by means of governmental support. Currently, we have been successful in finding support for PhD students at the Research Foundation (Fonds Wetenschappelijk onderzoek, FWO) that stimulates and financially supports fundamental scientific research and strategic basic research in Flanders. We have also established a collaboration with the *Industriemuseum* (<https://www.industriemuseum.be/en/events/printing-department>) to innovate design thinking by means of old crafts in typographic history.

The search for sustaining collaborators has grown from engagement within the academic field where common interests have been discovered between different or similar fields of study. We have done this through networking: attending conferences, engaging with stakeholders, giving lectures, workshops, getting involved in big research set-ups (like E-Read Cost), and through having the opportunity to work interdisciplinarily as a member of the Young Academy member of a working group at Royal Flemish Academy of Belgium for Science and the Arts, (KVAB: Koninklijke Vlaamse Academie van België voor Wetenschappen en Kunsten), setting up double degrees, participation in doctoral commissions, etc

Through our connection to an educational institution, READSEARCH has a clear influence on how the curriculum is shaped for graphic design. During typographic courses at PXL-MAD School of Arts, members of READSEARCH are implementing scientific approaches into the curriculum. In the BA program, assignments are written out that incorporate aspects of typographic legibility research, powered by active research lines, in an experimental and introductory manner. Undergraduate students get acquainted with the research in the field during the typography courses (theory as well as practice) and explore the role of the design researcher within the field of legibility research. Among our international master of arts programs, the Reading Type & Typography program (established in 2016) is strongly connected with READSEARCH. This degree program is centered on creating a self-initiated or prescribed project in the field of typography in relation to research about legibility and/or illegibility within the READSEARCH research lines of inquiry. Graduate students (internal and external) can enroll as interns in the READSEARCH research lab to experience and to conduct legibility research. The work (theory and practical experiments) created might have the potential to be further explored or embedded into ongoing research lines of READSEARCH.

Education enforced by means of design research is a strong tool for raising awareness and a means of educating academic design students in another way. The benefit of having an academic education lies in the fact that compared to a profession-oriented study, students learn the basic skills and get the necessary framework to be

able to look critically at one’s own work and to reflect on the work of others, whether merely for design purposes or to continue on into more academic fields of study and/or design research. Also, the latter fits directly into the research lab. Typography has many connections with interdisciplinary scientific fields that is of high importance for the various graphic professional specializations in order to broaden horizons and seek innovation. It has only been in the past seven or so years that (the practice of) typeface and typographic design has become an established field of (academic) study, which is also growing in recognition in the cultural mainstream of academic fields and is able to seek academic merit. Furthermore, typeface and typographic design apply the research in terms that the general public can engage with.

Knowledge-Bound Typographic Research as an Investment for the Future

Within an academic context, hybrid researchers are eager to more fully understand legibility in relation to the practice, especially in different contexts. Through their research, they give the practical profession of typography a better scientific foundation. In addition, such practical legibility research provides interesting data that designers, as well as researchers and stakeholders, can use to address the needs of readers—both general and those with disabilities/impairments—and to support new/evolving ways of reading more efficiently. In addition, design researchers are refreshing typographic education, which in the past has been fed primarily by historical and practicing practice and where the scientific interdisciplinary framework that typography provides has often been disregarded.

Unlike before, the interdisciplinary approach, as well as the inclusiveness that practical typographic legibility research encompasses within its studies, guarantees a healthy balance between an appropriate research methodology, valid test material (design parameters), proper reading environment, and readership. Bringing these skills together from interdisciplinary perspectives on equal footing constitutes the future of the scientific side of typography.

Academic design research within typography is pioneering and, as already demonstrated, offers an opportunity for innovation and development, now and in the future. This kind of typographic research pushes all three types of research activity: basic research, applied research, and experimental development.

The design of text, typography, has up until today incredibly relevant, yet it was barely studied from an interdisciplinary perspective before. Universities and colleges play an important role within the academization of typographic research and typographic education. We

should not forget that they also have the potential to create a fertile research environment in which researchers can freely make new discoveries that lead to new and further insights. From there, know-how can be quickly restructured and recombined to explore interdisciplinary challenges within renewed research paths (through the development and flourishing of ground-breaking research lines), and education thus supports the increasing importance of practical legibility research. It is this mindset that will have an impact on talent creation and the social (and economic) importance of reading.

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Author

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Ann Bessemans, *PhD*

Ann Bessemans is a legibility expert and award-winning graphic and type designer. She founded the READSEARCH legibility research group at the PXL-MAD School of Arts and Hasselt University where she teaches typography and type design. Ann is the program director of the international Master program ‘Reading Type & Typography’. Ann received her PhD from Leiden University and Hasselt University under the supervision of Prof. Dr. Gerard Unger. She is a member of the Data Science Institute UHasselt, a member of the working group Art, Science and Technology at the Royal Flemish Academy of Belgium for Science and the Arts and lecturer at the Plantin Institute of Typography.

www.readsearch.be

reading

Studying
Typography's
Capacity to
Improve Reading

Reneé Seward

Interview by Mike Zender

Introduction

For 16 years, Professor Reneé Seward has studied typography's role in learning to read. After graduating from the University of Cincinnati in 2002, she worked professionally for 3 years before going to North Carolina State University in 2005 for her graduate degree (Master of Graphic Design MGD). It was there that she formed and initially explored the parameters of the research question "In what way can mapping or visualizing phonemic sounds to typographic symbols enhance reading for dyslexic children 9 -11 years old?" under the guidance of Professor Meredith Davis. On May 9, 2022, *Visible Language* editor Mike Zender interviewed Reneé about her successful, sustained research program.

Keywords

*typography;
research;
reading;
collaboration;
co-design;
entrepreneurship*

Please describe your current research.

Learning by Design is a group I lead which conducts rigorous and robust research on all aspects of digital innovations to advance inclusive experiences in literacy and learning across the lifespan. From a design perspective, we conduct research at the intersection of typography, design, and the science of reading. We currently have 3 projects running in the lab plus one in a related lab.

1. *Literacy Fonts*: We are developing fonts that leverage variable font technology to embed early reading decoding skills within letterforms to allow struggling readers to decode words in the context of reading onscreen what they love. We are testing the effectiveness of these fonts in reinforcing reading skills. I am the PI on this project.
2. *See Words Anywhere* browser extension: This technology embeds the *Literacy Fonts* into an application that allows struggling readers to render digital content they love to read in our fonts which help them to decode their preferred text. Targeted for 3rd graders through adults, *See Words Anywhere* assists readers privately, eliminating any stigma associated with reading struggles. This tool also tracks specifically where a reader may be struggling due to their clicks in the text and suggests resources to help them overcome specific challenging areas. We are developing the technology and then conducting pilot testing to understand the tool's promise. I am the PI on this project.
3. Project LEARN: This program aims to build children's language skills via a series of books for Pre-K learners. It is a language development program in which informational texts on science and complementary hands-on activities provide excellent contexts for children to acquire and practice complex language skills. The results of this project will provide pilot data that will provide the basis for us to measure potential effectiveness of the program in an Initial Efficacy Project. I am a contracted designer on this project. The PI's are my co-lab leaders Dr. Allison Breit, Dr. Ying Guo, and Dr. Jo-Ann Prendeville
4. *Tongue Parts*: This project is developing and testing a gamified feedback tool to help address speech disorders. While not a project within our lab directly, I have worked with Communication Sciences and Disorder, Psychology, and Engineering researchers on this National Institutes of Health (R01 DC017301) funded project. Dr. Suzanne Boyce is the PI on this project with Dr. Doug Mast, Dr. Michael Riley and myself serving as co-PI's.

How is your current work related to where you started?

It's directly related. I started exploring how typography could help people with dyslexia read better. The more research I did, the more I learned. The more I learned, the more I met colleagues in related disciplines, which sparked new ideas related to existing work, which led to new questions to explore. I call these "make questions" because they are founded on some existing knowledge that we put in contact with a specific problem that is best answered by making something to get the answer. You can only theorize so long. An example of a "make question" would be, can someone learn better if the animation is fast or slow? Will teachers use the tool more effectively if they can make their own stories? The best way to answer these is to make something and see! It's a very designer way to do research.

What makes your research topic sustainable?

My undergraduate and graduate education prepared me for sustained research. From my undergraduate education, I was trained to be fearless in asking questions that could be answered through making or going out and finding the answers. I remember my professor Robert Probst encouraging me to take the mentality of just picking up the phone and call, with no fear, just asking "what if..." and using my status as a student to elicit people's help. I learned people were happy to help a curious student eager to learn. This advice and mentality served me well in graduate school and my current research. From my graduate education, I learned to develop a good research question whose hypothesized solutions could be explored by making testable things. I did this within my Master's Thesis which was crucial to my research success so far. My graduate education also prepared me to find collaborators. If I read of an important stakeholder on a project topic, I contact them. Most people have always been so kind and happy to help. Working with collaborators and testing the efficacy of our hypotheses enabled us to go after funding. My educational experiences have taught me to ask critical questions and make testable things.

Over time, I found that interesting research questions often lie where there is an existing body of research debated amongst researchers. These have proven to be great spots to ask a "make question."

Where did you get your initial funding/support?

It came from a non-profit technology foundation. Ironically, a faculty colleague and I co-wrote a grant to them and didn't hear back for two years, so we thought the proposal was rejected. We were delighted to hear we were ultimately funded.

Another boost came from Craig Vogel, the Associate Dean for Research, who put me in touch with the research dean at the College of Education, who ultimately introduced me to many of my current research collaborators who shared my interest.

Another critical moment of support was collaborating with a colleague who ran a grant-funded after-school program in the local public school system. Her credibility with the schools and her endorsement of my research literally opened the doors to the local schools to me for testing our prototypes. Initially, it was difficult to find any school willing to allow a designer to come into schools to test educational interventions without an educational degree. I also found that many of the local schools and community have a lot of skepticism of 'University Researchers' who are motivated more by collecting data for a publication than they are in truly working with educators, students, and community members to address problems. This was a large barrier at first, but we eventually overcame this barrier with my colleague's help and my commitment to the schools.

Does collaboration play much of a role?

Collaboration is key. I figured this out while developing my thesis. Initially, I thought I could just design a font to fix dyslexia. When that design was not working, I realized I had to reach out to experts in other fields to get closer to addressing core issues that a design needed to consider. Through the process of finding collaborators, I have learned about the depth and focus of several fields I didn't even know existed, like Communication Science and Disorders, literacy specialists, and educational psychology. From them, I learned new research methods for investigation in the field and gained a deeper understanding of the science of reading. I have also learned how to engage with these collaborators and community partners in co-design methods to develop testable tools.

How did you find collaborators?

The Associate Deans in each of the Colleges and the Office of Research within my institution have been incredibly helpful in identifying other faculty who share similar interests to me. Typically, when I connect with a colleague who may be a collaborator, we get together for coffee and let that conversation guide our next steps.

In terms of finding great research assistants, it is super helpful when my colleagues invite me to speak in their lecture class. It is also beneficial to have the privilege of teaching great undergraduate and graduate design students and trusting my collaborators in finding students in their area of expertise.

Do you support a research team? Who are they?

Oh yes! Over the years, I have had a large number of undergraduate and graduate students working on research with me from the field of speech pathology, computer science, education, and design. Currently, among the 4 projects I am involved in, we have 2 Ph.D. students in education and communication sciences and disorders, 1 project manager, 2 graduate design students, 7 undergraduate design students. These researchers are supported in various ways: fellowships, endowment funding, grants, college credit, and volunteering. I enjoy working with research assistants. They are so enthusiastic and passionate about our work. I believe these experiences offer them a great experience in an alternative area of professional design practice. It builds their resume. It teaches them research skills. It builds their design skills. It opens their minds to how design can positively impact society through collaborating, making, and research.

Most design researchers started their career as designers or design educators and shifted to research. What piqued your interest in research?

My heart is in this. I want to help black and brown kids learn to read. I want to make a difference starting in my community and hoping it can impact the world.

What is the relationship between your research and your continuing education / growth as an academic: your teaching; your design?

Through research I am constantly learning. It drives my reading and exploration of a lot of related topics. And research increasingly dominates my teaching. Every Friday now is devoted to teaching research. Some of Friday is devoted to meeting with graduate research fellows, some is spent with mostly undergraduate students who voluntarily meet with me to work on research, some time is meeting with co-op students I employ, sometime is spent in lab meetings for my on-going projects. I believe my teaching and research have made me a better designer.

Do you find research rewarding, or not?

Yes! I can't wait for my Friday time every week! That's not to say there aren't challenges. Rejection happens. It's part of the process. I learned that when something like a grant is rejected, just to re-write it. My attitude is "Oh well, revise it." A colleague once said successful people are ball throwers and that you have to throw out multiple balls, a lot of balls, to have some hits. Sometimes I need to ask new questions, re-orient my work for the audience. You have to know when to pivot. When something's not working you must ask hard questions including revising your basic research question.

Collaboration is challenging and rewarding too. Having a shared vision and a shared vocabulary are keys. Then you must consciously work to build trust and let the outcome be driven by the co-design process with your collaborators. I've learned that good potential collaborators are curious and open to engaging in a process of discover. So am I. That's important common ground.

Researcher

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Reneé Seward, MGD

Reneé Seward is an Endowed Associate Professor and Program Coordinator of the Communication Design program at the University of Cincinnati's College of Design, Architecture, Art, and Planning.

Reneé has been teaching typography and graphic design for the last fifteen years. Her students have won numerous awards from *Graphis*, *Graphic Design USA*, and *Creative Communication Award (C²A)* design competitions.

Her research focuses on developing digital and physical tools that seek to address our society's literacy problem. She currently is a co-founder in *See Word Design LLC* which sells two reading tools called *See Words School*® and *See Words Home*®. Renee was a *Cincy Innovates* winner, has been acknowledged as a Rising Tech Star by *ComSpark*, and was awarded by the *Business Courier* Best Software of the Year. The *SeeType* font her team designed recently won an *STA* award, and the *SEGD Global Design Merit Award*. She gave a TEDx talk on "Eradication Literacy Through the Power of a Font."