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Finding Our Way Through Environmental Communication

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Before there was reading there was seeing. Visible Language has been concerned with ideas that help define the unique role and properties of visual communication. A basic premise of the journal has been that created visual form is an autonomous system of expression that must be defined and explored on its own terms. Today more than ever people navigate the world and probe life's meaning through visual language. This journal is devoted to enhancing people's experience through the advancement of research and practice of visual communication.

If you are involved in creating or understanding visual communication in any field, we invite your participation in *Visible Language*. While our scope is broad, our disciplinary application is primarily design. Because sensory experience is foundational in design, research in design is often research in the experience of visual form: how it is made, why it is beautiful, how it functions to help people form meaning. Research from many disciplines sheds light on this experience: neuroscience, cognition, perception, psychology, education, communication, informatics, computer science, library science, linguistics. We welcome articles from these disciplines and more.

Published continuously since 1967, *Visible Language* maintains its policy of having no formal editorial affiliation with any professional organization – this requires the continuing, active cooperation of key investigators and practitioners in all of the disciplines that impinge on the journal's mission as stated above.

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The Environment is (Still) Not in the Head:

Harry Heft & Contemporary Methodological Approaches to Navigation and Wayfinding

Ashley Walton

Traditional approaches to spatial cognition focus on postulating underlying mental mechanisms, such as cognitive maps. Alternative theoretical approaches from the field of Ecological Psychology pioneered by Harry Heft offer needed perspectives with respect to how we understand and investigate navigation and wayfinding behavior. Successful environmental communication is about orchestrating an interaction that is flexible and robust; that can capture the idiosyncrasies of everyday activities. Abstracted, disembodied, and static representations of experience like the cognitive map fail to capture these idiosyncrasies. Employing a theoretical framework that focuses on the on-going perception-action processes of navigation will provide new ways to conceptualize communication systems that are adaptive, dynamic, and can successfully operate amongst the increasing technological complexity of contemporary spaces. New methodological tools from the field of Ecological Psychology can provide ways to identify these on-going processes that modulate interactions within environments as the interaction unfolds. These processes are constituted by patterns of physical movement and sensory experience as well as socio-cultural factors. The way individuals are engaged in these processes can change throughout the course of the interaction; the way designers establish, fluctuate, and disrupt the flow of this engagement is driven by when and how they intend users to perceive features of a visual communication system.

New technological methods for communication have emerged that allow information and interaction to be further embedded in physical spaces and feedback loops to become further intertwined. These communication exchanges happen simultaneously across different mediums and between both users and technological systems (*figure 1*).

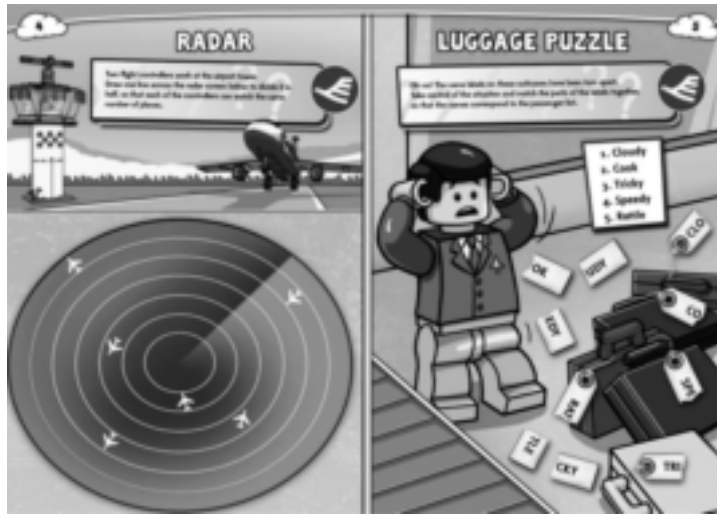

Figure 2
Complex spaces like airports have multiple communication exchanges that operate on different scales through different mediums, both between users and technological systems.

It is no longer possible to consider pieces of a design solution in isolation from one another. Design and ecological psychology both continue to take on the challenge of understanding how individuals behave and interact within the complexity of their environments. The tenets of ecological psychology are not unfamiliar to designers. The founder of the field, James Gibson, introduced the concept of affordances which was then popularized in the field of design by Donald Norman's book, *The Design of Everyday Things*. Lesser-known and more contemporary developments in ecological psychology can provide new approaches to investigating how users navigate amidst the increasing complexity of contemporary space.

Dr. Harry Heft, a professor of psychology at Denison University, has an extensive history of writing about how ecological psychology provides a needed perspective concerning how we perceive and interact with our environments (Heft, 2010,1999,1997). The focus here will be his more recent work regarding an ecological approach to studying spatial cognition and wayfinding processes (Heft, 2013,2012,1996).

Heft discusses in his chapter titled "Wayfinding, navigation, and spatial cognition from a naturalist's standpoint" in *The Handbook of Spatial Cognition*, how the field is traditionally focused on describing our use of cognitive maps. Cognitive maps are overviews of a layout that focus on geometric relations not seen from the ground surface, but from a bird's-eye-view. Heft argues against the idea that exercising spatial knowledge requires referencing a cognitive map existing in the head. First, it is problematic because it is not the way we experience the world. The vantage point of a bird's-eye-view is something we rarely directly experience, thus it is disconnected from the nature of our everyday interactions with the world. For example consider the difference between Googlemaps and Google Streetview (*figures 2 and 3*). The bird's-eye-view of Googlemaps is a simplification of what is depicted in Streetview. Objects are shown in isolation, but as Heft explains, the objects we experience while navigating environments rest on surfaces among multiple other objects and perceptual features. This creates a multitude of relational properties among these features that can be used to identify spaces and paths of locomotion. Second, cognitive maps are problematic because they are static, not dynamic (Heft, 2012). Not only do these simplifications neglect how objects are situated in relationship to each other, the relations between these features are constantly changing because the perceiver is constantly moving. Cognitive maps depict only one moment in time, failing to capture the on-going processes of change in perceptual experience that unfold while traversing an environment (Heft, 2012). As we move, the relational properties we perceive among environmental features change, and these transitions provide crucial information about where we are and where we have been. Heft has experimentally investigated these claims demonstrating that individuals are sensitive to transitions while navigating a route, and that these transitions can aid the wayfinding process (1979, 1983, 1996). Accordingly Heft provides his own definition of wayfinding: "a continuous, integrated perception-action process controlled by the detection of information over time" (2012, p. 268). It is clear that cognitive maps alone cannot properly capture these ongoing time-dependent processes.

Figure 2
Googlemaps displays a disembodied, bird's-eye-view of the navigation trajectory.

Figure 3
Googlemaps' Streetview provides depictions of the immediate experience of navigating the environment.

"GETTING SOMEWHERE SOCIALLY"

Another key criticism of cognitive maps is what Heft calls the "out there-ness": the idea that space exists independently of the individuals that occupy it (2012, p. 270). He claims instead that our relationship with our environment is central: we adapt to our surroundings, and the environment is modified as a result of our actions. These reciprocal changes happen across multiple time scales. Socio-cultural processes play a crucial role in modulating behavior outside the time frame of the interaction, across the time scales of years and even generations. Heft claims that underestimating the contribution of these processes has dire consequences to our success in understanding how we execute and develop wayfinding skills. He explains that unfortunately most research regarding these skills has come from North American and Western European samples. So in order to understand the role of culture in wayfinding behavior, Heft describes accounts provided by ethnographic studies, including the two summarized below (2013, 2012).

THE HAI||OM OF NAMIBIA.

Heft describes the accounts of Widlock, ethnographic studies of the Bushmen of Namibia in southern Africa who are known for their exceptional tracking and hunting skills (1997). During his fieldwork, Widlock tested the men and women's ability to accurately point at distant features, to places they had never been. When compared with GPS readings their performance demonstrated high levels of accuracy, as depicted in Widlock's table (*table 1*). Widlock also found that women outperformed the men at this task, a surprising result because it is the men in the society that are responsible for hunting and tracking. But then what contributes to these accurate pointing skills, if not experience hunting and tracking? Widlock proposed the source to be the way he observed the Bushmen of Namibia pointing

frequently during everyday conversation. This pointing was often oriented towards locations, invoking shared reference of different landscape features. Widlock termed this "topological gossip" (1997). Heft explains that Bushmen's orientation skills are puzzling if one looks to the mind for an explanation, because Widlock's documentation of their references does not form a coherent unified set of locations like that of a map. Instead these references are connected to goal-directed action and social discourse. Widlock explains that for the Bushmen of Namibia wayfinding is not about moving from one geographic location to another (1997). It is about getting somewhere socially, navigating towards the location of a task, of a meal, or a conversation. Here we see an example of socio-cultural processes dictating the structure of spatial understanding, in place of geometric abstractions.

Table 1
Table from Widlock (1997) displays the accuracy of direction estimates when the Hai||om were asked to estimate the distance of different landscape features.

TABLE 1. Hai‖om estimates of direction.

Subject	*N*	*average deviation*	*skewed to east*	*skewed to west*	*not known*
HO, y. man	21	12.24°	10	9	1
AK, eld. man	21	10.7°	5	15	0
HU, y. woman	20	12.35°	9	8	3
MK, y. man	20	10.85°	8	4	7
GK, eld. woman	20	10.95°	9	9	2
AS, eld. woman	20	8.55°	4	14	2
DD, eld. man	19	31.63°	1	17	1
AB, eld. man	20	27.7°	0	20	0
DK, eld. man	13	18.15°	5	7	0
AR, boy	12	28.67°	2	10	0
Total	186	16.40°	53	113	16

CAROLINE ISLANDERS OF MICRONESIA.

Heft also cites Edwin Hutchins, describing an example of culturally dictated navigation processes from Hutchin's 1995 book *Cognition in the Wild*. Hutchins observed the navigation methods of Micronesian sailors in the Caroline Islands (*figure 4*, next page). The Micronesians would frequently embark on voyages between the islands, which necessitated knowing both the direction the boat was going as well as the distance it was traveling across a large area of ocean. What Hutchins found was that the Micronesians' knowledge of both distance and direction did not originate from the use of maps or a compass, instead they made use of relational properties between

themselves and features in their environment. In order to understand the direction of their course, they used the stars. The rising and setting of stars on the eastern horizon traces consistent paths across the sky, so they can serve as a reference point that does not involve the calculations necessary if distance was to be tracked using the global reference system of a compass and a map. The way the Micronesians sailors kept track of distance made use of unique relational properties; instead of calculating the bearings of stars in reference to their moving boat, they would imagine that their boat was stationary and that islands were moving past them. To index the distance they were traveling towards their destination they identified a reference island off to the side of the direction of their course, called an *etak island*. As they progressed along their journey they checked the bearing of the island in relationship to star locations until the etak island was at the bearing known to be associated with their destination (*figure 5*). And so why do the islands move? Hutchins explains that using a frame of reference that can be visualized from the natural point of view of the canoe decreases the number of moving systems that a navigator needs to keep track of. It is more difficult to update positions of the boat and stars with respect to a reference island, than only update the position of an island with respect to the boat and stars. Star paths and etak represent a dynamic reference system that prioritizes the immediate perceptual experience of the traveler in maintaining the course of direction, without reference to a detached, disembodied representation. Of course with the introduction of GPS these practices among the Micronesian are less common, but Hutchins' ethnographic work provides a window into strategies that developed in the absence of Western navigation tools.

Figure 4
The Caroline islands in the Pacific Ocean, the home of the Micronesian sailors described in Hutchins (1995).

Figure 5
Diagram from Hutchins (1995) describing how Micronesian sailors navigated between islands by monitoring the bearing of the reference (etak) island until it was at the bearing known to be associated with the final destination.

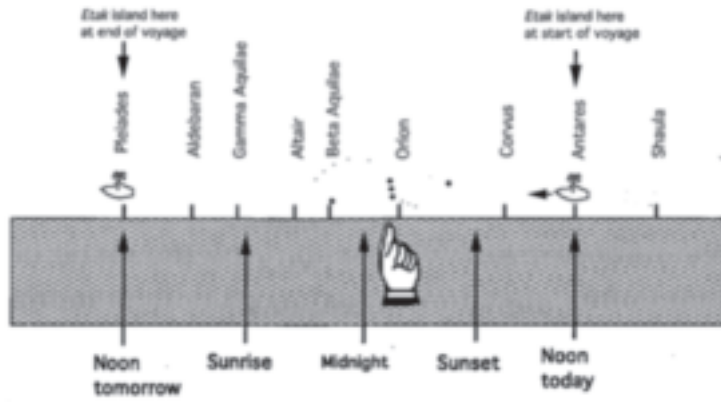

Figure 2.15 Just before midnight the navigator points to the etak island. All he needs to do is point to the location of the current time on the time scale that is superimposed on the spatial landmarks provided by the star points.

METHODOLOGICAL APPROACH: DYNAMIC SYSTEMS THEORY

To say that cognitive maps do not effectively capture our navigation experience is not to say that this particular mode of visualization cannot function as a communicative tool. Designers often employ cognitive maps as a way of visualizing the experience among team members throughout the design process, or even include some version of a bird's-eye-view as a way of communicating information to the end user. But what Heft is trying to point out through his examples is that the cognitive map does not function as a neutral tool or harmless metaphor. Believing that individuals use cognitive maps in the process of navigating the world constitutes a theoretical framework that filters and ultimately warps our understanding of wayfinding behavior. How a behavioral phenomenon is conceptualized is pivotal to defining the vocabulary we use, the tools we employ, the kinds of questions we ask, and how we interpret what we see. In designing ever more complex technological systems to be responsive to human interaction, we may need to start asking new questions, and using new words. Orchestrating communication that is flexible and robust requires a theoretical framework that is motivated towards capturing the dynamic, on-going processes that characterize the way we experience the world.

Ecological psychology has a history of developing methodologies for capturing these processes of behavior through the use of dynamical systems theory (see Ashby, 1960; van Gelder, 1998). In this approach behavior is understood as the result of a coupled brain-body-behavior system where the individual and their environment are in constant

interaction (Beer, in press, p. 16). Randall Beer, whose earlier work focused on building a six-legged robot that could walk, conceptualizes the environment "E" and the agent "A" as coupled with a sensory equation "S" and a motor equation "M" shown in Figure 6 (Beer, 1992). These equations take into account how environmental variables affect the agent's behaviors and states, and how the agents' behavior can change environmental variables. They are mutually coupled in that one does not dominate the other, and they simultaneously constrain one another—or limit one another's actions.

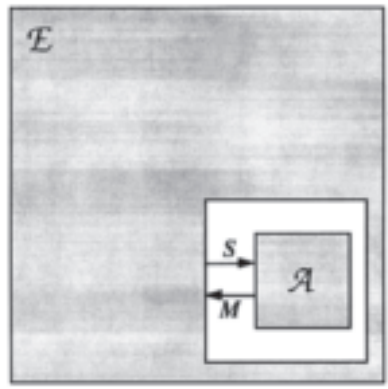

Figure 6
Visualization from Beer (1992) depicting how a sensory equation "S" and a motor equation "M" couple the environment and the animal, or organism.

Behavioral dynamics applies the dynamical systems approach to navigation, capturing the coupling not only between individuals and their environments but also the coupling that emerges between the individuals themselves (Warren, 2006). The relationship between two individuals and their environment is represented by two sets of dynamical equations like that described above by Randall Beer, and the relationship between the two individuals is captured with another set of dynamical equations. These equations are meant to account for how different factors influence the way that these users coordinate their movements across time and space, including physical structures in the environments, biomechanics of the body, and perceptual information. To better understand these processes, experimenters design movement coordination tasks that are inspired by everyday goal-directed behaviors. Across different trials, aspects of the task context are manipulated to reveal how environmental changes influence the movement and coordination patterns of individuals throughout the interaction, captured by a magnetic motion tracking system. For example, an experiment at the University of Cincinnati's Cognition, Action and Perception Lab, explores the act of navigating a two dimensional space with another person. As in Figure 7, the participants stand across from each other, on the opposite sides of a large table. Visual stimuli are projected

onto the table from below; participants can manipulate these stimuli using motion-tracking sensors that are attached to their fingers. Each participant controls a dot that appears on one side of the table. Their task is to navigate their respective dots using the motion sensors to the goal box depicted on the opposite side of the table. White dots also appear on the surface that serve as obstacles, participants are told to navigate to the goal box without running into any of these obstacles and to do so in such a way that both of them end at the goal location at the same time.

Figure 7
The interactive virtual table in University of Cincinnati's Cognition, Action and Perception lab where participants complete navigation tasks while their movement trajectories are recorded. *Image taken by Ashley Walton (2014).*

This simple two-dimensional task is an initial step to capturing the key challenges of behaviors like walking through a crowded city street to get lunch with a friend: moving towards an end destination, making sure you don't run into anything or anyone in the process, and reaching that destination at the same time as your companion. This approach can help build a better understanding of how these patterns of synchronized movement emerge in the context of the interaction. Approaching behavior from a dynamical system framework produces a picture of behavior that is not a static representation of a single moment of time, but a description of how different components and features of the environment interact to give rise to an individual's actions and experiences. By emphasizing the ongoing process of the interaction, we may become better equipped to create communication systems that are robust to unpredictable changes.

As Heft has demonstrated, understanding how perceptual information is experienced during wayfinding requires an understanding of what this information conveys to individuals in relation to these socio-cultural processes. The patterns of movement and sensory coordination necessary to successfully navigate an environment must be synchronized with the patterns of cultural and social behavior that guide the interpretation of symbols within that space.

As users become coupled with communications systems and engage with information to stabilize behavior to accomplish different tasks, the manner in which they are coupled to that information changes. In constructing a communication system designers must establish the coupling of users to the visuals and information in the environment, and maintain that coupling across time and space. This coupling not only has practical implications but also contributes to the communicative aesthetic. The way designers disrupt, fluctuate and maintain the flow of this coupling of the user to the environment can be thought of as the orchestration of the aesthetic experience of a space.

Ecological psychology has drawn inspiration from Martin Heidegger in exploring the different ways users are coupled with their environment. Heidegger describes human behavior as skillful engagement with entities in the world, but environmental influences can cause disruptions in this engagement (1962). He distinguishes between three modes of coupling with the environment: ready-to-hand, unready-to-hand and present-at-hand. Ready-to-hand is when we are engaging with the world and do not exercise explicit awareness of the properties of objects we are engaged with. If we are using a hammer, we do not notice its size, color or shape. Unready-to-hand is when our skillful coupling with the world is temporarily disturbed, we become aware of the properties of the hammer, nails and board that are interfering with its functionality. Our coupling with the environment is characterized by frustration and explicit awareness of the details of our activity. Present-at-hand is when we are not engaged in a task but are focused on considering the specific properties of objects; the hammer is no longer a tool but merely an object with various properties.

Understanding these different modes can provide ways to conceptualize how communication systems can be constructed to facilitate and disrupt the flow that couples users to their environment. Paul Dourish in *Where the Action Is* explains how both the ready-to-hand and present-at-hand modes are critical; there is a need for ways to transition between them in our use of physical tools as well as abstract entities. As users navigate through a space

they instigate different patterns of engagement with objects, other users, technological systems, and abstract communicative symbols. Heidegger's ready-to-hand defines a type of coupling marked by efficiency and the unconscious, unready-to-hand by frustration, and present-at-hand by the appreciation of specific properties of the environment with which we are engaged.

These distinctions can provide ways for designers to approach the management of the coupling of users and communication systems. In answering the questions "Where am I?" or "Where am I going?" with efficiency seems to require Heidegger's ready-to-hand coupling between the user and environmental entities. But the additional challenge of constructing environmental communication systems is answering the question "Where am I?" with more abstract meaning, understanding location as part of a social narrative instead of geographic coordinates. Doing so may require transitions to present-at-hand, where there is a conscious awareness of features and properties. The experience of a space depends on the orchestration of how and when communicative meanings emerge as a salient aspect of our experience, or operate to support the completion of tasks unbeknownst to our explicit conscious attention. "Bumping into" the communication infrastructure can be thought of as the disruption of the coupling that establishes a flow of the experience of a space. Ensuring that this manner of coupling is disrupted or established at the right moments, facilitating and obscuring the conscious experiences of different aspects of communication systems can be a way to conceptualize wayfinding that is both efficient and aesthetically pleasing.

CONCLUSION

In advocating for researchers to focus on the emergent relationships between behavioral processes and the environment, Wolhwill titles his paper with an emphatic exclamation: "The Environment Is Not in the Head!" (1973). This plea leaves researchers the daunting task of understanding behavior within infinitely variable contexts. Design and ecological psychology have the right tools: at their best they are refinements of everyday thinking that employ thoughtful rigor and disciplined imagination. Psychology is in the position to invest in an extensive and disciplined description of human behavior, and design can provide expertise in harnessing the complexities of real-world contexts that include emerging technologies and socio-cultural processes. Endeavors of these disciplines can be combined to build robust interactive principles that guide the optimization of communication systems to be adaptive to how users respond to novel situations and unforeseen errors. The goal of this interdisciplinary collaboration is not to control or simplify interactions, but establish a dialogue with the coupling of users to place and context—designing new ways to manipulate and communicate information in our exchanges with the environment and others.

AUTHOR BIO

Ashley Walton was awarded a Bachelors of Science in Design as well as a Bachelors of Interdisciplinary Studies in Brain and Mind Studies from the University of Cincinnati. She focuses on combining quantitative and qualitative methods in understanding behavior in order to create interactions that are both beautiful and reflect an understanding of human need. She is currently pursuing a Ph.D. in Experimental Psychology and working in Behavioral Medicine at Cincinnati Children's hospital developing pain management tools for Sickle Cell patients.

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Overview:
Visual theorist and design historian Johanna Drucker, in *SpecLab: Digital Aesthetics and Projects in Speculative Computing*, defines the digital humanities as "the study of ways of thinking differently about how we know what we know and how the interpretative task of the humanist is redefined in these changed conditions"[1]. Design and the digital humanities connect through critical making practices, centering on human experience and advancing the prevailing expectations of their respective disciplines.

At the convergence of conceptual and material practices[2], the ongoing development of a framework for critical making offers a means to understand complex relationships between research, scholarship and production. In design, emphasis is placed on innovative notions of what criticism or authorship can be within the context of design-making; in the digital humanities, focus is on innovative notions of what "making" can be as a form of interpretation within the context of conventional scholarly dissemination. The intersection of these two areas presents opportunities to bring form and content together in ways that are practical and theoretical, rhetorical and physical.

Critical making in design is aligned with practices that facilitate innovation and exploration related to technology, materiality and communities. In graphic design — a discipline, a medium, a practice and a tool[3] — "critical practice" has been used to describe a range of activities that position the designer as author, producer, scholar, curator or programmer[4]. These endeavors, whether individual or collaborative, may involve humanistic or scientific inquiry, and move beyond the traditional structure of client-based relationships. From a pedagogical perspective, key components of critical making include "hands-on practice, the processing of enhanced seeing and perception, and contextualized understanding"[5].

In the digital humanities, critical making distinguishes its practices from traditional forms of humanities scholarship. With an emphasis on tool building, information visualization and digital archiving, the digital humanities merge two seemingly opposing modes of scholarship: reading and making. Critical making dichotomies of thinking/making, knowing/doing and cognition/embodiment permeate current digital humanities discourse[6] and projects demonstrate a desired interest in building through existing design and development processes. *The Critical Making Zine*[7] uses physical production to publish and distribute a series of essays on technology, society and DIY culture. *Speaking in Code*, an NEH-funded symposium hosted at the Scholar's Lab in 2013, addressed questions related to "DH code-craft": tacit knowledge as it relates to the design and development of digital humanities projects[8].

Perspectives:
This special issue of Visible Language investigates critical making at the intersection of design and the digital humanities, which is a site for expanding the role(s) of divergent scholarly and creative work. We invite submissions that address one or more of the following questions:

- What are the theoretical or pragmatic ways to frame critical making in design and/or the digital humanities? Where are the similarities, differences and challenges? How are these advantageous?
- In what ways might design authors and producers connect with the digital humanities? Where or how are digital humanists' experiences of critical making intersecting with designers? How do these crossover 'ways of seeing' impact our scholarly and creative work — and future hybrid practices?
- How might forms of understanding such as speculative design, prototyping or hacking play a role in critical making, and in what ways are these influencing the scope of work in both areas?
- In what ways might design and the digital humanities collaboration be fostered in the studio or classroom? What are some examples of pedagogical approaches to teaching critical making?
- What are the forms these arguments might take as part of this special issue?

Visible Language is a journal that invites evidence-based research. For this issue, we encourage exploratory, creative works that incorporate evidence-based research through critical commentary, traditional analysis, audience responses or participant feedback.

REFERENCES

[1] Johanna Drucker. SpecLab: Digital Aesthetics and Projects in Speculative Computing (Chicago: University of Chicago Press, 2009), xii.

[2] Mark Ratto, "Critical Making" in Open Design Now: Why Design Cannot Remain Exclusive, Bas van Abel et al. (The Netherlands: BIS Publishers, 2011), 202.

Proposal due: January 15, 2015
Abstract **acceptance/rejection:** March 15, 2015
Full papers / works due: June 15, 2015
Review period: June 15 – August 1, 2015
Review feedback: August 1, 2015
Final paper submission: September 15, 2015
Anticipated publication: October 2015

Submissions:
In keeping with the theme of merging form and content, the traditional printed journal will be expanded to include a corresponding online space for interactive and digital work. We invite dialogue on what defines scholarly works in regard to non-traditional forms of writing and disciplinary crossovers. Submissions may include, but are not limited to, case studies, interactive reading experiences, audial and visual works.

Proposals should include a 300-word written abstract and a brief outline to show the structure of your argument. A corresponding visual abstract is strongly encouraged. For digital work, please include a URL or screenshots. Final articles can range from approximately 3–5,000 words.

Please send proposals through January 15, 2015 to Jessica Barness, jbarness@kent.edu

Open Peer-Review Process:
Submissions will be reviewed through an open peer-review process. An open peer-review process makes available the submission author's name to the peer-reviewer. Reviewer names and reviews will be published on the Visible Language journal website. Proposals will undergo review; a selection will be shortlisted for development into full-length papers / works and these will also be peer-reviewed prior to publication.

Interested in serving as a peer-reviewer?

Peer-reviewers will be responsible for providing feedback about abstracts and/ or final submissions between January – August 2015. If you are interested in serving as a peer-reviewer, please get in touch.

Guest Editors:
Jessica Barness is an Assistant Professor in the School of Visual Communication Design at Kent State University, where she teaches graphic and interaction design. She holds an MFA in Design from the University of Minnesota with a minor in Writing Studies, and an MA and a BA in Art from the University of Northern Iowa. Barness' research through design investigates theories in social issues, language and interactive technologies. Her work has been exhibited at venues such as Hebei Normal Museum, China and FILE Electronic Language Festival, Brazil, and published in Communication & Place and Currents in Electronic Literacy. She has also presented research at the International Committee for Design History and Design Studies Conference (2014), SEGD Academic Summit (2014), AIGA Design Educators Conference (2013) and HASTAC (2013), among others.

Amy Papaelias is an Assistant Professor in the Graphic Design program at SUNY New Paltz, teaching courses in web and interaction design, as well as 2D design and visual communication. She holds an MFA in Intermedia Design from SUNY New Paltz and a BA in Cultural Studies from McGill University. Her creative research lies at the intersection of design, culture and technology with specific interests in interactive typography and the digital humanities. She has presented her design work and pedagogy at Theorizing the Web 2014, AIGA Design Educators Conference (2007, 2013), TypeCon (2005, 2007, 2012), UCDA Education Summit (2011) among others. In 2013, she was selected to participate in One Week One Tool, an NEH-funded Institute for Advanced Topics in the Digital Humanities, hosted at the Center for History and New Media at George Mason University and co-authored a long paper on the experience that was presented at Digital Humanities 2014.

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[4] Albinson, Ian and Rob Giampietro. Graphic Design: Now in Production (Minneapolis: Walker Art Center, 2011).

[5] Rosanne Somerson. "The Art of Critical Making: An Introduction" in The Art of Critical Making: Rhode Island School of Design on Creative Practice, ed. Somerson, R. and Hermano, M. (Wiley, 2013), 19.

[6] "Critical Making in the Digital Humanities: an MLA 2014 Special Session Proposal" by Roger T. Whitson, accessed on March 3, 2014. http://www.rogerwhitson.net/?p=2026

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Design for Information: An Introduction to the Histories, Theories, & Best Practices Behind Effective Information Visualizations

Isabel Meirelles

Beverly, MA: Rockport Publishers, 2013.

For a complementary perspective of this book, please refer to the review written by Aaron Marcus in the *Information Design Journal* 20(3), 296–297

The book is a thorough representation of both the field of information visualization and the research interests of the author, whose focus is on "the theoretical and experimental examination of the fundamentals underlying how information is structured, represented and communicated in different media."

Beginning by the "big picture," the book includes an amazing collection of examples, the most thorough I have seen to date in a volume. The author organizes the content according to several categories represented by the titles of the chapters: 1) Hierarchical structures: trees; 2) Relational structures: networks; 3) Temporal structures: timelines and flows; 4) Spatial structures: maps; 5) Spatio-temporal structures; and 6) Textual structures. An appendix, notes, bibliography, contributors list, and index, complete the apparatus of the book.

Design for information is an extensive taxonomy of data visualization types, and is "a must" for anybody interested in the work done in the area. Each one of the hundreds of examples is explained and discussed, forming a kind of encyclopedia on the subject. It seems that nothing escaped from the through gathering of examples that Meirelles got involved in. The discussions and explanations normally focus on what information is represented and how it is represented.

It is interesting to see as well how many different professional fields use today diagrams to organize and represent information: basic science, applied science, education, engineering, medicine, technologies, etc. The value of the book is centered on the inclusion of examples of how many different problems are today being confronted by data visualizations, how many historical efforts preceded whatsoever is done today, and how the advent of the computers have allowed the field to explode, handling large data sets as well as dynamic representations.

At the end of the examination of the 224-page volume one becomes curious as to how might these diagrams have performed with the users they were intended for in terms of ease of comprehension; what conclusions could one arrive at from an evaluation of the examples included regarding perceptual and cognitive human factors; or how could a complementary book contribute to the development of best practices. I would not expect that one volume could be so extensive as this one and also cover the field critically. One, however, has to wonder how the super-complex visualizations permitted by computer programs today would perform regarding comprehension, memorization, and use of the information presented. The discussion on perception and cognition is very brief, and it might leave some readers wondering about the assertions made: they are proposed as principles without them being discussed. This topic, as well as Gestalt theory, are not considered during the description of examples. The size of some reproductions is too small to assess their quality as data visualizations, they appear as samples of problems dealt with but not as information in themselves. To compensate for this, the book includes valuable URLs for people interested in seeing in better detail many of the diagrams shown.

While the above could be perceived as a weakness, the strength of the book is its truly amazing array of examples and the rare historical diagrams it offers. It also displays an uncommon erudition, and includes an extensive and useful bibliography. One does not know how long Meirelles took to complete the manuscript, but it feels like a life-time project. These assets, coupled by an excellent production, make it an indispensable publication for whoever can be interested in information visualization.

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