Case Transfer: A Design Approach by Artifacts and Projection

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Introduction

Understanding the needs and wants of users is widely believed to be essential for design; also widely accepted is that various groups of professionals are specialized in studying users. For example, the human-factors specialists study usability—mainly physical and cognitive usability, although some[1] emphasize emotion and experience as well. The social and behavioral scientists focus on people's psychological, social, and cultural needs and wants.[2] User study is conducted not only after the fact, to test and evaluate usability of products and services, but also at the "fuzzy front end," to determine what to design.[3] The latter is often referred to as "design ethnography," "new product ethnography," or "user experience study," and it has received much attention in design scholarship and literature.[4] Design ethnography aims to obtain knowledge about the culture of users to discover their needs and desires—especially the "latent" ones. Typically, the design process begins with a rapid ethnographic study of users and use contexts. Study results then form the basis of design requirements by which designers might create innovative products or services.

In this article, we call into question this current practice and received view on design ethnography and the design process. We argue that the default practice of first-user-study-then-design is conditionally useful: It is most suitable for a design context that is relatively determined. We also propose that when the design context is highly undetermined, a design project might begin with projecting new, possible alternatives instead of studying the users. Based on Peirce's abduction, his semeiotic and some quasi-experiments, we further present an approach we call transfer to exemplify our proposal. The sectors of design practice, education, and research have been fairly serious about user study, design ethnography, and the like for the past decade and more. These models can of course be useful and should be taught and practiced. However, in our opinion, they have overshadowed the projective competence, without which nothing new can be imagined. We mean the generative capacity to conceive and synthesize future systems, situations, or artefacts. While there is an abundance of research, discussions, and interest in user study approaches and methods, a parallel development in projective competence has not taken place.[5] The aim of our examination is to re-open a forgotten path for design and design research: namely,

1 Leon D. Segal and Jane F. Suri, "The Empathetic Practitioners. Measurements and Intrepretation of User Experience." in *Human Factors and Ergonomics Sociaty 41st Annual Meeting 1997: Ancient Wisedom, Future Technology,* edited by H. E. S. Price. (Albuquerque: Human Factors and Ergonomics Society, 1997); Pat Jordan, *Designing Pleasurable Products: An Introduction to the New Human Factors* (London: Taylor & Francis, 2000); A. D. Burns and S. Evans, "Insights into Customer Delight" in *Collaborative Design. Proceedings of Co Designing 2000* edited by L. B. Stephen Scrivener and Andree Woodcock (Coventry, London: Springer-Verlag, 2000).

2 Ilpo Koskinen, "Empathic Design in Methodic Terms." in *Empathic Design: User Experience in Product Design,* edited by K. B. Ilpo Koskinen, and Tuuli Mattelmaki. Edita, (Finland: IT Press, Edita Prima Ltd. 2003).

3 Ibid.

4 Susan Squires and Bryan Byrne, *Creating Breakthrough Ideas: The Collaboration of Anthropologists and Designers in Product Development Industry.* (Westport: Bergin & Garvey, 2002).

5 Certainly research on design cognition has been going on for a while. Its results are published often in the journal "Design Studies," and presented at the Design Thinking Research Symposium. However, this research has not yet produced substantial interests in design research or widespread adoption in practice of education. Much is still to be done to address the imbalance.

projecting alternative artifacts is essential, and theories, processes, methods, and tools ought to be developed to support it.

The Default Process Is Not Always the Best

Drawing on the propositions advanced by Jonas and Nelson, we question the default process of first-user-study- then-design. Jonas[6] examines and integrates various design processes into a generic one. He describes the design process as a macro-process composed of three domains of knowing: analysis, projection, and synthesis. Each domain of knowing itself has a micro process that includes four steps: observing, reflecting, deciding, and acting. His model is comparable to other models that describe the design process as beginning with understanding the context of the users, making design proposals, and evaluating and implementing the most "satisfying" solution. However, Jonas, like Nelson and Stolterman,[7] thinks that analysis, projection, and synthesis are activities and competences (or domains of knowing) that are intimately related but ultimately independent from one another. As Nelson and Stolterman point out, successful analysis and description of the design context does not guarantee that appropriate solutions are generated or good judgments are made. If understanding the problem or context does not "cause" design, then there is no necessary temporal sequence between analysis and projection or between user study and design. The default is only one possible process.[8]

"Wait a minute," says one who is well-trained in the default. One might argue that although understanding the design context/ problem is different from conceiving a design solution and although in theory there can be different design processes, the advantage of understanding design context first is to give a sense of direction or to narrow the so-called problem-space in which solutions might be sought. To design without first understanding context is blind and inefficient. In our opinion, this counter-argument has force only if designing is perceived or functions as problem solving. Often, designers do solve undesirable problems, including unfulfilled user needs. For example, users are unable to navigate a website or a new service feature is not used, etc. Here, the design context is relatively determined and the end goal is relatively known: to identify the causes of problem and to rectify them. The default process of understanding before projecting makes much sense here. This holds true also for incremental redesign.

However, problem-solving is not the only task or motivation of design. As Krippendorff[9] points out, designers also seek opportunities to create something new, even when there is no problem. Given the Internet, what new services can be created? Given multi-touch technology, what else can it be used for? In these open-ended situations, it is neither necessary nor always useful to conduct a user study first because certain users' needs and wants can only be identified after the design is introduced. As unintuitive as it

6 Wolfgang Jonas, "Research through DESIGN through research - a problem statement and a conceptual sketch." in *DRS Conference Wonderground.* (Lisbon, Portugal: 2006).

7 Harold Nelson and Erik Stolterman *The Design Way: The Intentional Chande in an Unpredictable World* (Educational Technology Publications, Inc: 2003).

8 Similarly, Boland regards the default sequence, intelligence → design → choice in management, as the "rational man economic theory" and suggests a meaningful alternative, which he labels as "Karl Weick's sensemaking manager" and which is compatible with our line of thought: projection → analysis → synthesis. According to Weick, all six possible combinations of analysis/ projection/- synthesis sequences can be observed in management practice. Richard J. Boland Jr., "design in the Punctuation of Managemnet Action." pp. 106-112 in *Managing as Design*, edited by R. J. Boland, Jr., F. Collopy. (Stanford: Stanford Business Books, 2004).

9 Klas Krippendorff, *The Semantic Turn. A New Foundation for Design.* (Boca Raton, London, New York: Taylor & Francis, 2006).

sounds, the rather well-known story of the short message system (SMS) makes the point clear. No one expected or predicted the popularity of SMS. No one could know how SMS would change the way people, especially younger ones, socialize or how new spelling practices would emerge. SMS has not been designed to solve any identified communication needs. But given its existence, it affords people new forms of communication. In other words, it does not address problems but reveals the potential of human communication. Whether we call the new communication practices "latent needs" is rather irrelevant; much more critical is that all new artifacts have the potential to facilitate new forms of user behaviors and actions. The purpose, function, and context of use are determined by the interaction between the new artifact and people and, therefore, come after its introduction. There is no point in first analyzing the present, which does not include the future facilitated by the new artifacts.

It is critical to remember that the traditional user study as analysis of the present or the past makes up only a part of the design competences, albeit an important one. As argued, analysis at the front end of the design process is appropriate when the design context is relatively determined. Sanders and Stappers[10] also note the limitations of many user studies. They suggest that the complexity of the interconnected world demands a new approach to design and development. As are we, Sanders and Stappers are interested in an open-ended design context and on "exploration and identification of presumably positive future opportunities." Their suggestion to achieve this openness is co-creation that involves users in the design process. Unlike user-centered design (UCD), participatory design (PD) sees users as "partner" instead of as "subject" of designing. Users not only describe their needs and wants but also are involved in envisioning the fulfilment of these needs and wants.

Despite their differences, PD and UCD in our view are founded on the same fundamental beliefs. First, both approaches take the understanding of user needs and wants as a guiding principle of design. Second, both approaches draw on people as sources of knowing in design, although UCD focuses on people's ability to present their perspectives and PD on their creative power. However, we do not share these beliefs. In our view, design innovation is independent from and does not need to be guided by user study—participatory or otherwise. Moreover, we believe the chief source of design knowledge is existing artifacts. The approach of case transfer, explored below, deviates from PD and UCD by taking projection as the chief means and artifacts as the primary knowledge sources and thus offers a fundamental alternative and a potential complement to PD and UCD.

Case Transfer: An Alternative to the Default Process

Case transfer is based on two assumptions. First, projecting new artifacts is independent from analyzing and understanding a design

10 Liz Sanders and Pieter Jan Stappers, 2008. "Co-creation and the new landscape of desifn." *CoDesign* 4:5-18.

11 Wolfgang Jonas, "The Paradox Endeavour to Design a Foundation for a Groundless Field." in *International Conference on Design Education in the University.* (Perth, Australia: 2000).

12 In his study of the evolution of the mind, the eminent archaeologist Steven Mithen suggests that artifacts are exemplars and templates allowing copying and imitating—and we should add, most importantly, transferring. His idea is in sync with the notion of "memes," which Langrish has explored in some depth in design. Stephen Mithen, "Mind, brain and material culture." in *Evolution and the Human Mind,* edited by C. P. and S. Stitch, (Cambridge University Press: 2000); J. Langrish, "Darwinian Design: The Memetic Evolution of Design Ideas." *Design Issues* 20:4 (2004): 4-19. See also Jan Michl, "On Seeing Design as Redesign." *Scandinavian journal of Design History* 2002 (12): 7-23.

context inclusive of user needs and wants. Second, existing artifacts are knowledge sources for projection of the new. Jonas[11] argues that design is an historical discipline, and the design knowledge base is the artifacts that have been created before. Jonas makes this claim in his debates on the foundation of design. His central thesis, following systems and evolution theory, is that to create something new necessarily involves creating variations, playing with conventions, and breaking existing rules. A foundation of fixed and permanent rules or laws is antithesis to creating the new.

Instead of a foundation, designed artifacts (can) serve as an archive or a "construction kit" allowing for reconfiguration. Artifacts can allow this continuous process of redesign only if they embody knowledge that can be retrieved. The issue of whether artifacts embody knowledge has triggered intense debates in design research; however, we believe it can be taken as given. Fields of study ranging from the specific practice of reverse-engineering to the whole field of archeology operate on the basis of this belief.[12] The question about artifact and knowledge is more about *how* they relate than *whether* they do.

Our interest in artifacts is not so much about understanding the past as about looking into the future. We hypothesize that existing designed artifacts are knowledge sources for projection. We see that we can take knowledge from one artifact and put it in another domain or context to create something new. This movement is what we call transfer.[13] Transfer within and across domains can be articulated using other common names: analogical thinking, for example, or metaphor making.[14] An analogy or a metaphor is a use or an application of concepts from source domain to target domain. That analogy and metaphor are central to creative thinking is widely accepted. In cognitive science and artificial intelligence,[15] as well as in design,[16] research is carried out to understand the nature of analogy and metaphor.

Our study, however, is not following design cognition or analogical thinking research. The cognitive faculty to create analogy and metaphor is taken as given, not as question. Rather, we focus on artifacts as sources of knowledge for transfer. We specify three types of transfer: local, regional, and long distance.[17] In local transfer, knowledge is moving within the *same* domain; in regional transfer, it moves across *similar* domains; and in long-distance transfer, it moves across *different* domains. We have explored these three types of transfer in a series of quasi-experiments to construct a conceptual framework for further methodological development.

In the first study, two designers collected and analyzed mobile phones (local), mobile objects (regional), and avant-garde objects (long Distance) and used them to conceive new mobile communication devices. The same study was repeated by six groups of design students from two different universities.

13 We have argued that transfer is as important as, or even more important than, the concept of generalizing for design purposes. See Rosan Chow and Stan Ruecker, "Transferability. The Wonder on the Ground of Design Research." in *DRS International Conference "Wonderground."* (Lisbon: IADE, 2006).

14 In conversation, Alain Findeli pointed out the link between analogy and transfer to us.

15 See, for exapmle, D. Gentner, K. Holyoak, and B. Kokinov, "The Analogical Mind: Perspectives from Cognitive Science" 59-124. (Cambridge, MA: MIT Press, 2000).

16 H.P. Casakin and G. Goldschmidt, 2000. "Reasoning by visual analogy in design problem-solving: the role of guidence." *Environmant and Planning B-Planning & Design* 27:105-119; Ashkok Goel, 1997. "Design, Analogy and Creativity." *IEEE Expert:* 62-70; P. W. Yaner and A. K. Goel, 2008. "Analogical recognition of shape and structure in design drawings." *Ai Edam-Artificial Intelligence for Engineering Design Analysis and Manufacturing* 22:117-128.

17 Kervin Dunbar studied molecular biology labs and found that analogies were frequently used by the biologists. Most analogies were frequently local, from the same experimental domain, with regional analogies involving a whole system of relationships from a similar domain and long distance analogies being ones that required mapping across very different domains. The names local, regional and long distance come from him. See kervin Dunbar, "How scientists really reason: Scientific reasoning in real-world laboratories." in *Mechanisms of Insight,* edited by R. J. Sternberg and J. Davidson, (cambridge, MA: MIT Press, 1994).

In the second study, two design students collected and analyzed mobile Internet services (local), non-Internet based services (regional), and performing art practices (long distance) and used these sources to conceive new mobile Internet services. We followed the basic techniques of grounded theory to observe and analyze the research results. Comparative coding, making memos, conceptualizing, and concurrent literature review were performed as the core concepts were constructed. These studies showed consistently that transfer was productive, although piecemeal. Both formal and contextual elements of the designed artifacts were transferable, including physical and sensual form, material, function and feature, character, and context of use. These studies also showed that regional transfer was the most productive type. We discuss these results in greater detail, together with the concepts grounded on them, in the following sections.

Peirce's Abduction and Semeiotic

As the studies were being carried out and observations made of the results, we turned to Peirce's articulation of abduction and semeiotic. We appealed to Peirce because of existing research that applies abduction to explain analogy making,[18] and because of previous arguments raised in design.[19] To our knowledge, March[20] was the first to introduce the Peircean concept of abduction to design. He quoted Peirce thus: abduction" is the only logical operation which introduces any new ideas; for induction does nothing but determine a value; and deduction merely evolves the necessary consequences of a pure hypothesis." Later, Roozenburg[21] considered abduction in design more precisely. He differentiated between explanatory abduction and innovative abduction and concluded that the latter should be taken as the paradigm of the crucial step in the design process that generates the new. Abduction[22] is the key form of reasoning in design and also for transfer.

If we believe in the centrality of abduction, then we must also examine Peirce's semeiotic because, for Peirce, logic goes beyond symbolic logic and is a formal science of truth of representation.[23] Logical reasoning has as its only purpose the manipulation of signs to further understanding and knowledge.[24] All thoughts are in sign. Abduction deals with possibility, induction with actuality, and deduction with regularity,[25] and these categories form the basis of Peirce's system of signs. For Peirce, a sign "is something which stands to somebody for something in some respect or capacity. It addresses somebody, that is, creates in the mind of that person an equivalent sign, or perhaps a more developed sign. That sign which it creates I call the interpretant or the first sign. The sign stands for something, its object."[26] All signs always exist in this triadic relation. The sign is something that denotes an object; the object is anything that can be thought; the interpretant is the (mental) effect of the sign.

18 John Sowa, "Pierce's Contributions to the 21st Century" in *International Conference on Conceptual Structure* (Aalborg, Denmark: 20060; John F. Sowa and Arun K. Majumdar, "Analogical Reasoning." 16-36 in *International Conference on Conceptual Structures,* vol. Conceptual Structures for Knowledge Creation and Communication, LNAI 2746, edited by A. Also, W. Lex, and B. Ganter. (Dresden, Germany: Springer-Verlag, 2003). Stephen M. McJohn, 1993. "On Uberty: Legal Reasoning by Analogy and Peirce's Theory of Abduction." *Willamette Law Review* 29:191-235.

19 Lionel March, "The Logic of Design" 265-276 in *Developments in Design Methodology,* edited by N. Cross. (Chichester: John Wiley & Sons, 1984); N. F. M. Roozenburg, 1993. "On the Pattern of Reasoning in Innovative Design." *Design Studies* 14:4-18.

20 Ibid 23.

21 Ibid 23.

22 We have elaborated the formal differences of the three types of logical thinking elsewhere, R Chow, "Abduction Revisited." in *Communicating by Design.* (Brussels, 2009).

23 Jay Zeman, "Peirce's Theory of Signs," 1977 http://web.clas.ufl.edu/users/jzeman/peirces_theory_of_signs.htm (accessed 4/25/2008).

24 Geert-Jan M. Krujiff, 2005. "Peirce's Late Theory of Abduction: A Comprehensive Account." *Semiotica* 153:431-454.

25 Gary Shank, 2001. "It's Logic in Practice, My Dear Watson: An Inaginary Memoir from Beyond the Grave." *Forum: Qualitative Social Research* 2.

26 C. S. Peirce, *The Collected Papers of C. S. Peirce,* Edited by p. W. C. Hartshorne & A. W. Burks (Cambridge: Harvard University Press: 1931-1958).

Peirce named three different kinds of interpretants: rheme (open), dicent (actual), and argument (formal). Rheme is interpreted as a sign of qualitative possibility, 1stness; dicent is interpreted as a sign of actual existence, 2ndness; and argument is interpreted as a sign of law, 3rdness. The relationship with an immediate object (or idea represented by the sign) is characterized by Peirce in one of three ways: Qualisign is a quality (1stness) acting as a sign: it is determined according to its own internal properties, and it qualifies something actual. Sinsign is an actual existing object or event (2ndness) that acts as sign: it is determined according to action and reaction in the relationship. Legisign is law (3rdness) that acts as sign: it is determined because it is interpreted as the sign of an object, and it instantiates in something actual.

Peirce also described signs according to their relationship with the dynamical object, using the terms icon, index, and symbol. An icon resembles the object: it demonstrates the qualities of its object and functions as a presentation of the relevant properties of the object. Index has a direct existential connection to its object: it demonstrates the influence of the object and functions as a referential identification of the object. Symbol is a rule or law that "will" determine its interpretant: it will be interpreted to be a reference to its object by disposition or habit. Peirce combined these different categories of signs and eliminated the ones that were not possible, resulting in ten classes of signs (see Figure 1).

27 Alex Scott, 2004, "Charles S. Peirce's Theory of Signs" www.angelfire.com/md2/timewarp/peirce.html (accessed 4/5/2009).

Figure 1
Peirce's Ten Classes of Signs*
** Note: Examples in italics are taken from Scott.*[27]

	Icon	**Index**	**Symbol**
Tone	Open Iconic Tone *(Hardness, warmth)*	**X**	**X**
Token	Open Iconic Token *(A photo)*	Open Indexical Token *(A cry in the street)* Actual Indexical Token *(Bullet hole in the wall)*	**X**
Type	Open Iconic Type *(Map)*	Open Indexical Type *(A knock on the door)* Actual Indexical Type *(Manner in which a person behaves)*	Open Symbol *<common noun>* Actual Symbol *<proposition>* Formal Symbol *<syllogism>*

Open	Icon	Index	Symbol
Tone	Hunch *(feeling of possibility)*	**X**	**X**
Token	Form *(Individual function or feature, material, physical/sensual form)*	Context *(stakeholders, purpose, needs, wants, context of use, manufacturing process)*	**X**
Type	Metaphor *(Relation between function,material, and form)*	Scenario *(network, culture)*	Principle

Figure 2.
Transfer as a Sign-Generating Process in Peircean Terms (0=Object, R=Representant, I=Interpretant)

Transfer as Abduction: The Generation of Signs

We take Peircean signs not only as a classification scheme, but also as how people reason and make inferences about the world. Following Shank,[28] we see the six open signs as six possible forms of abduction, the three actual signs as three different kinds of induction, and the formal sign as deduction. We identify transfer as abductive reasoning and see a sign relation between the source (existing products and services) and the target (new concepts) (see Figure 2).

During transfer, the sources act as signs, the new concepts are objects of signs, and the designers perceive the sources as denoting the objects. We have interpreted the results from the quasi-experiments in terms of these signs. According to Peirce scholar Joseph Ransdell,[29] all Peircean signs should be considered as aspects of signs. In other words, every sign likely has iconic, indexical, and symbolic aspects. In design, then, we might say that every existing service or product, when used as sign for creating something new, also has these three aspects. We suggest that the iconic aspect is basically the form of a product or service;[30] the indexical aspect is its context; and the symbolic aspect is the underlying principle of the design (see Figure 3).

Applying to the context of the design, the six forms of abduction can be labelled as Hunch, Form, Metaphor, Context, Scenario, and Principle.

Hunch: A feeling that an object or a service might have some possibility of being transferred.

Form: An individual physical shape, material, function, or feature. *The designer took an organic shape of a shell to give form to a product.*

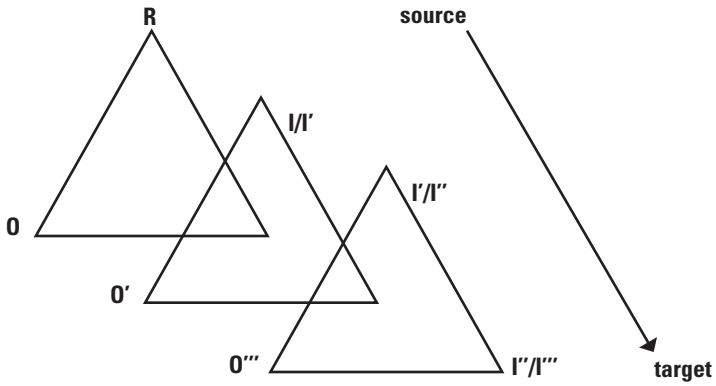
Metaphor: Some relation of individual design elements. *The designer took the model of the public bus system as a metaphor for a public phone service.*

28 Ibid 34.

29 Joseph Ransdell, "Some Leading Ideas of Peirce's Semiotic" http://www.cspeirce.com/menu/library/aboutcsp/ransdell/leading.htm (accessed 6/22/2008).

30 The form of service design has been explored in W. Joans, R. Chow, and N. Schaeffer, "Service Deisgn Descriptors: A Step toward Rigorous Discourse." in *8th European Academy of Design Conference* (Aberdeen: Robert Gordon University, 2009).

Figure 3
Design Interpretation of Peircean Six Open Signs/Abductions



Context: An object or service pointing to an individual cause or consequence, such as stakeholder needs, manufacturing processes, or anything that has an effect on how the object or service comes to be. *The designer interpreted a pistol as pointing to a dangerous situation. The designer thought of a rescue call feature on a cell phone for that situation.* (We believe this sign is very important because it has led to many interesting concepts in the quasi-experiments.)

Scenario: A product or service pointing to some relation, such as a network of people or a culture. We have not found any scenarios in the quasi-experiments, and this absence deserves further investigation.

Principle: A product or service interpreted as referring to some rule by virtue of a disposition or a habit. *The designer associated a pistol with a mobile communication device as a result of a disposition or habit.*

In addition to generating these concepts, we have found out that local transfer is not very productive because its results so resemble the sources that they can be considered copies. Regional transfer and long distance transfer tend to generate more novel and interesting results. This observation is in line with the general belief in the creative power of metaphor and analogy. However, we notice also that transfer is easier in regional transfer than in long distance transfer. We surmise that seeing resemblance between things similar, as in regional transfer, is easier than seeing the similar in things different, as in long distance transfer.

Based on the research results, we generate this design process for case transfer:

1. Collect existing targeted artifacts as a baseline. Because local sources do not help create novel concepts, they are better used as a baseline for comparison only.
2. Collect similar artifacts as sources for transfer. Because regional sources afford novel and easy transfers, they are the primary sources.

3. Analyze the sources in terms of the Peircean system of signs, allowing the system to serve as an operational guide.
4. Interpret the "signs" to create new concepts, allowing the "signs" to refer to the forms, contexts, and principles of design that can be abduced.
5. Evaluate concepts with users, letting the new artifacts reveal potential user behaviors and use contexts through interaction.

Conclusions and Further Research

We have argued that the default practice of first-user-study-then-design is not the only or the best approach for design. For open-ended design situations, we suggest the design process should begin with projection and present case transfer to exemplify our position. We have examined case transfer in a series of quasi-experiments and have used Peircean abduction and semeiotic to construct a conceptual framework. We end by drafting a more developed process.

One might suggest that our empirical studies merely confirm what is known about metaphor making and ask why we have not begun our study with that knowledge. However, we are not interested in examining the function of metaphor or analogy per se, but rather in developing a method to support deliberate projection by artifacts. We find that artifacts can be sources for projection and can be meaningfully categorized in terms of local, regional, and long distance transfers. We also have learned that artifacts are sources because they are potential signs referring to the formal, the contextual, and the principle. All these elements of design can be abduced to create something new.

One might still charge that Peircean semeiotic is cumbersome and pedantic and that we seem to have made a rather simple approach unnecessarily complicated. We agree that case transfer might appear fairly simple (after the explication), and we also believe that it might be practiced in various forms with different degrees of rigor. However, what Peirce offers and what our studies contribute is a way to ensure rigorous development of the method. By articulating it in some depth, we are able to identify the directions on which to focus and the gaps to fill. We now know that regional sources are the most promising and can be collected, analyzed, and transferred systematically. We also know that there are a good number of open questions and issues. We have examined the abductive aspect of case transfer; however, collecting existing artifacts and analyzing them are not the straightforward tasks they might seem. The criteria for choosing what is considered similar or different must be further examined and developed. Although Peircean signs can be the guide for analyzing sources, the specific design elements still need to be carefully detailed. Furthermore, case transfer is presented as independent from UCD and PD; however, there is much to gain

when these processes are combined in various forms. As these suggested areas for further study show, case transfer opens up an entire realm of questions for research, which is the primary aim and outcome of our investigation.

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