# A Brief Taxonomy of Prototypes for the Digital Humanities

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**Abstract**
In principle and in practice, the use of prototypes in the companion "interdisciplines" of design and the digital humanities is perhaps surprisingly similar, given the many other differences that exist between the two fields. However, in both cases there are important distinctions to be made between various categories of prototypes. In general, there are three categories of prototype, which are intended for experiment, development, and provocation respectively. Although it might be argued that the overlap between these three groups renders them useless, if they are construed correctly, it becomes clear that the distinctions are not only meaningful, but can also be suggestive of new methods of working.

**Keywords**
Prototype; Provotype; Design; Digital humanities

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## Introduction

Prototypes are one of the ubiquitous parts of the process in both design and the digital humanities (DH), and as such are not always interrogated in sufficient depth to make the distinctions between different types clear. There is always a danger in this naïve use of a term, and we face it in DH too; namely that without some attention to the details of what various people mean when they say "prototype," we run the risk of some serious collisions of expectations.

A variety of taxonomies of prototypes have been proposed over the years. Perhaps the most common approach is to rate prototypes on a spectrum of low- to high-fidelity, which is considered important because it is one of the factors that influences responses in user studies (e.g., Lim, Pangam, Periyasami, & Aneja, 2006). Another strategy is to group prototypes by what they are representing. For example, Stephanie Houde and Charies Hill (1997) distinguish among prototypes that represent the role a system will play in the user's life, ones that model implementation considerations, and ones that consider look and feel.

On the more whimsical side, NASA researcher Marvin Zelkowitz (1984) proposed an early taxonomy of how prototypes fit into projects, based on varieties of trees. His categories were:

- Pine (prototypes refine unknown aspects);
- Tulip poplar (typical large projects);
- Palm (multihosted systems);
- American elm (majestic multiversion application packages);
- Mimosa (flimsy software for research purposes only);
- Bonsai (student work);
- Stump (funding cut off);
- Sycamore (exploration of wild alternatives leading to disaster); and
- Weeping willow (ultimate disaster).

I propose, however, that another interesting way to look at prototypes is in terms of the kind of project they are supporting. It is clear to people working within each category of project what they are doing with their prototypes; what is sometimes less obvious is that the use of prototypes within other categories might be different – or that other categories exist at all. For the purposes of this discussion, I suggest three categories.

First are production-driven prototypes, which are intended for refinement from a rough early version through ever-more-polished intermediate versions, until the final stage is ready to serve as the basis for a robust product or system.

Second are experimental prototypes, where the goal is not to create a product but instead to produce a kind of generalized knowledge about an idea that the prototype embodies. In this use of prototypes, both design and DH have advantages over other scholarly fields, where research questions need to deal with an established object of study, rather than with an object that has been designed intentionally to have the features necessary for addressing the questions.



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A third category of prototype is what some researchers (e.g., Boer & Donovan, 2012), refer to as "provotypes" or provocative prototypes. The goal is neither to prepare for a working system nor to address a research question, but instead to challenge presuppositions, break down stereotypical understandings, and generally produce changes in the way people think about a particular topic or situation.

Provotypes are sometimes associated with critical design, which similarly looks to excite thinking in ways that are novel, interesting, and occasionally challenging. Although this form of prototyping has been used for some time in design, it is an approach that has yet to gain much traction in the digital humanities, where for the most part the experimental prototype has been understood as sufficiently esoteric that there is little need to go further. The time, however, may soon be upon us when the DH community is ready to explore the possibilities offered by this third approach.

## Experimental prototypes: Do artifacts have politics?

The argument might be made that the three types of prototypes are really just phases of the same project. For example, the early stages of a development prototype might be considered as being first provocative and then experimental, since typically many changes occur in a short period at the beginning as the concept is explored. However, the goal of the development prototype is always to reach a product, and it is in this respect that provocative and experimental prototypes differ. In general, the goal of a provocative prototype is to make some kind of a statement that challenges expectations, while the purpose of an experimental prototype is to address a research question, typically by deliberately embodying some aspect of the problem so that it lends itself to closer inspection, understanding, and in some cases, testing.

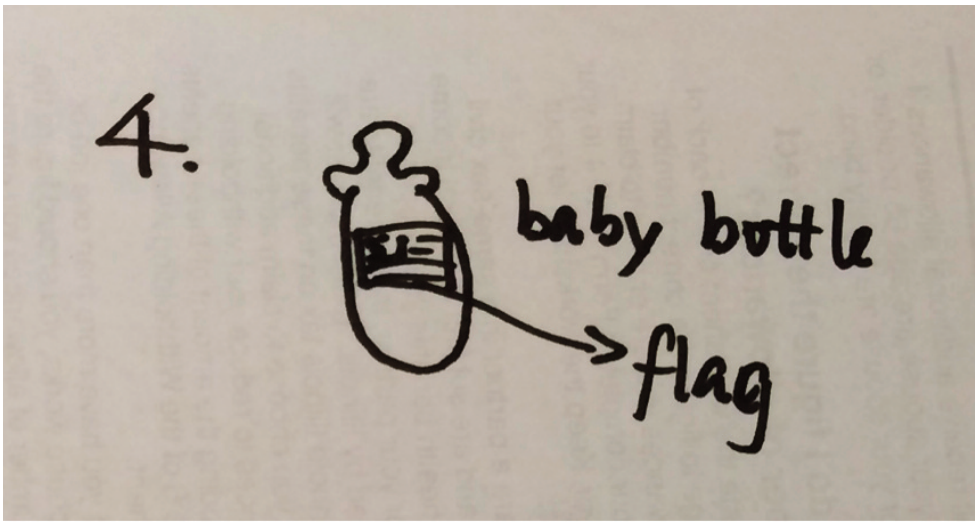
Opinions vary as to the value of the latter. In Canada, for example, evaluation committees for the federal Tri-Council of funding agencies – the Natural Sciences and Engineering Research Council of Canada (NSERC), the Social Sciences and Humanities Research Council (SSHRC), and the Canadian Institutes of Health Research (CIHR) – have typically been more interested in testing than in prototyping. Consequently, the most effective approach for seeking funding is to discuss the testing in detail, while leaving the prototype as a kind of unfortunately necessary side effect of the real project. In the computer science research community, the necessity of avoiding concepts that have not been instantiated means that functional prototypes are an essential component of many projects. However, this necessity is a double-edged sword, since the imperative of getting started with the programming has tended to result in very little, if any, attention given to design issues. In fact, when challenged on this question, computer programmers often express the opinion that their work is design, whether or not they have had any formal design education. Of course the same is seldom said for architecture, for instance, or surgery.

In the maker community, however, prototypes are understood as a means of thinking about a question – much as writing is a way of thinking about questions in literary studies. In this paradigm, testing is somewhat irrelevant, since the learning is occurring during the process of creating and handling (whether physically or virtually) the object of study. To take a classroom example, a group of graduate students at the Illinois

Institute of Technology (IIT) was tasked with designing prototypes that reflected on Langdon Winner's (1986) classic chapter "Do Artifacts Have Politics" in his book *The Whale and the Reactor*. Winner's point is that, whether deliberately intended by the designer or not, many designs have consequences of a political kind. One of his examples is a road to certain public parkways or beaches in New York that was accessible by car but not by bus, as a series of unusual bridges with insufficient clearance for buses was built across it. The result was that although the parkways were public in theory, in practical terms the bridges reified racial and class prejudices by making them unavailable to anyone who wanted to reach them using public transit.

One of the students, Xinyue Zhou, designed a set of baby bottles that, in the first iteration, had national flags wrapped around the main part of the bottle (see Figure 1). The argument she was considering was that nations prefer that a spirit of nationalism be inculcated early in children: that it is taken in, so to speak, with the mother's milk. However, since she was not designing nationalistic tattoos for the breast, it might also be argued that she was suggesting national interests introduced in childhood become a surrogate for maternal nurture – even in early infancy. The nation, in effect, begins to replace the parent.

**Figure 1: Do artifacts have politics? Xinyue Zhou considers early exposure to nationalism in infancy.**




As a first prototype, the baby bottles wrapped in flags suggest any number of ideas related to the concept of how we teach and learn nationalistic attitudes. For instance, she has three bottles: one each for China, the U.S.A., and Canada. The degree of nationalistic fervour varies somewhat between the three countries, so that in the U.S.A., for instance, there may be a significant segment of the population that would not see any ironic distance at all in the need for national pride to begin as soon as possible in the lives of citizens. In Canada, on the other hand, nationalism is often seen as somewhat embarrassing, a fact of life but a regrettable one, especially in the increasingly global community. There are also differences between the two countries in terms of what it means to be a citizen. The metaphor for immigration to the U.S.A. is the melting pot, for example, in which previous nationalities are merged into a



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common American identity. In Canada, the metaphor has traditionally been the cultural mosaic, in which Canadian identity is composed of the aggregate but intact national, regional, and tribal identities of its people. For the majority of Canadians, a flag on a baby bottle might seem irrelevant, disconcerting, or even in poor taste.

It may be instructive or useful to test in some manner the nationalistic baby bottles, in order to help understand the variations of responses, but in the context of making as research, it does not seem particularly necessary. They are clearly embodying an idea, and additional interpretations of that idea can take place through examining the object and interrogating its implications, independent of other approaches to studying it.

There is also something to be said for the iterative cycles of prototyping – the fact that it is often not particularly difficult to make small changes quickly that will have significant implications for interpretation. For example, in the second iteration of this project, Zhou moved the flags from the surface of the bottle to the surface of the nipple (see Figure 2). As she explained it, the nipple is the most intimate part of the object – it actually goes in the baby's mouth. Placing the flag there removes any doubt that this is just a branding exercise, such as handing out paper flags to celebrate a national holiday, easily accepted and easily forgotten. Instead, the flag becomes part of the essential workings of the object. Now the baby will be literally suckling on the flag.

**Figure 2: The next iteration of the nationalist baby bottle gets more personal, focusing the idea and removing some unwanted ambiguity.**

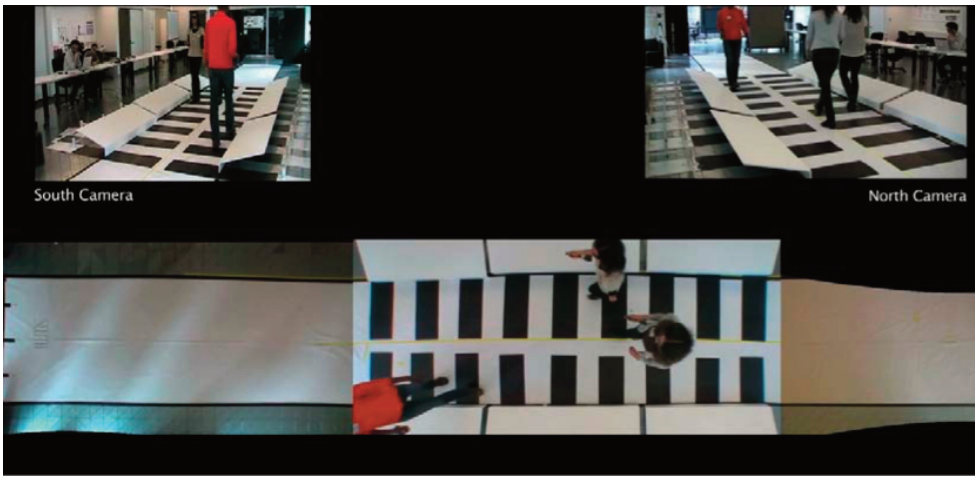
Here again, interpretation works both by examining the design choices made regarding the object and by considering the choices that were not made. Zhou might equally well have placed the flag underneath the bottle, where it would be visible to the parent while feeding the child. That choice would have made it clear the primary recipient of the

message was the parent and not the child. The choice of the nipple, on the other hand, does not exclude the parent, who is really the only person in the equation able to understand what is going on, but makes the statement that the flag is really there for the child. In effect, it is a kind of instruction or suggestion to the parent that the domestic environment should include nationalism, and perhaps even that other forms of training in national spirit should begin as soon as possible. In the larger social context, whenever the baby is taking a bottle in public, it is also a way for the parent to communicate to others a fairly high degree of commitment to the nation.

Finally, as with any product prototype, we should consider materials. These baby bottles are not made of glass – they are not a high-end, expensive product for an exclusive customer base. Instead, they are made of very inexpensive plastic that is coloured for gender stereotyping. This is a product idea that is geared toward a large demographic.

National pride expressed through baby bottles is an illustrative example of a prototype embodying an idea, but it is not necessarily an example of a prototype being developed in order to address a research question. For that purpose, there is an example in the work of Juan Salamanca, whose PhD dissertation dealt with the design of smart objects in the sense that they had some understanding of their social context (Salamanca, 2012). In thinking about that idea, and for purposes of subsequent testing, he designed a crosswalk that could understand the minor navigation conflicts that arise between people or groups of people walking toward each other (see Figure 3).

**Figure 3: Juan Salamanca's prototype for a crosswalk with social intelligence.**




In this case, the crosswalk was able to display suggestions for paths that people might follow in order to avoid accidentally running into one another. This is particularly relevant for cases where one or more of the people, in the terms of Actor-Network Theory (ANT), has not "subscribed to the sidewalk's program of action" (Salamanca 2012, p. 154), which is to say is not obeying the rules of the road. Causes for such inattention might consist of being lost in conversation, reading texts on a cellphone, or a lack of awareness of social conventions in a particular country or city.

Salamanca's study therefore applied various conditions, which included two people walking toward each other and a pair of people walking toward an individual, in both conditions people either had their eyes looking ahead (full perception) or cast down (limited perception). For the purposes of his analysis, Salamanca extended the usual dyadic framing of ANT, consisting of two actors – one human and one non-human – into a triadic framing, with two or more human actors mediated by a non-human one (in this case, the socially aware crosswalk).

Since the crosswalk had been designed specifically in order to address a social situation where an artifact might provide guidance, it was possible to manipulate the details of the interaction in order to gain insight into various aspects of the problem. In this case, the research questions were as follows:

- How can smart artifacts mediate the mutual understanding of people when they interact?
- How can the design attributes of smart artifacts promote social interaction between interacting actors?
- What are the methodological implications of ascribing autonomy and adaptability as properties of everyday artifacts (Salamanca, 2012, pp. 5-6)?

The conclusions of the project are derived not only from the prototypical crosswalk, but also include two other prototype-based studies:

> Overall, the studies found that actor-networks exhibit a *social viscosity* that hinders people's interactions. This is because when people try to collectively accomplish goals, they offer resistance to one another. The studies also show that the intervention of smart artifacts can facilitate the achievement of cooperative and collaborative interaction between actors when the artifacts enact the dominant moral principles which prompt the *preservation of social balance*, enhance the network's *information integrity*, and are located at the *focus of activity*. (Salamanca, 2012, p. xiv)

One of the advantages shared by design and the digital humanities is that both fields are willing to accept the idea of an object of study being created for the purpose of addressing a research question.

### Production prototypes: Varieties of cellphone vibrations

Whereas an experimental prototype embodies an idea for purposes of study, a production or development prototype embodies an idea for purposes of dissemination and use. Production prototypes, like any artifact, can be treated as an object of study, but that is not their primary purpose. The prototyping cycle is therefore usually less exploratory, except perhaps in its initial phases, and is more sequential. That is, an experimental prototype may sometimes follow a sequence of iterations, but is more likely to resemble a starfish, with a central concept and different prototypes to explore each of the aspects of the concept. A development prototype tends instead to begin with a single idea that is then refined until it is ready for production, distribution, and use.

A discussion that frequently arises with respect to production prototypes revolves around the twin concepts of fidelity and quality. Typically, the early phases of the process involve broader strokes, and therefore, in the interests of minimizing time and cost, it is common to begin with low-fidelity prototypes, perhaps using materials that are readily available in any design studio, and increase the fidelity as the iterations move closer toward a finished product. An iconic example is told of the industrial design firm IDEO, where during a client meeting, a designer prototyped a new kind of pistol grip for surgery using a white board marker, 35 mm film canister, clothespin, and tape (Brown, 2009). Since low-fidelity prototypes are intended to be suggestive rather than definitive, their quality or degree of polish is sometimes given less attention than would otherwise be the case. However, even given a marker, empty film canister, and clothespin, it is possible to put the tape on crooked or straight, to pay attention to the alignment of the components, and so on – all of which have a perceptual effect, perhaps in some cases only subliminal, on the people who interact with it, potentially creating unnecessary noise or distraction.

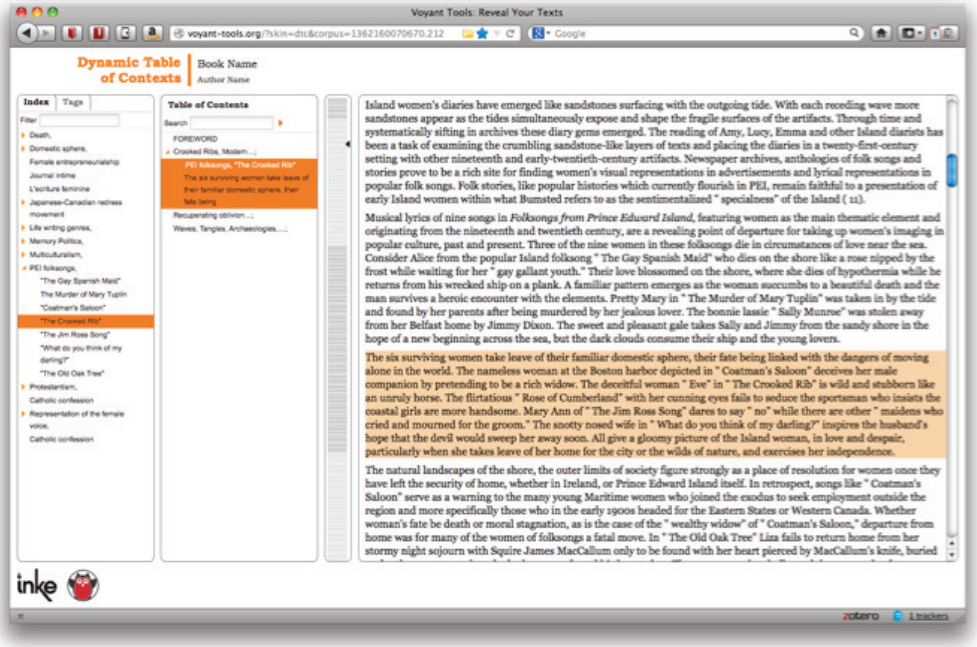
As an example sequence for a production prototype, imagine working on the vibrate feature on a cellphone (e.g., Shirazi, Holleis, & Schmidt, 2008). In order to understand how different forms of vibration work for people, a designer might begin by experimenting with an existing phone where the user can set the vibration patterns (e.g., Mundhra, 2014). Options include pre-set patterns, tap patterns, and Morse code. The next step would be to create a hollow prototype with a form factor (weight, shape, perhaps even surface materials) that is similar to the new cellphone being designed, and then install a variety of vibration-producing mechanisms in the shell in order to get a sense of how they feel. Variations might include the number and placement of the actuators, the frequency, strength, and intermittency of patterns of vibration, and the sequencing among multiple actuators. Some researchers (e.g., Peilot & de Oliveira, 2013) have even looked at the use of continuous low-level vibrations that signal a change by stopping. A further iteration might include a mechanism so that the vibration (or cessation of vibration) can be triggered at selected times throughout the day, increasing the realistic dimensions of the phone in use.

An example of a production prototype in the digital humanities is the Dynamic Table of Contexts (DToC) (see Figure 4). The goal was initially experimental, but eventually we began to work toward a system that could be used by online publishers. The DToC provides the user with an online reading environment for electronic scholarly books where the two conventional overviews provided in print editions – the table of contents (ToC) and the index – have been dynamically merged. The reader can employ the ToC as an interactive navigation tool, adding and subtracting items from the index into the ToC in order to better understand where certain topics are discussed. Each of the items in the ToC is a live link into the reading panel, allowing for easy discontinuous access to selected parts of the book. In the production version, we included not only the index, but also the XML (Extensible Markup Language) markup and a string search, each of which can be used in conjunction with the ToC.

Earlier versions of the DToC prototype were intended to address a series of specific research questions. Examples include whether or not a dynamic merging of the

semantic XML markup and table of contents could be helpful as a prospect for an electronic book, or to what extent this approach could benefit researchers beyond what could be done with string searches. With the switch to a series of production prototypes, however, our attention turned from addressing research questions to making sure we had working features for all the core functionality, in a platform that was relatively stable, and in a form that would be readily perceivable as having value for the DH community.

**Figure 4: The Dynamic Table of Contexts began as an experimental prototype, but in its most recent form, it has been iteratively developed into a production platform for online XML publishing.**




The change in mandate for the DToC prototype corresponded with its inclusion as a component of the Implementing New Knowledge Environments (INKE) project, where over the course of the seven years, the team shifted focus from experiments to the creation of working environments that incorporate the results of some of those experiments.

### Provocative prototypes: This computer is made of meat!

Sometimes called "provotypes," (e.g., Boer & Donovan, 2012), the purpose of provocative prototypes is distinct from either of the other two categories in that they do not exist to address a research question or to lead to a product. Instead, their goal is to interrupt people's thinking, to astonish, to disturb – in short to provoke a reaction. In this respect, provotypes align most closely with the fine arts, although they are also a component in what is sometimes called "critical design," where the focus is on designing objects that make some social, cultural, or political statement.

In the digital humanities context, provocative prototypes most commonly appear in work from the deformation theorists, although they are also increasingly common from

the ludic design community, where the provocation is around the principle that fun should be a natural part of work. An example from this area is the Bubbles component of Voyant Tools (Sinclair & Rockwell, 2015). Bubbles reads sequentially through a text file, and each instance of a word (or token of a type) enlarges the size of a bubble by increments. The size change can optionally be accompanied by a popping sound that is associated with the size of the bubble, which is to say the frequency of the word.

Milena Radzikowska (2015) describes the use of provotypes in the context of both experimental and development projects, where we see some value in expanding the discourse in order to avoid becoming constrained to incremental design strategies. In this case, the "provocation" is intended to create subsequent dissatisfaction with a small change, so that an intermediate step becomes a desirable goal for the entire team or organization.

## Prototypes in studio courses

Any of the other three categories of prototypes can also be used as the basis for hands-on or constructivist learning in the studio classroom. Depending on the nature of the project that is the focus of the course, it may be possible to include more than one category. In classes that involve prototyping, it is worthwhile to keep the distinctions between the three categories clearly in the forefront of the discussion, since students will tend to adhere with unusual tenacity to the category they know best. In this sense, they may need to unlearn to a certain degree what they already know, in order to take full advantage of the opportunities inherent in the other uses of prototypes.

## Conclusion

Although the use of prototypes in research and practice is widespread in the design community and is increasingly common in the digital humanities, the varieties of prototyping can sometimes lead to confusion and mismanaged expectations. By distinguishing clearly between prototypes for research, production, and provocation, it is possible to reduce potential difficulties and also to encourage a wider range of use of prototypes.

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