Traditional and Digital Signage

Jörg Müller

joerg.mueller@uni-muenster.de

Abstract: In this paper we explain how the content of traditional and digital signs heavily depends on the context in which the sign is seen. This is followed by a comparison of the properties of traditional and digital signs, in which we show that digital signs enable us to exploit many proporties that signs have, in particular context adaptivity and indexicality.

1 Introduction

Signage has influenced urban life since ancient times. Today, we can observe that some of the traditional, static signs are being replaced by digital signs (see Figure 1). While it may seem obvious that there are differences between traditional signs and digital signs, there is also a good number of common properties, which should not be forgotten.

Figure 1: Traditional and digital signage live side by side.

2 Signage

The study of the meaning and use of signs and symbols is called Semiotics [KP06]. Semiotics emphasizes that information is a representation of some object. The Semiotic Triangle (see Figure 2) depicts the relationship between a representation (e.g. on a sign), the object (that is depicted) and the interpretation (of the audience).

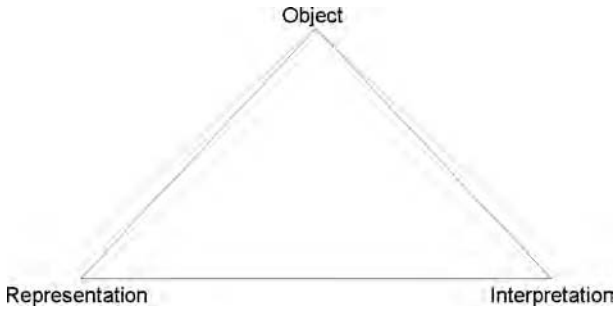

Figure 2: The Semiotic Triangle

Three types of representation are possible. Symbolic representations refer to an object via convention (e.g. script). Iconic representations use similarity to a depicted object (e.g. images). Finally, indexical representations refer to an object in the immediate context (e.g. via an arrow). Symbols and icons may work independent of context, i.e. in a "one size fits all" manner. Indices in contrast are deeply embedded in the context of the audience. Indices can refer to something spatially (e.g. 200m left) or temporally (e.g. tomorrow). Potentially they could also refer to social context (e.g. "the guy with the red hair"). The applicability of indexicality to context-aware computing systems has been investigated in [KP06].

Not only for indices, but also for symbols and icons, the interpretation of the audience may widely differ depending on the context in which the representations are delivered. Marshall McLuhan with his famous quote "The medium is the message"[ML64] emphasized that the medium itself, e.g. a sign, has a certain effect on the audience independent from and interacting with the content shown. William Mitchell captures this effect in his book "Placing Words" [Mit05], page 9, as follows:

> "But the introduction of technologies for inscribing physical objects with text, and the associated practices of writing, distribution, and reading, created a new sort of urban information overlay. Literary theorists sometimes speak of text as if it were disembodied, but of course it isn't; it always shows up attached to particular physical objects, in particular spatial contexts, and those contexts — like the contexts of speech — furnish essential components of the meaning."

This effect of different interpretations in different contexts is related to the psychological

effect of *priming*[And04]. People interpret new facts in the contexts of stimuli they have been presented before (e.g. when being told about old women before, they are more likely to recognize an old woman in an ambiguous picture). Mitchell captures this effect as follows:

> "Shouting "fire" in a crowded theater produces a dramatically different effect from barking the same word to a squad of soldiers with guns. Writing it on a hydrant yields yet another result. The meaning of a message depends not only upon the information that it contains, but also upon the sort of local ignorance or uncertainty that it reduces — in other words, upon what the message's recipients require information *about*." [Mit05], page 3.

This underlines the importance that time and location have both for understanding and designing digital signage. In order to implement context adaptive digital signage, the signs need to be equipped with models of their spatial and temporal context. Signs can be seen from a variety of distances and potentially refer and react to their context in a variety of scales. Therefore, both space and time need to be understood in different scales — which is a classical topic of GIScience[1]. Montello[Mon93] highlights that to understand scales of space, it is important how the space is perceived, e.g. from an airplane a country may be perceived differently than from the ground. He introduces the scales of figural, vista, environmental and geographical space. Figural space is projectively smaller than the body, e.g. a table or distant landmark. Vista space is projectively as large or larger than the body but can be perceived without moving around, e.g. a room or the horizon. Environmental space surrounds the body, but it can be directly perceived by moving around, e.g. a city. Geographical space is too large to be directly perceived, it can only be perceived by representations, e.g. maps that map it to figural space. This indicates that, while a single sign will probably always be within vista space, whole display ecologies can fill environmental or even geographical space. Signs can also index to space in any of these scales.

For digital signage, it is not only important how the physical space surrounding the signs is structured, but also how people experience it and behave in it. The unreflected use of "space" to refer to locations where humans interact with other humans or technology has come under critique. Harrison and Dourish[HD96, Dou06] draw on their experiences with Media Spaces to introduce the distinction between space and place. Space is the mere spatial environment and configuration ("the opportunity"), which, in the case of built up environments, certainly has evolved through social processes. Place, in contrast, is the social meaning of a location ("the understood reality"), which evolves through social behavior of people, in coordination with mores and norms. It is emphasized that placeness can not be designed into systems, it can only be designed for. The evolution of placeness also heavily depends on the feeling of ownership people experience. In the case of the Xerox PARC Media Space for example, cheap equipment could be reconfigured and appropriated by users, which strongly influenced their feeling of ownership. In the Bellcore Media Space on the other hand, expensive equipment was used to create a life-like video conference experience, but users could not appropriate the technology. As Harrison and Dourish state: "It wasn't theirs, and they could not *make* it theirs."

[1] Geographic Information Science

Table 1: Comparison Traditional and Digital Signage (iterative improvements in *italic*, completely novel in **bold).**

Property	Traditional Signage	Digital Signage
Content	Text, Graphics	**Animation, Video, Reactive, Interactive**
Content Source	Mostly big business, sometimes smaller, user-generated	*Anybody*, **Life sensor data (weather), life from the Web (News, Train table)**
Multiple Content	A few, cumbersome	*Any content available*
Updates	Expensive, about 10 days	*Cheap, within milliseconds*
Content Depth	What fits the sign	*Any depth with interaction*
Indexical Content	To location, to time and audience within limits	**Any measurable context: e.g. time, history, audience**
Context Adaptivity	Location, time (put out Open sign), audience by location	*Any measurable context: Time in milliseconds, audience up to individual*
Audience Measurement	Manual counting or interviews	*Automatic*
Learning	Manually by media planner	*Automatic*
Interactivity	Sometimes mobile phone	**Touch, Gesture, mobile phone, Web etc.**

Further insights on the behavior of people in space are given by Goffman[Gof59]. In his analysis of social life interpreted as a scene play, Goffman uses a theatrical metaphor for place. "Front stage" and "backstage" distinguish different modes of behavior in interaction. A salesperson may for example treat a customer more formally in the shop room than in the storage area. A digital sign can be interpreted as a stage, where people can perform *on it* by submitting certain content as well as perform *in front of* it by behaving accordingly (e.g. users performing in front of the Dynamo displays [Bri05]). As users constantly seek to maintain a certain role, they may for example want to know whether a photo of them appears distorted on the sign.

3 Properties of Digital Signage

Digitial signs have many properties that differ from their paper and wood counterparts. Originally, signs were painted manually on the presentation surface. Later, printing and computerized printing technologies simplified reproduction and inclusion of other artwork, e.g. photos. Light installations made simple animations possible (as you still can see in Las Vegas). Scrollable billboards enabled to show a few different content pieces in a row. Digital signage goes beyond the possibilities of these technologies in a number of ways (see Table 1). While traditional signs supported text, graphics and very simple animations, digital signs enable full animations, video, content that reacts to the audience, and interactive content. For traditional signs, big business was the most important source of content. Some smaller businesses could afford some signs, and (illegal) graffiti have been an instantiation of user-generated content in major cities around the world.

Often, content providers need to visit the location of the sign themselves. Digital signs enable anybody to submit content, regardless of his location. This opens whole new possibilities for harnessing the 'long tail' of numerous small content providers as well as for user-generated content, despite the unsolved issue of content filtering. Additionally, life sensor data (like weather) and life Web data (like news or train delays) can be presented. While scrollable billboards enabled a limited number of different content items, on digital signs unlimited different content can be presented. On traditional signs, updates are cumbersome, and many advertising signs are only updated every 10 days or so. On digital signs, updates are cheap and can be performed within milliseconds. On traditional signs, the depth of the content is confined to what fits on the sign. In order to provide further information, signs need to refer to other resources (e.g. Web addresses). With a "would you like to know more?" functionality, interactive digital signs can harness the power of Hypertext and provide unlimited content depth in-place.

For presenting indexical content, traditional signs can refer to the location (e.g. "200m left"), to time (e.g. "party tomorrow"), or to the audience (e.g. "I want YOU for US Army"). Because of the high effort of updates, with traditional signs it is often difficult to get indices to dynamic factors right (e.g. the sign still being there one week after the party, or "YOU" referring to nobody when there is no audience in front of the sign). Digital signs can flexibly index to time, history ("the film you watched here yesterday") and audience ("buy the same jeans as the guy with the red hair").

Regarding context adaptivity, traditional signs have been adapted to the location (and the expected audience at that location) for a long time. There have also been limited possibilities of adapting to the time (e.g. putting an "Open" sign on a shop door). Digital signs in contrast can adapt to any measurable context within milliseconds, and also adapt to the audience up to the individual (and his facial expression). Audience measurement with traditional signage has been performed manually, by counting, observing and interviewing the audience. Although traditional signage can also be equipped with automatic audience measurement, this is more common with digital signage (e.g. for interactive digital signage, interaction logging is easy). In order to learn models which content works well in which context, traditionally media planners created statistics manually. Digital signage opens the possibility to accomplish this learning automatically with Machine Learning mechanisms[Mit97] (although this can in principle also be applied to traditional signage).

Recent developments enabled partially interactive traditional signage. Being equipped with dedicated hardware, such signs could send data, e.g. ring tones, to mobile phones. Digital signage offers broad possibilities for interaction: Touch interfaces, gestures, Web interfaces and interaction via mobile phones.

4 Conclusion

As we have seen, the effect of signs depends heavily on the context. This includes the behavior of the audience in front of the signs, but also the behavior of content providers who want to know their content appears in context and if this fits their social role. Additionally,

signs can refer to their environment via indexicality. While digital signs are in many ways similar to traditional signs, they offer a number of novel possibilities especially regarding context adaptivity and indexicality.

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