Return to the Native: From NLS/Augment to HTML 5

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ABSTRACT

We present a demonstration of the shopping-list-as-map part of the 1968 NLS system coded in native HTML5 on the WWW.

This demonstration is part of a project examining the state of the field of Hypertext with particular focus on adoption and development of techniques from its early days. This demonstration examines the advances made in hypertext since 1968. Although the WWW has made enormous strides in accessibility, due in no small part to its distributed, scriptable and themable nature, in a real sense, it has only been in the last few years that WWW browsers have been able to reproduce what was demonstrated in 1968's NLS without resorting to plug-ins and extensions.

We will compare the capabilities of NLS and the WWW, as well as the differences in philosophy between the two systems that brought us to this point.

1. MOTIVATION

The development of HTML5 is the pinnacle of the most prevalent hypertext system to-date, viz. the WWW.

We view the development of HTML5 as a case study of a socio-technical system that authentically provides support for user practices and behaviours anticipated by the developers of NLS. What has emerged between the demonstration of NLS and the recommendation of HTML5 is a system of standards and a community of users that (mostly) drives development rather than a prescriptive vision that dictates a plan.

The demonstration for ACM Hypertext 2016 is meant to continue the discussion of the state of hypertext development and provoke new questions. For example:

- does adopting the model that led to the codification of HTML5 elements inevitably mean that otherwise good ideas will be excluded because they do not fit with existing standards or dismissed because users do not immediately gravitate to them?
- how important are interpersonal and social elements to gaining wide acceptance for novel systems?

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2. BACKGROUND

In 1968, Douglas Engelbart and his team produced the first word processor, outline processor, fully-computerized hypertext system, graphical user interface, demonstration of e-presence, and computer mouse [18]. Several members of his team would go on to join the newly formed Xerox PARC and significantly influence the design of modern computer interfaces. Notably, it has only been in the last few years that WWW browsers have been able to reproduce that system without resorting to plug-ins and extensions. Now with the HTML5 standard much of what was presented in the user interface to the NLS/Augment system (hereafter NLS) is to be basic to common WWW browser software.

Our goal in demonstrating the proof-of-concept replica of part of the NLS demo is to assess progress by comparing the state of two significant hypertext technologies: oNLine System (NLS) as demonstrated in 1968 and the World Wide Web (WWW) as represented by the capabilities of HTML5. Direct comparison of the WWW and NLS is difficult because their architectures are fundamentally different. However, the comparison is apt because until recently the WWW did not have native (built-in) support for some of the functionality of NLS, and indeed the standards around videoconferencing are still not finalized, although they are implemented in several major browsers.

Nonetheless there have been substantial advances between the demonstration of NLS and the current state of the WWW. We consider how much advancement there has been in various areas, and what lessons can be learned from considering the significance of the convergence of the technological support provided by NLS in 1968 and provided by HTML5 now.

2.1 Two Hypertext Systems

The goals of NLS — as described by Engelbart in the 1968 demonstration — and those of the WWW — as described by Berners-Lee in contemporary publications — are strikingly similar.

According to notes accompanying a video recording of the demonstration NLS was 'a tool for navigating through [information] structures and examining them in ways that would be too complex otherwise' [22].

Similarly, Berners-Lee [7] writes that he thought 'suppose all the information stored on computers everywhere were

linked' and then 'suppose I could program my computer to create a space in which anything could be linked to anything' [7, p 4].

Engelbart speaks in terms of augmenting human cognitive abilities through technology and evolving practices [18], whereas Berners-Lee speaks of linking information, but both had a vision of enabling humans to navigate information.

2.1.1 NLS

NLS was created by a small group of people and intended for use by other information professionals like them. There were no formal user studies or needs analysis. The initial idea came from Engelbart but many of the innovations and details came from other members of the group [11].

NLS was a monolithic system running on a single time-shared computer. It used an embedded markup language. NLS was the first computer system with a graphical user interface (GUI). NLS's GUI used a mouse, chorded keyboard, and a screen that could display multiple independent rectangular regions which could include text, static graphics, and video. One particularly interesting achievement shown in the 1968 demonstration was the combination of an interactive map and multi-level hierarchical shopping list that could be altered in real-time [22].

In terms of the Needs-Satisfaction Curve of a technology [21] NLS was a high-tech product; that is to say, it delivered less than the median customer of a commercial product would need. According to Norman, 'When technology reaches the point that it satisfies user needs, consumers no longer seek the best technology; they seek the most convenient one, the one with the most satisfactory user experience, the lowest cost, and the highest reliability' [21, p. 251]. Clearly, NLS was not yet at that point to be broadly accepted as a consumer commodity, but neither was it intended as such. To reach the level of consumer commodity, improvements would be needed in both the software technology and other factors affecting users' experience such as the hardware interface and the widespread availability of computers. However what we will see, after a discussion of HTML5, is that the conceptual underpinnings and fundamental technology that we believe today's users want was already present in NLS, although it may have been concealed behind the unfamiliar and complex interface.

2.1.2 The World Wide Web

The WWW was conceived by Tim Berners-Lee. In 1995, he and Robert Cailliau shared ACM's System Software Award for their work in bringing about the WWW [2]. Berners-Lee [5] credits Cailliau with many essential, but non-technical advancements which made the WWW possible. Technology alone is insufficient to ensure successful development. Today's WWW runs on many hardware platforms. Of particular interest today are interfaces on desktop and laptop computers (with screens at least 14"-diagonal and high resolution colour graphics), and small-screen devices (such as smartphones). At its simplest, the WWW is composed of browsers for displaying content, and servers for transmitting that content to browsers. Although there are many protocols involved in that process, the 'HyperText Markup Language' (HTML) is an essential piece, encoding a hypertextual representation of documents to be transmitted from server to browser. There have been many changes (both de facto and de jure) to HTML over the years since it was first codified in an Internet Engineering Taskforce (IETF) RFC [4]. In 2000, the markup language was re-cast into XHTML using the extensible markup language (XML) to make the language easier to adapt to changing conditions [25]. The next year, Berners-Lee and others publicly initiated an effort to move the WWW in a new direction with the creation of the Semantic Web project [6] which would build on XHTML.

2.2 W3C's and WHATWG's Divergent Views

Progress continued within the WWW Consortium (W3C) on developing a new (and incompatible) version of XHTML to support the expansive ideas represented by the Semantic Web. However, in 2004 at the W3C Workshop on Web Applications and Compound Documents a schism developed which led to the formation of the Web Hypertext Application Technology Working Group (WHATWG) [10]. According to the WHATWG [26], 'Apple, Mozilla and Opera were becoming increasingly concerned about the W3C's direction with XHTML, lack of interest in HTML and apparent disregard for the needs of real-world authors.' WHATWG was, and may still be, driven by a pragmatic concern for what today's programmers (writing browser software and webpages) *are* doing, whereas the XHTML 2 group idealistically tried to create a system based on what *should* be done.

2.3 One Track — HTML5

The divergent paths of development ceased when the W3C agreed not to pursue development of XHTML 2 but to instead join the effort by the WHATWG to standardize existing practices.

HTML5 is a descriptivist approach of standardizing existing practices (working from the bottom-up) rather than being guided from the top-down by a prescriptive vision. The main principles which guide the development of HTML5 are: to be backwards compatible; to define error handling more rigorously; and to evolve towards greater in-built support for the types of WWW-based applications we see today [16, 24]. The selection of markup elements (e.g. navigation, header, footer) was based on an analysis of the use of CSS `class` attributes from over two billion webpages collected by web crawlers [16, p. 6].

HTML5 is a standardization of not only the markup language used to describe the page, but also the Application Programming Interfaces available to JavaScript running on the page. It is not a monolithic entity, but an evolving collection of standards in varying states of readiness and implementation. It includes native support for drag-and-drop, video, remote procedure calls (à la Ajax), drawing, data storage, geolocation, graphical widgets for new kinds of input and output, and more.

HTML5 now provides (natively) almost everything that was in NLS. No previous version of HTML was able to support all that functionality natively.

3. DEMO: HTML5 SIMULATING NLS

The accompanying demonstration (see Figure 1) uses the HTML5 standard as implemented by the Firefox browser. We show a working model of the dynamic shopping cart with associated 2D map like that demonstrated in 1968 and referred to above. The map is implemented using the `canvas` element. The nested hierarchies are represented by ordered lists which are manipulated in memory through the DOM and ECMAscript. The lists of locations, etc. are displayed

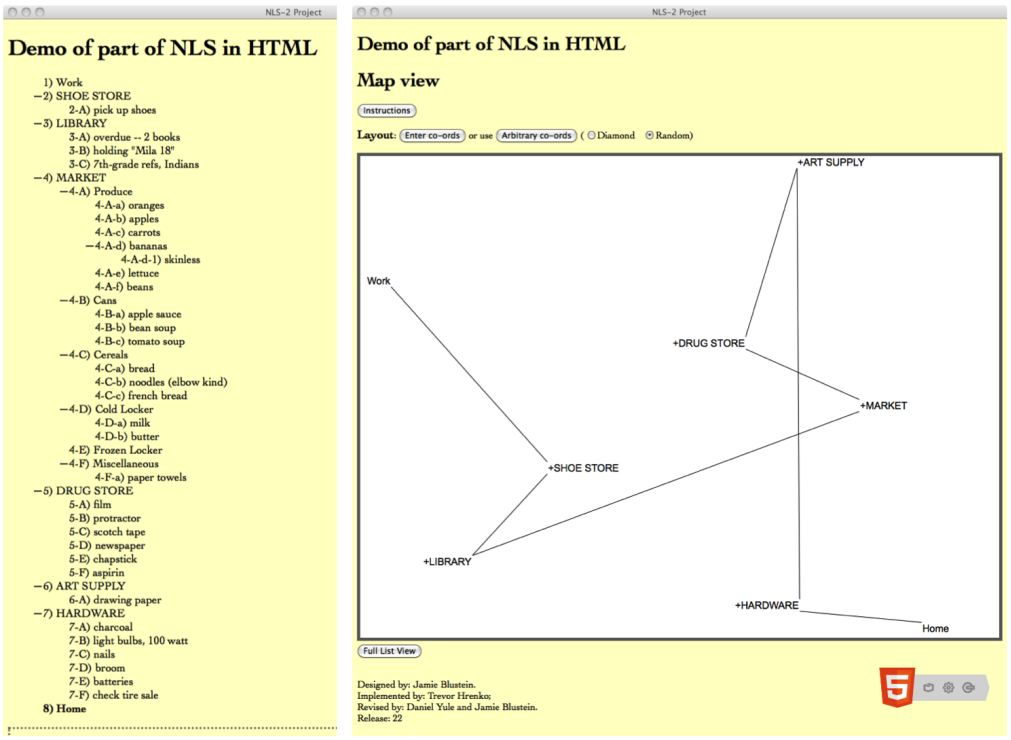

Figure 1: Screenshots of demonstration

to users in menus. We use the `localStorage` API for storing data persistently (i.e., so it is retained between sessions).

4. CONCLUSION

Our conclusion is in three parts: what seems not to have changed, what has, and predictions.

4.1 Running on the treadmill

Although, hardware and network performance have improved tremendously since 1968, many of the capabilities of NLS were not matched by the WWW until very recently. Networking capabilities are one of the only exceptions to this observation.

One lesson that can be extracted from the legacy of NLS is that people cannot be directed to do things in prescribed ways even if the vision is eventually borne out, given that the features demanded by users of the WWW were very similar to those first envisioned by Englebart 50 years earlier.

Without Englebart's grand vision, the ideas behind HTML5 might not have existed at all. It took fifty years for the world to change enough that Englebart's original ideas could become widespread. However, HTML5 is not a grand vision; it simplifies what has already been done. Perhaps in another 50 years, we will finally catch up to the promise of XHTML2 and the semantic web By contrasting NLS and HTML5 it is apparent that we (the hypertext/WWW programming community) have not done much more than executing the vision of the original founders.

Just as the WWW could not be successful without Cailliau's non-technical contributions so future progress will be impossible without engaging many people [3, 18]. We cannot rely solely on visionaries in standards bodies to drag the rest of us along to 'the next "Big Thing"'. People must also be ready to accept it.

4.2 Substantial progress

At the first Hypertext conference, Halasz [14] challenged the community to solve seven major issues with hypertext. The list and progress towards solutions has been a recurrent theme at the conference. In 2007, Goble [13] showed how, within parts of the WWW, all of the issues have at last been resolved.

Competing interests led to standards (some good, others not so good) that have led to improved efficiency in developing across many platforms, and have often driven development.

Engelbart's ideas that led to the development of NLS, although recognizing that 'communications is an integral part of the design' [18, p. 87] were more aligned with Bush's memex [9] than the modern conception of social media and e-commerce. The modern Semantic Web and the Web of Linked Data [15] are considerably more advanced in scope and depth than their early precursors in NLS. However, we believe that it has fallen victim to the same problem that NLS did decades before, of being too far ahead of the curve.

4.3 Predictions

If the experience from 1968 until the present is a reliable predictor then we expect that prescriptive approaches to systems will be difficult to sustain. Popular demand will dictate where the money and research goes, and entertainment is what is usually popularly demanded [17].

Where should we be going? For real improvements in the state of the user-based WWW (not the Web of Linked Data) we should mine features from earlier systems that were seen as too complicated, computationally expensive,

autocratically organized, or unusual at the time of their release. Of course, some of this has already been done: for example innovations from Microcosm [12] have been ported to the WWW, Trellis [23] and VIKI [19] have inspired parts of StorySpace and Tinderbox [8].

If any new ideas are to be considered a success, they must be measured by the balance they strikes between prescriptive and descriptive impulses.

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