WHERE – Physical Entries to the Internet

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Abstract. This contribution shows how the experienced location of data or information, and of computing, changed since the first general use of information and communication technology. We show how many current and future non-professional users will develop a view of locality for physical tagged entry points to resources that are in fact nodes in an, often global, network.

Keywords: Internet, Wearable Devices, QR code, Cloud, Information.

1 Once Upon a Time

How did we ever manage without our smartphone? Well, we had computers, end before that we had books, and before that … Indeed, there has been life before:

People told each other stories and transferred **information** orally. If the information was complicated, people used rhyme to keep the knowledge reproducible, and started to carve information in sticks or clay. When books were still very expensive, one copy was enough to provide information to a community, e.g., a convent. Who was unable to read found someone able to read who could tell the story, to explain the law, or to evaluate the execution of a contract. The most important information for everyone was the location of the information: where to consult the expert or the document.

Information processing often required calculations. In due time experts developed tools like the slide rule. Figure 1 shows a recent one, still hand-made [1]. Another device is the abacus. Figure 2 shows a historic example from around from 1340, Upper Italy, currently in the German Historical Museum Berlin [2]. For complex calculations experts either made their own tool, owned one, or needed to know where to find one.

Fig. 1. Slide rule, hand-made made by Robert Munafo at the age of 14.

Fig. 2. Abacus from 1340 Upper Italy, German Historical Museum, Berlin.

In summary: both for information and information processing devices there has been clear physical locations to keep them and to use them.

2 Computers Expanded our Possibilities – an Example

When we started our research in cognitive psychology in the early 60's, one of our challenges was to develop models of individual differences in human information processing. The phenomena of individual difference in cognitive style was one of our key interests. Markov models seemed a promising way to characterize individual sequence preferences, so we choose a domain where sequences are an obvious relevant characteristic, melodies created by music composers. Based on a hand transcription of 46 melodies by Orlando di Lasso [3], we build Markov models to predict the most probable continuation(s) of melody fragments for this composer, intending to compare these to other volumes of this composer's work, or to collections from contemporary other composers.

Keeping the information available was the first problem: working from the printed score was not (yet) feasible, working from a hand written or typewritten notation was rather clumsy. Luckily there were new tools available: machines like the Friden Flexowriter allowed us to input our data, to reproduce them, to correct errors, and to make multiple copies of the 7-hole paper tape that were the physical store of our data. A tape could always be read again and a human-readable document could be printed by this machine, see Figure 3. We could read the printed document, but we mostly considered the paper tape to be the actual information: We would store it safely at a location

of our own choice, we could hand over a copy to a colleague when needed, and we could easily transport it. In this way, we had our information or data on a set of paper tapes, and we wrote a program in ALGOL-60 to build the Markov models, typed it in the Flexowriter, producing a readable print as well as another tape that we considered our program.

In Amsterdam, a single computer was available for both universities and for the Mathematical Center (later renamed CWI), an Electrologica X-1with 8K of memory words and, next to the binary console, a paper tape station, seer Figure 4. To use it we had to go to the Mathematica Center, bringing our data and our programs on paper tape. We were allowed on night (9 hours) each week, to consider this computer ours, which was enough to work on one matrix multiplication as part of our project.

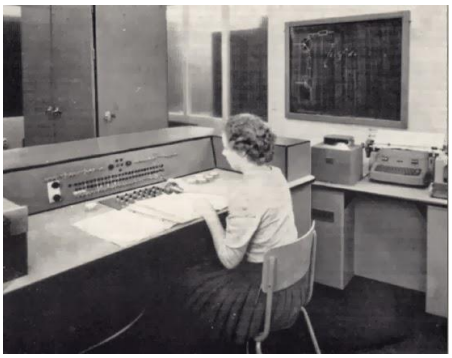

Fig. 3. Friden Flexowriter [4], and **Fig. 4.** Electrologica X-1 [5].

Around 1970 my department acquired its own “minicomputers”, from DEC’s PDP series, running UNIX. Now the location of the computer was next to the office and we just walked around with our programs and data tapes.

In the early 80s personal computers became available and we could buy on privately (see Figure 5), a Commodore DX with a detachable keyboard and two 5.25" floppy disk drives, running a disk operating system that was similar to UNIX, and, moreover, could be enlarged with UNIX-like editors etc. The machine could be carried and did fit in the overhead compartment of a plane so we were able to travel with our own machine, and with both our programs and data on disks. The computer, the programs, and the data or information resources were all in people’s own hands and could all fit in the luggage of s single traveler.

Then mainframe computers got connected, and we could, both, send email to others, and to work on remote machines, where UNIX was the universal language as well as the hierarchical map structure of resources. Email addresses were in fact complete specifications of the chain of computers that our message should go to, e.g. “utzoo!utgpu!water!watmath!clyde!rutgers!seismo!mcvax!botter!gerrit” (1987), and the same network knowledge allowed us to go to remote machines and login. Figure 6 shows the network of European nodes. Because collaborated with colleagues in many European countries, we did set up an account at one of the available mainframes and we all used the same login name and password, so we could see who was working in our UNIX

domain and we used one file to communicate. We knew the path and the location of the machine was, and we knew where the programs and the data were that we were collaborating on.

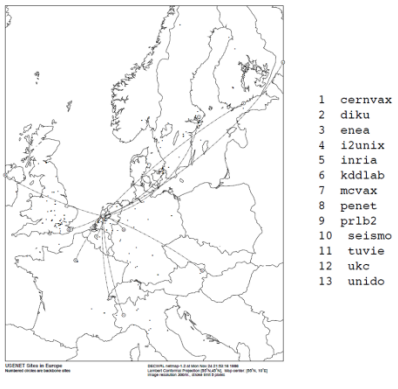

Fig. 5. Commodore SX 64-1, and **Fig. 6.** European network in 1986.

Another possibility that existed for some time was (at least when using UNIX) to work between machines and connect the UNIX filesystems. When being employed by several universities this allowed us access to all programs and data stored at all sites, and even to operate peripherals to read or write at remote locations. This indeed provided strong opportunities, and required precise knowledge of the current state of the remote machines.

But the internet developed, paths were getting too complicated, and in fact multiple paths were used even in a single connection or transport.

3 Who Cares Where our Things are Anyhow

Email no longer requires the user to know the path or even the machine that hosts the mail server of the addressee. Addresses may refer to provider domains (Gmail), institutes (vu.nl), locations (.eu, .nl), type of business (.ed, .com, .org). Many of us will have multiple addresses, for which we may have to login to several systems. And some of our addresses are aliases (..@acm.org), that allow us to reroute the mail to whichever of our actual mail address).

We find our tools increasingly at websites. And if we download the tools or apps, we are used to get updates for which we sometimes pay and sometimes we are not even aware.

Our programs and information can be stored at machines that we know and that we trust. We store our data partly in local memories or hard drives, partly in the cloud, and we sometimes share with specific colleagues or friends, and sometimes with the world, and we might well forget we stored, or shared, or where we left them. In the case of the programs and the interactive websites we create, we will mostly be more carefully about in what system, and with whom we share certain rights. But we need to keep track of

locations, names, and passwords. And sometimes we want certain access information to be easily available for a certain community or at a certain location.

4 Here is What You Need at This Moment

Sometimes, people feel enabled if they find information or interactivity at specific physical locations.

4.1 Industrial Design Teams Work in Physical Spaces

Vyas did a field study in a design school [6] where he provided 2D color barcodes to the members of several design teams, showed them how they could stick these to any physical artifact like a sketch, a 3D mock-up etc., and how they could use their phone cameras to send tweets to the artifact and read the history of tweets to this artifact. Figures 7–10 show some examples. We found that as soon as an artifact was tagged and tweeted to, there was no need to scribble on the sketch anymore: all discussion and comments were tweeted. Somewhat surprisingly, in several (unrelated) projects designers invented an unexpected type of physical artifacts to tweed to, for discussing about other business: They took a clean sheet of paper, tagged is and pus a single word on it like “vote” or “planning”, see Figure 11.).

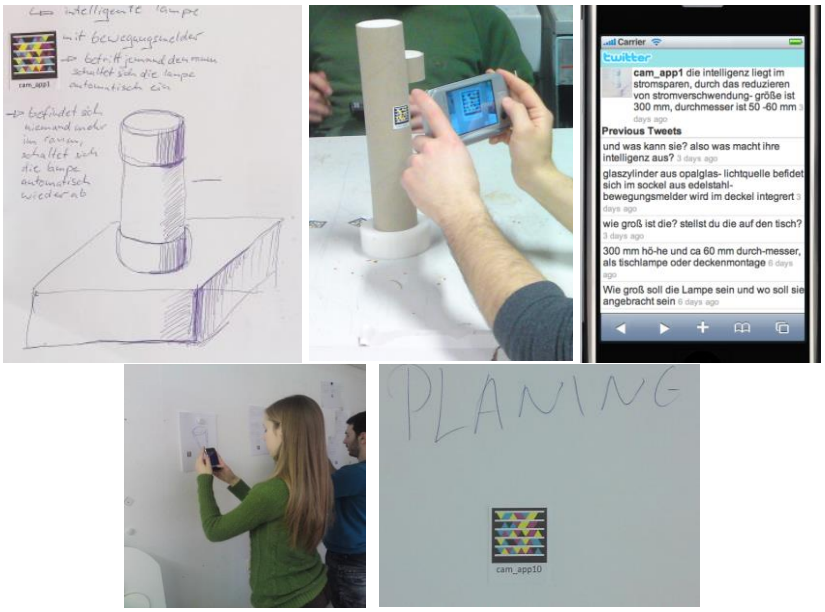

Fig. 7. Tagged sketch; **Fig. 8.** Tagged 3D mock-up; **Fig. 9.** Tweets; **Fig 10.** Reading tweets and commenting; **Fig. 11.** Call for planning suggestions.

Whether sketches, 3-d mock-ups, or simple calls for ideas, in all cases the tagged artifacts were positioned at a location where team members would go to read, comment,

and discuss. The tweet flow was the ongoing conversation, located wherever the tag was.

4.2 Pointing is to a Location

We teach in multiple countries. In the case of China, we know that outside the Universities there is a language problem. Most people we need to talk to, like Cab drivers or waiters in restaurants, only communicate in Chinese and sometimes they cannot read complex phrases. We use our Lifescribe pen and notebook (Figure 12) and ask our students to translate our written notes to written Chinese, at the same time pronouncing this translation (Figure 13). Whenever we need to communicate we find the right page in our notebook, and point to the translation – if that does not work we point with our pen and the system will pronounce the sentence. Interestingly, anybody who has never seen or used this before considers the pen to be the resource of the sound. For the regular user, the location on the right page in the notebook is the location where the pronunciation is, see Figure 14. And at the same time, the regular user will probably use the pen as input device for his regular computing devices like phone or laptop and network connections where the scribbles and the accompanying sound will be stored and often shared.

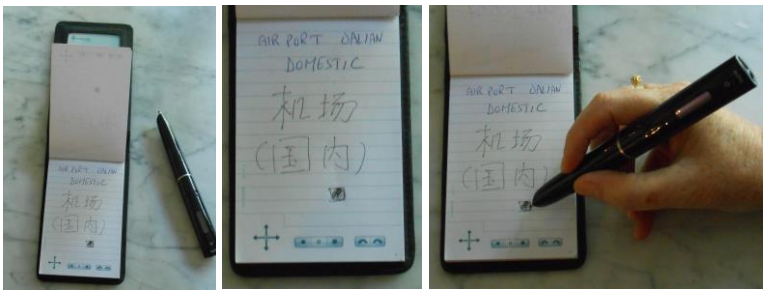

Fig. 12 and **13.** Lifescribe Notebook and pen; **Fig. 13.** English phrase and written and spoken translation; **Fig. 14.** Pointing to the scribbles triggers the sound track.

4.3 Smartphones Open Up the QR Code

QR codes are now arriving at many locations for very different purposes. Some public transport companies put them at stations to allow travelers access to actual traffic information. A QR code on a wine bottle provides information on production and content. Small businesses put them on their leaflets that people will find in their (physical) mailboxes, or pick up from the counter, see Figure 15. At the time of writing, the smartphone is the common device for people to capture the code and find out about its meaning. Where the code is, there we will find the information.

Our students are experimenting with “interactive posters” to enhance the possibilities to engage their peers at conferences, see Figure 16. In this case, the codes are intended to provide many types of experiences: interactive websites, videos of presentations, interactive PowerPoints, and strait forward text and pictures. The actual locations that the codes refer to are, consequently, websites, videos on YouTube or, in China,

Youku. For the young researchers that crowed around the poster, phones in hand, the codes directly provide them the content of the discussion and the possibility to compare, e.g., the PowerPoint and the actual performance.

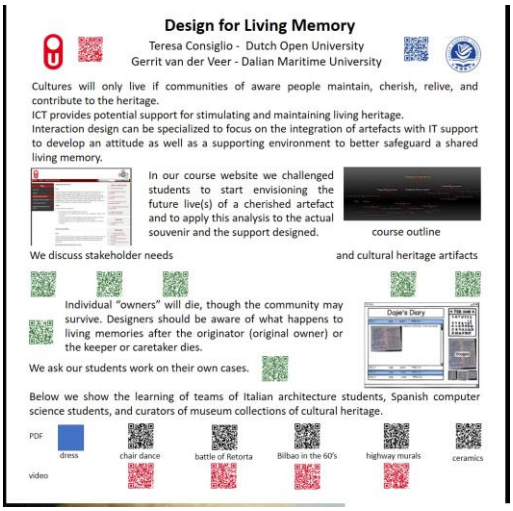

Fig. 15. Advertisement with QR code; **Fig. 16.** Interactive conference poster.

5 Future Meanings of "Here"

Computing artifacts, increasingly, are connected, may be traced, and can be hacked. Professionals in computing should know, and should want to know, where things are: in their smart wearable device (for now their phone or their pen), in their laptop, in their pen drive, their company network, or in the cloud, and they should be concerned about ownership, changeability, safety and privacy.

The nonprofessional users of computing and of networked computing (at this moment these are already the majority) would need protection, by law and provided by ethical design and implementation. But at the same time, they cannot be bothered personally. RFD tags and GPS trackers seem to relate to things, not to the humans using them.

A special issue, and in fact the core concept of this paper, is the meaning of location for users of tagged entries to information. Currently the tags seem obvious (for devices like the Livescribe pen, however, they are invisible for the user, even if these needs to know and understand).

For most users of the tags that are increasingly being used to draw attention to information that may be relevant for the observer, for the agent that puts the tag, or for both, a tag is just location to point a wearable device on to find out if there is something relevant at the current moment in the current context. And even if the current common wearable is a smartphone, still growing, and decreasing in social acceptability of use in many contexts, new and more usable wearables will soon be available: think of camera-

enhanced pointing device like pen, cameras in (simple or smart) glasses, in smart watches and in other types of smart jewelry.

The use, in all these cases, suggests that relevant information, fun, or interaction is "there" – something non-professionals seem to understand quickly and easily. They will relate to non-local information and interactivity, without telling too much about that and about the related aspects of safety and privacy. There certainly is a task for designers, for the law, and for providers here.

Acknowledgement

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