absenT Presence

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Our paths diverge
life takes us to the empty places
past presences have been here
but are lost

I touch the brown crackled wallpaper
feel past hands touching
toes echoing
forgotten footfalls

1. NOT BEING THERE

Presence is a word pregnant with meaning in both CSCW and VR communities. Normally we are interested in feeling an awareness of people's activities elsewhere. Sometimes we need to explicitly find out what people have been doing in order to understand the way shared workspaces have changed. Tower's DocuDrama [Schäfer et al., 2001] is an example of this, but the concept of animating changes goes back far further [Pendergast & Beranek, 1991].

Research in Leeds Met has shown that even marginally 'intelligent' avatars can give virtual visitors a sense of co-presence in an infrequently habited virtual space [Gerhard, 2003]. This lead to wondering whether various forms of replaying of human presence could give the same effect, perhaps lights moving on a gallery floor following the footsteps of past visitors.

We call this sense of past presence 'absent presence'.

In September 2003, several people in the Department of Computing at Lancaster University participated in Scrapheap (Computing) Challenge, an *extreme prototyping* event. This challenged participants to design, prototype and present working computing artefacts as solutions to specific computing challenges [Scrapheap, 2003]. We refer to the activities during this event as "extreme" because all comprehension, investigation, brainstorming, conceptualisation and realisation of prototypes had to be completed within a single working day.

Alan Dix was one of the judges for the challenge and was tasked with producing a HCI challenge. He had already decide that 'absent presence' was a suitable subject when he realized that he would be away at the annual HCI conference in Bath on the day. It this seemed not only appropriate but apposite.

This paper describes the challenge, thee teams entries and the way this has already inspired further research and publications. In particular, one of the entries was the inspiration for a visualization system for web activity that creates 2D spaces based on web log analysis on which past or present visitations are played like footsteps.

This work suggests a whole avenue for using the recording and replay of activity to create sense of human presence when absent.

This paper will start by looking at the Scrapheap competition, the original challenge and the entries produced. We will then discuss in broad terms some of the outcomes form the Scrapheap before looking at the web visualization, Quantum Web Fields in more detail.

2. THE CHALLENGE

Cyberspace is lonely, each web page or document is empty. And yet cyberspace connects, mobile phone and IRC. Like a solo yachtsman we chatter on the shortwave, but the sky touches ocean all around. We connect to distant places, but follow fellow-less paths.

The absent presence challenge was to create a system that for some environment, virtual or physical, where visitors are normally alone or have few people around, can in some way sense the presence of those who have gone before ... and also the visitors' own presence in some way is taken forward.

The aim is not to establish contact with past people (although that is not prohibited), but just to give visitors to the space (museum, web page, monument) a sense that others have been there

The system should in some way capture an aspect of the previous visitors' behaviour (sound, mouse movement, link history, physical movement) and use this to make the absent presence more life-like

The teams 'entries' were judged on six criteria

- Experience – do you feel you are not alone
- Usability – of the added system itself
- Disruption – does it interfere with the usability and experience of the physical space or electronic system it is augmenting
- Practicality – if it is a free web site add-on, would the installation be simple enough for people to feel worth while, if it is augmenting a public space would the costs

(capital and recurrent) be reasonable, if it is commercial does it have an effective income model

- Robustness – could it reasonably be expected to function without extensive support for long periods (months to years)
- Scalability – how does it cope with the range of actual visitations likely in real life (e.g. if it were for a web page would it cope with very infrequently hit pages or very high-traffic sites)

The teams were not judged on the day, but instead they had to install their system and over a few days it can collect 'visitations'. The event was on a Tuesday and Alan was away until the Friday afternoon. He interacted on the Tuesday via phone and enigmatic text messages.

3. EXAMPLES

The teams were given several example scenarios to get them thinking … (reproduced as given, capitalisation deliberate)

the whispering wall

you visit an art gallery ... as you pass a picture, you hear a strange rustling sound ... or is it whispering ... you approach the picture and as you get closer the sound gets louder it is the soft chatter of many voices, too quiet and mixed up to hear individually except, every so often, one voice rises above the others and you hear a comment about the picture, perhaps on its composition, perhaps the emotions it raises the sound comes from beside the picture where there is a small microphone on a stalk and a notice "touch me and say what you feel" as you touch the microphone the whispering voices still and you speak your feelings, knowing that others will hear the faint echoes of what you will say

arctic ghosts

in oulu in the north of finland there are six months of day and six months of night during the long day video cameras in a public square record the paths that people take as they meet and chat and savour the sunlight in the dark of winter people rush, wrapped tight in fur coats, not daring to linger in 40 degrees of frost but from the warmth of cafes and bars, they look out of the windows and see upon the lightless pavements small spots shine, moving about sometimes alone, sometimes in pairs, sometimes meeting each other, lingering by shop windows, moving towards doorways - one comes to the door of your cafe and disappears on the threshold the movements from six months before replayed, remembered, reminding that summer will come again

furry footprints

you click on a link and go to a web site you haven't visited before as you start to read the web page you notice a small group of cartoon animals at the far right of the screen, they move slightly but do not demand attention as you move your mouse over a link one of the icons, a badger wearing a baseball cap, breaks from the group and floats near the link icon and small text box appears saying "I went there" you ignore it, click the link and go on ... ... but sure enough on the far right of the new page there is another group of cartoon animals but including the badger curious now you move your mouse towards the group it scatters and spreads slightly as you approach, but then stays still so that as you hover your mouse over each animal a small tooltip appears "follow me to 'short courses'", "follow me to 'student life'" you click over the badger and are taken to the badger's suggested next destination and a larger cartoon of the badger suggests a tour through the site in fact each animal is not a pre-built tour, but created from scanning the web log for long sessions and then using these to build tours based on past visitors' paths the animals on each page represent particular visitors' paths that included the page you are on

4. SYSTEMS

The three teams, Sons of Sensor, .:thePooch:. and Rectifier, produced markedly different systems all though all focused on the sensing and display of physical presence.

4.1 MOOD FLOOR

Sons of Sensors developed the Mood Floor. A wooden floor is place in the interactions lab on the way to the coffee machine. As users walk over the floor green squares light up where their feet touch the floor (Figure 1). When users reach the coffee machine, they can "register" their mood as either red or blue by pressing either a blue panel or a red panel on a weight table. Then when they walk across the floor a second time, the colour that they've selected will appear underneath their feet.

Mood is expressed through valence, which comes in three primary forms: red mood (valence is not explicitly defined); blue mood (valence is not explicitly defined); neutral – (no valence attached). Secondary colours appear when primary moods crossover. For example, the colour purple indicates when a person who has selected blue walks over a red area. Valence information decays over a period of several hours, and therefore gives an impression of the mood of the previous visitors. The longer the user stands in one spot, the stronger the valence imprint and the longer the imprint will take to decay (max of 2 hrs 40 minutes).

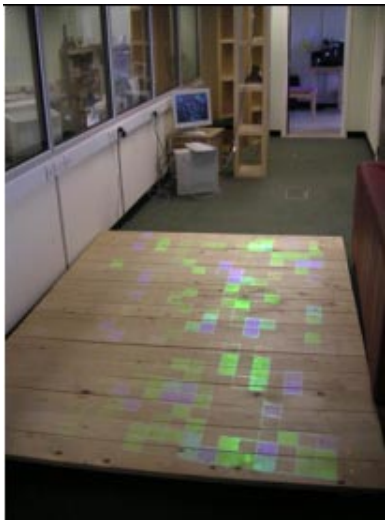


Figure 1. Mood floor lit up by user activity.

4.2 KIRLIAN TABLE

For this challenge, thePooch took inspiration from the images found in Kirlian photography, a technique that reportedly allows you to view the psychic aura of the person or object being photographed. The Kirlian Table reproduces this effect by showing the psychic aura of objects placed on the table (Figure 2). The longer the object is present, the more 'psychic' energy is

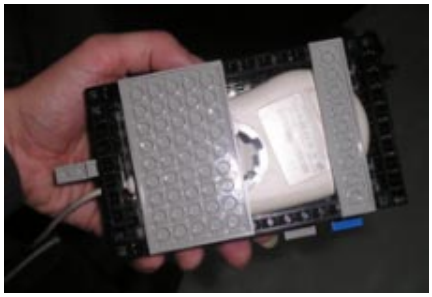
stored in the table and the more intense the aura. On removal of an object, the psychic aura lingers and slowly dissipates - items that have charged the table for longer take the longest to fade. The patterns of aura evident on the table represent a stratified 'archaeology' of activity centred around the table. At any one time, these patterns indicate the artefacts of discussion, work and recreation which have been previously place on the table.

Figure 2. Kirlian table after object is moved.

4.3 FAIRIES

The Rectifier team chose to build a means of enabling a piece of contributory art work that detects a participant's physical presence at a location. Users generate "presence events" using custom-built sensor equipment installed in household furniture (Figure 3). Presence events in the demo application simply describe whether a participant is seated at a location, or is no longer seated.

The custom-built sensor sits under a sofa cushion and when users sit on the cushion, they generate a virtual fairy which appears on a display that is situated next to the sofa. Every time someone sits on the cushion, they generate new fairies. As a participant remains at a location, the fairy's form changes until the user moves away. Over time, the entities that embody presences decay, making way for fresher more recent presence interpretations.



Fiigure3. Custom-built sensor equipment for household furniture

5. AND AFTER

Remarkably all three systems were up and running three days after. How many three year multi-million euro projects can manage to keep demos going that long!. This was so amazing we made it the subject of a report to UsabilityNews [Dix, 2004]. The Scrapheap as whole has been the subject of a paper (currently under review) where discuss it both as a methodological technique – extreme prototyping; and as a way in which we can unpack various dimensions and attributes of the ambient display of human activity. One of the other challenges was about awareness of current activity, so this together with the absent present challenge gave six systems widely spaced over the design space.

Figures 4 and 5 show two example diagrams from this paper relating to the temporal parameters of the phenomena and visualisation and the systems were placed on scales or described using attributes relating to these. For example, by their nature absent presence systems must have a long delay between sensing and visualization, or a long persistence, or both.

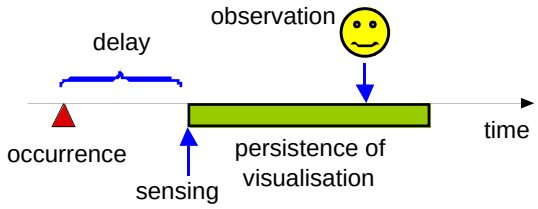


Figure 4. Temporal properties of visualization

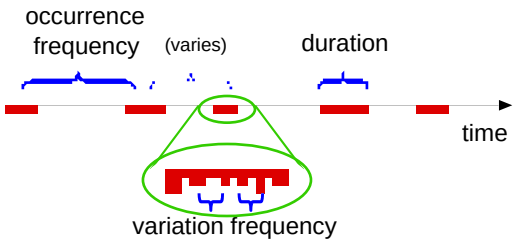


Figure 5. Temporal properties of phenomena

The Mood Floor was also used as the inspiration for joint work between Alan Dix and Geoff Ellis of Huddersfield University on visualizing web presence. The Quantum Web Field uses a heavily modified Kohonen-style algorithm to give web pages a fuzzy 'presence' on a matrix and then to trace individual visitor sessions across this.

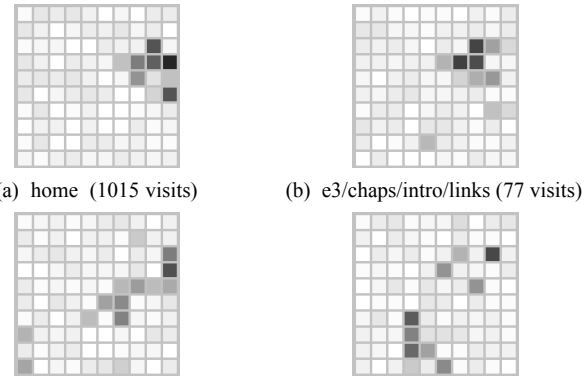
6. THE QUANTUM WEB FIELD

In the world of large-scale phenomena each object has a unique location in space. However, in the quantum world each particle has a spread out existence – a probability of being at any particular location. Likewise, in the Quantum Web Field, each page is given a probability of being found at each square. These probabilities are arranged so that pages that tend to appear next to one another in session paths have high probabilities on adjacent squares.

There is a large literature on web visualization including visitation patterns, this is usually in order help the designer to analytically understand or evaluate the web site, or to help users navigate it (e.g. Narcissus [Hendley et al., 1996] or Disk Trees [Chi et al., 1998]). However, the Quantum Web Field is less about functional aims and more focused on giving viewers a sense of human presence in the web world. The paths traced are not reproduced exactly and are not deterministic, but are intended to have human-like dynamics. In fact, the human ability to detect 'odd' movements has meant that the Quantum Web Field has also be used to spot non-human activity (web crawlers, site suckers).

6.1 WHAT IT LOOKS LIKE

Figure 6 shows the web fields for four pages. The darker squares are those where the page has a higher probability of being placed. The algorithm has a 'crowding factor' which makes pages spread out over the network of squares, but it does not force each page to occupy a single square. In fact, by adjusting parameters during the procedure that generates the web field, it would be possible to make the algorithm 'cool' into a state where there was a single page per square. However, by allowing each page to have a more diffuse mapping to the net we are able to visualise sites where there are more pages than squares. Also the many–to–many relationship between squares and pages allows some freedom when plotting footsteps through the site, thus giving more human-like paths.



(a) home (1015 visits) (b) e3/chaps/intro/links (77 visits)

(c) hci2e/resource.html (422 visits) (d) e3/chaps/ch1/links (21 visits)

Figure 6. Web fields for sample pages

Looking more closely at the web fields in Figure 6, we can see that (a) and (b) have more concentrated locations than (c). Also, note that (a) which is the site home and (c) the resource page both have a high probability associated with the fourth square down on the right hand side (a and c). There are several hundred pages on this site (www.hcibook.com) and only one hundred squares. Finally, note that (d) has a bimodal nature. It is the 'links' web page for chapter 1 and one area corresponds to being close to the links area of the 'intro' web page (b). The transition between these would be quite common for someone skimming the 'links' pages, hence the algorithm places the pages closely on the web field.

In the quantum world, particles only get a single location when they are observed. Similarly, when a session visits a page, a single square is coloured as the 'wave function' collapses. The location for the page is chosen in a random, yet proportionate manner, based on the probabilities in the page's web field. The location of subsequent pages in the session also depends on their web field, biased by the distance from the last visited page. The overall effect is that a session path visits a series of squares that tend to be close to one another, but have the occasional jump across the net. Identical paths do not necessarily hit the same squares, although they will tend to follow similar paths across the net. This leads to a visualisation that has enigmatic quality, giving a sense of purposeful activity and human-like variety, but defying a simple explanation.

Figure 7 shows a typical path across the net. To ease interpretation, the squares are numbered with the order in which they are visited and cells also fade with time.

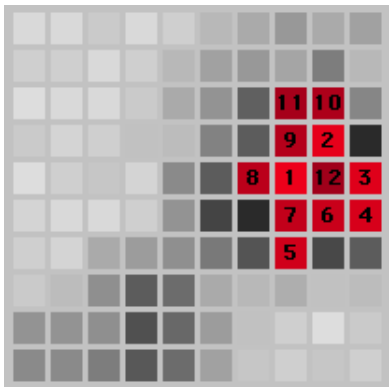


Figure 7. Path through the web net

6.2 HOW IT WORKS

The Quantum Web Field uses web logs to produce the structure.

(a) web logs are pre-processed to extract sessions and create co-visitation statistics

(b) the comes-next matrix is used to produce a 2D visualisation space

(c) live web visits are sampled

(d) the sampled sessions are drawn into the 2D visualisation space

Figure 8 shows these steps. Steps (a) and (b) are part of a pre-processing stage and steps (c) and (d) are carried out in real time to give the actual visualisation.

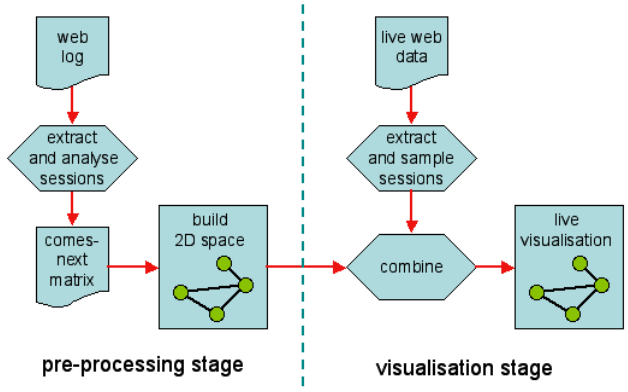


Figure 8. Stages of visitation visualisation

A common algorithmic structure is used both for the Quantum Web Field and also another web presence visualization the Molecular Meanderer which uses a ball-and-sprint style of 2D layout which is then used to trace paths of web activity.

6.3 LIVE SAMPLING

We need to sample visitors in order to avoid swamping the visualisation. A previous paper examined the use of sampling in detail [Dix & Ellis, 2002]. In the case of web visitors the sampling regime can be relatively simple as each visitor is largely 'independent'. This implies that instead of randomly deciding which visitors to display we can simply choose every n-th one where 1/n is our sampling density.

The precise form of sampling depends on the nature of the web site. If the range of visitation rates is quite small we can simply use a fixed sampling rate. In this case the number of displayed visitors will be proportionate to the number of actual current visitors.

However, where the range is an order of magnitude or more, then simple proportionate sampling would lead to displays that were nearly empty in quiet periods and overfull in busy ones. In such cases, a non-linear mapping is required between the number of visitors and the number displayed. We present here one such non-linear sampling.

First of all, depending on the visualisation characteristics, we decide on the minimum and maximum number of visitors we would like to see visualised at any moment. For the Quantum Web Field a sensible maximum is WxH / 2 x average visit length. We call these D_{min} and D_{max}. We also decide on a level of visitors, V_{busy}, for which we are happy to see the display saturate at D_{max} displayed visits. The target number of visitors displayed, T, at any point is then a log linear function of the number of current visitors, V. All the visitors are displayed when there are less than D_{min} of them:

$T = V$ if $V \leq D_{min}$

$T = D_{min} + K \log(V/D_{min})$ if $D_{min} \leq V \leq V_{busy}$

where $K = (D_{max} - D_{min}) / \log(V_{busy} / D_{min})$

$T = D_{max}$ if $V_{busy} \leq V$

In addition to the sampling rate, the time a path continues to be displayed and the rate of fading needs to be dependent on the current number of visitors, so that even when the number of visitors is very low one can get some sense of recent activity. Figure 9 shows the target number of visitors displayed (lower curve) and the additional number of fading paths (upper curve) plotted against the number of visitors. Note the slightly odd shape at the lower left side which shows the number of current visitors displayed cannot exceed the actual number present.

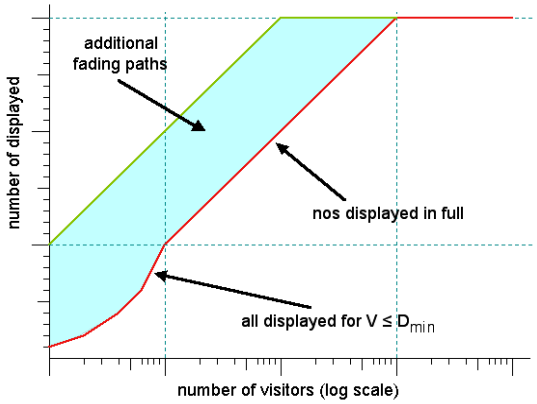


Figure 9. Non-linear sampling function

7. SUMMARY

The absent presence entries in the Scrapheap competition and also the Quantum Web Field show that it is possible to create designs that give senses of presence in environments that have been inhabited in the past. This is useful particularly in low frequency social spaces where the total number of visitors is relatively high, but the number at any time low. The same techniques can of course be used to link social spaces where there is not a requirement for direct social engagement, but more giving an ambient sense of co-presence.

In the Quantum Web Field we have seen that logs of past activity can be used to structure non-planar structures (web pages) into spaces that are suited for visualization and preserve the human-ness of paths. We have also seen that it may be necessary to sample logs of past activity in order to reduce display density. However, this needs to be done in ways that preserve key attributes of the data, in this case the path of a session (leading to session sampling) and the sense of volume of activity (leading to a non-linear sampling regime).

8. RECORD AND REUSE ISSUES

These examples vary from relatively simple replay in the lights at Oulu to the Quantum Web Field, which uses the record to produce a visualisation and then samples the visualisation. The key issue in all is the human-ness of the transformed record … what must be retained in order to be able to replay something and retain that human feel? Some of the examples use specially recorded data, but the web visualisations used standard logs collected for other purposes.

9. ACKNOWLEDGEMENTS

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