Ephemerality as a Design Driver: Evanescent Screen Enabled by the Arctic Weather Conditions

Ismo Alakärppä
University of Lapland
Po Box 122,
FI-96101 Rovaniemi, Finland
Ismo.alakarppa@ulapland.fi

Elisa Jaakkola
University of Lapland
Po Box 122,
FI-96101 Rovaniemi, Finland
Elisa.jaakkola@ulapland.fi

Abstract
This paper contributes to the discussion on weather-based phenomena as an affordance for creating user interface elements. The transient characteristics of nature concretely represent ephemerality and provide novel metaphors for interaction design. We have studied arctic weather conditions as a new possibility in the context of ephemeral user interfaces and evanescent information presentation. In this article we present our work in progress dealing with an evanescent screen concept referred to as BreathScreen. BreathScreen is an ephemeral surface for projections enabled by breath clouds produced by human beings in arctic weather conditions. Our work entails preliminary observations from experiments with BreathScreen and introduces possibilities for the presentation of personal information. It also and brings out pragmatic challenges encountered in the implementation of BreathScreen.

Author Keywords
Evanescent screen; ephemeral user interface; arctic; weather; vapor; fog; cold; winter.

ACM Classification Keywords
H.5 Information interfaces and presentation (e.g., HCI)

Introduction

Nowadays people are balancing between social visibility and privacy. Those are the drivers of an increasing interest in apps and other solutions that make data and information ephemeral and self-destructing. Ephemerality and evanescence have recently gained a growing amount of attention in the human-computer interaction (HCI) field of research (Dun et al. 2012; Seah et al. 2014, Shein 2013; Döring, Sylvester and Schmidt 2013; Kwon et al. 2015). According to Döring et al. (2013), an ephemeral UI includes elements that are intentionally created to last for a limited time and typically utilize materials such as water, fire, soap bubbles, and plants.

Accordingly, after Snapchat became popular, several large companies, including Facebook and Apple, have launched ephemeral features such as disappearing and self-destructive messages (wired.co.uk 2015; en.softonic.com 2015). However, owing to the absence of materiality, these solutions do not fully meet the definition of an ephemeral UI (Döring et al. 2013). Most of the existing implementations utilizing ephemeral materials are designed to be used indoors or they require stationary infrastructures (i.e. Barnum, Narasimhan and Kanade 2010; Imura et al. 2011; Rakkolainen and Lugmayr. 2007; Plasencia, Joyce and Subramanian 2014; Kwon et al. 2015; Sun 2015). We argue that evanescent screens constitute an important ephemeral UI element in the context of information presentation. The term *evanescent* means *quickly fading* or *disappearing* (Oxford dictionary 2015). We define an evanescent screen as a user interface that presents perceivable information for a few seconds.

In our view, the existing UI implementations have not fully utilized actual weather conditions. We therefore focus on weather and a mobile evanescent screen concept referred to as BreathScreen to address the possibilities of evanescent information presentation enabled by exhaling in Arctic weather conditions.

Artic weather conditions as an affordance for creating evanescent screens

With arctic weather conditions we refer to the typical winter season in northern Finland when the mean temperature remains below 0°C/32°F (Finnish Meteorological Institute 2015). Weather is an essential part of our everyday life. However, research on weather-based phenomena as an affordance in UI elements is lacking. According to Gibson’s (1977) theory of affordances, we not only perceive objects as forms and spatial entities, but also as possibilities for action in the environment. In this light, natural phenomena such as weather can be considered to be mostly unused potential for interaction and information presentation.

To stimulate this discussion, we propose the novel notion of a weather-based user interface (WUI). A weather-based user interface is defined here as a UI building on weather phenomena that are used as an essential part of interaction or information presentation. For example, when we exhale in cold weather, our breath mixes with cold air and condenses into visible vapor. Hence, we can momentarily see a fog cloud. We call this phenomenon a cold breath and consider it as a mobile evanescent screen that affords the presentation of personal information.

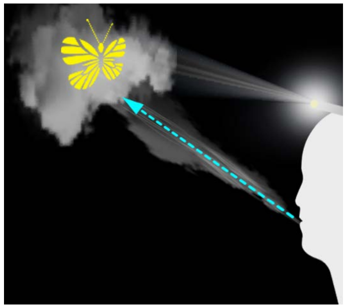

Figure 1: The first experiment

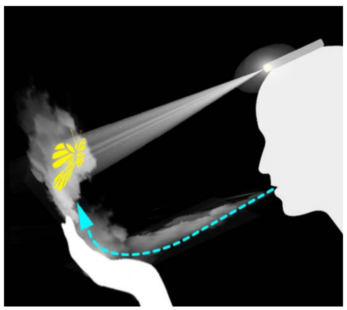

Figure 2: The second experiment

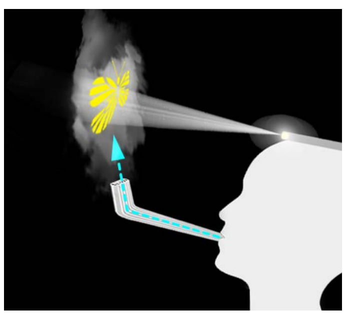

Figure 3: The third experiment

BreathScreen

Our objective regarding the BreathScreen concept was to create a human-driven, mobile, and evanescent screen that affords personal information presentation. The concept was formed using the combination of arctic weather conditions, cold breaths, and a mobile projector. We projected images in mid-air on cold breaths, making several experiments outdoors in the dark with varying wind speeds and in temperatures ranging from -4 to -12 degrees Celsius. We also made experiments indoors in a dark laboratory environment, where an arctic climate could be created artificially. The temperature in the lab varied between -8 and -20 degrees Celsius and the wind speed between extremely strong and no wind at all. We experimented on various images ranging from simple, single-coloured symbols such as arrows to more detailed pictures such as butterflies.

The first experiment (Figure 1) revealed that BreathScreen requires dark surroundings to generate a visible image. The projection has to be made approximately at the height of the user's eyes to achieve a clear and understandable image. We also observed that a projection on a cold breath near the user's face results in a splintery image. If a projection was made with a one-second delay, the cold breath had moved further away allowing the formation of a more coherent image. Although it was possible to create a perceivable image, the experiment revealed that the receding cloud was extremely vulnerable to wind. This made image formation difficult and unstable. Whenever an image formed, it was also visible to other viewers nearby, reducing the level of privacy.

Based on the first experiment we decided to work on the vulnerability of the image formation and bring the content near the user's face. In the second experiment setting, the exhalation flow was directed to the palm with uplifted fingers at an angle of 90 degrees (fig. 2). The resulting fog screen produced a perceivable image, but it was challenging to find the right blowing angle to generate a steady screen. When the image was formed near user's face, the bystanders only saw a fragmented, unrecognizable image.

In the third experiment we created a flat and wider screen that is easier to form. We made a wide blowing array comprising eight straws side by side with the end part pointing up at an angle of 90 degrees (fig. 3). The array produced a vertical fog screen 20 centimetres away from the viewer's face. The projected image was clear, and the screen was also wider and easier to form than one made with the palm. Also, in this experiment setting the content could not be viewed by the bystanders.

Figure 4: The third experiment with a blowing tube

In the last two experiments we managed to generate a clearly perceivable image that stayed in the air for less than five seconds. It produced an illusion of the image hovering above the palm or in mid-air near the face (fig. 4). The experiments show that the distance as well as the projection angle with respect to the user and the cold breath are critical. The projection has to be made from the user's viewing angle, and the ideal BreathScreen angle is 90 degrees with respect to the user. The screen should be formed near user's face in order to maximize the privacy of the projected content. However, the greatest challenge to privacy is that the projected image may remain visible if there are surfaces beyond the fog screen.

The screen in the third experiment was more stable and easier to produce than a fog screen made with the palm. The optimal environmental conditions consist of a dark space, low wind, and a temperature of minus degrees Celsius. The experiments showed that simple, high contrast, and especially yellow or white pictures projected against a completely dark background are easiest to perceive.

Conclusion

This paper contributes to the emerging discussion on ephemeral user interfaces by introducing two supplementary concepts – the evanescent screen and weather-based user interfaces (WUIs). In addition, we have demonstrated the potential of WUIs by presenting the evanescent BreathScreen, involving the momentary cloud of a cold breath produced in arctic weather conditions.

The main idea of BreathScreen is that a cloud of fog is created in front of the viewer's face by exhaling in cold weather. The fog is then directed to flow vertically as an evanescent screen for projections. Our screen solution is easy to implement because the vertical air flow can be created with the palm or with some other simple and inexpensive construct. Evanescent screens enabled by cold breath present a new opportunity to implement human-driven solutions for presenting ephemeral information. The transient characteristics of a cold breath concretely manifest evanescent information and provide a novel metaphor for interaction design. This analogue can be seen as an advantage in the context of ephemeral UIs and nature – potentially in other contexts as well.

However, there are some pragmatic challenges to the wider utilization of BreathScreen, for example limiting the projection on the fog, the complexity of weather phenomena, and the requirement of arctic weather conditions. Hence, in the future we aim to systematically explore the physics of the weather conditions enabling BreathScreen. Also, we will examine the solutions to limit a projection on the fog and the possibilities to create an artificial cold breath.

References

1. Peter C. Barnum, Srinivasa G. Narasimhan, Takeo Kanade. 2010. A multi-layered display with water drops. *ACM Trans. Graph. 29*, 4, Article 76 (July 2010), 7 pages. http://doi.acm.org/10.1145/1778765.1778813
2. Alan M. Dun, Michael Z. Lee, Suman Jana, Sangman Kim, Mark Silberstein, Yuanzhong Xu, Vitaly Shmatikov and Emmett Witche. 2012. Eternal sunshine of the spotless machine: protecting privacy with ephemeral channels. In *Proceedings of the 10th USENIX conference on*

Operating Systems Design and Implementation (OSDI'12), 61-75.

3. Tanja Döring, Axel Sylvester, and Albrecht Schmidt. 2013. A design space for ephemeral user interfaces. In *Proceedings of the 7th International Conference on Tangible, Embedded and Embodied Interaction* (TEI '13). ACM, New York, NY, USA, 75-82. http://doi.acm.org/10.1145/2460625.2460637
4. Finnish Meteorological Institute. 2015. Retrieved December 12, 2015 from http://en.ilmatieteenlaitos.fi/seasons-in-finland
5. Gibson, J.J. 2013. *The Ecological Approach to Visual Perception.* Psychology Press, East Sussex, GB.
6. Hyosun Kwon, Shashank Jaiswal, Steve Benford, Sue Ann Seah, Peter Bennet, Boriana Koleva, Holger Schnädelbach. 2015. FugaciousFilm: Exploring Attentive Interaction with Ephemeral Material. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (CHI '15), 1285-1294.
7. Oxford dictionary. 2015. Evanscent. Retrieved Dwcember 10, 2015 from http://www.oxforddictionaries.com/definition/english/evanescent
8. Diego M. Plasencia, Edward Joyce, Sriram Subramanian. 2014. MisTable: reach-through personal screens for tabletops. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '14), 3493-3502.
9. Ismo K. Rakkolainen, Artur K. Lugmayr. 2007. Immaterial display for interactive advertisements. In *Proceeding of the international conference on Advances in computer entertainment technology* (ACE '07), 95-98.
10. Sue A. Seah, Diego M. Plasencia, Peter Bennett, Abhijit Karnik, Vlad Otrocol, Jarrod Knibbe, Andy Cockburn and Sriram Subramanian. 2014. SensaBubble: A Chrono-Sensory Mid-Air Display of Sight and Smell. In *Proceeding of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '14), 2863-2872.
11. Softonic.com. 2015. How to send disappearing messages in iOS 8. Retrieved December 10, 2015 from http://features.en.softonic.com/how-to-send-disappearing-messages-in-ios-8
12. Xinglin Sun. 2015. Gone and Back: Physical Interaction on a Condensation- based Ephemeral Interface In *Proceedings of the 2015 British HCI Conference* (British HCI 2015), 301-302. http://dx.doi.org/10.1145/2783446.2783621
13. Wired.co.uk 2015. Facebook launches Snapchat-style 'disappearing messages'. Retrieved December 11, 2015 from http://www.wired.co.uk/news/archive/2015-11/13/facebook-self-destruct-snapchat
14. Asuka Yagi, Masataka Imura, Yoshihiro Kuroda, and Osamu Oshiro. 2011. 360-degree fog projection interactive display. In *SIGGRAPH Asia 2011 Emerging Technologies* (SA '11). ACM, New York, NY, USA, Article 19 , 1 pages. doi>10.1145/2073370.2073388