

Exploring the notion of information push and pull with respect to the user intention and disruption

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1. Introduction

With increased sales of wirelessly connected devices (e.g. WAP phones) and the capability to track and record user context, especially that of location (e.g. through the network service provider), there is growing concern regarding the ways in which information will be ‘pushed’ to the user. The classic example used to fuel such concerns being the electronic discount vouchers that are ‘pushed’ to a pedestrian’s mobile phone as they walk past a high street store. The implication is that in the future consumers will be bombarded with information that they have not requested nor desire to receive. However, such a scenario places the consumer as very much the victim but this need not be the case.

The central theme in this paper is that of information dissemination. We argue that information dissemination flow can be classified as either “PUSH” or “PULL”. We define these terms:

- PULL: Information flow that is expected by the user;
- PUSH: Information flow that is not expected by the user. (NB. not the same as the term used by the network community e.g. WAP v1.2)

For example, we classify spam (or junk) e-mails as being PUSHED onto the user and an e-mail confirmation from an online booking agency as being PULLED.

Reasoning about data dissemination in this way gives us some interesting results and an initial framework onto which the design of emerging applications may refer to improve data target accuracy and reduced information noise. We also introduce the notion of media specific interactions – as an audio broadcast within a large store will attract more people’s attention than a small projected display. We also analyze a range of scenarios and highlight important design aspects (and potential future uses) when a system aims at presenting any form of information to the user.

1.1 Illustrative scenarios

This section introduces four core scenarios, which we refer to throughout the paper to illustrate the key features of our approach.

1.1.1 Scenario A - Location-based voucher dissemination

A high street music store is transmitting discount vouchers for the latest chart topping CD to people as they walk nearby the store. I find receiving this voucher slightly annoying because the incoming message disrupted me by grabbing my attention (and I already own the CD on offer). However, I know that John was considering purchasing this CD and so inform him of the offer enabling him to travel to the store and so collect the voucher.

1.1.2 Scenario B - Department store ‘Tannoy’ announcement

I have lost my child in a large department store and have informed security. I am greatly relieved when a ‘Tannoy’ announcement is made stating that ‘the child of Mrs Brown has been found and is currently waiting collection at security’.

1.1.3 Scenario C – Museum

I visit a Museum containing a range of visual exhibits. I wander through the museum and focus on a subset of exhibits that I am particularly interested in.

1.1.4 Scenario D – Filling in a questionnaire

I've completed a consumer questionnaire about my favourite soft drink in return for the promise of a free pack of microwaveable popcorn. However, in addition to the popcorn I also receive a range of promotional material for other beverages.

2. Background

2.1 Information dissemination

In this section we consider a simple design space (see figure 1) for comparing some common information dissemination techniques with regard to the intended target of the information (private to public) and the actual recipients of the information (private to public). For example, the electronic voucher mentioned earlier is directed to people in a particular locale and is received privately. Similarly, a 'Tannoy' announcement might be delivered to a public space but directed to a private individual.

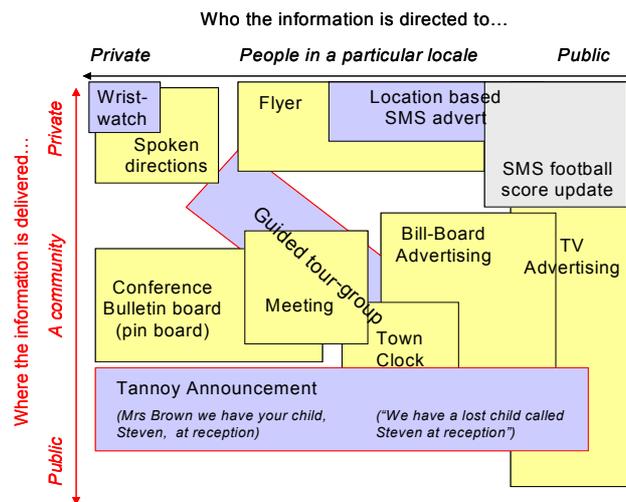


Figure 1. A simple design space depicting some common information dissemination techniques with regard to the information's target and actual delivery audience.

This design space assists us in determining the dissemination properties of particular devices and therefore the most suitable device to use in a given scenario in which we wish to deliver information with minimal disruption.

2.1 The spatial nature of information dissemination

In order to reason about the dissemination of information with regard to both public and private spaces it is useful to consider a mechanism for analyzing their spatial aspects. A useful technique used in the Collaborative Virtual Environment (CVE) domain is termed the "Spatial Model of Interaction" [1]. CVEs are 3D virtual environments presented to users through 3D computer graphics techniques. The spatial model of interaction is used to manage the interactions among a number of users and artifacts within the world [2].

In this paper we are investigating the extent to which the spatial mode of interaction can be exploited in order to support reasoning about PUSH and PULL information flows. To this end we employ a simplified version of the spatial model, see figure 2.

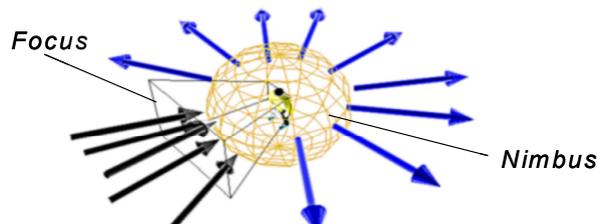


Figure 2. The simplified Spatial Model of Interaction, depicting the user (or artefact) and their focus and nimbus, and the direction of their respective information flows.

The essence of this model is based around two spatial components: the Focus and the Nimbus. The focus is the space in the environment with which the user is aware, and the nimbus depicts the area that information dissemination affects. Note that there is generally a nimbus and focus for each sense (visual, audio, etc.) or technology medium (large display or loudspeaker) and the shape of these spaces (we use a sphere and a canonical volume) can vary to suit the dissemination characteristics required.

3. Our Approach

Our approach is to consider user intention as a key to distinguish between the notions of information PUSH and information PULL. Reasoning about data dissemination in this way raises some interesting issues and implications. By considering the notions of PUSH and PULL (section 3.1) and the notion of impact on the user (section 3.3) we can explore the design space onto which emerging applications may refer in order to improve data target accuracy and reduced information noise.

3.1 Arriving at a definition for PUSH and PULL

It is problematic to arrive at a succinct definition of ‘push’ and ‘pull’ that enables clear categorization. However, in this paper we have argued for the following definitions:

Information PULL: *Any information flow that occurs as a result of a conscious initiation (of any type, e.g. questionnaire, requested track in CD store) by the user.*

Information PUSH: *Any information flow that occurs which is unexpected by the user (e.g. walking down the street and a flyer is pushed into your hand).*

(Note that our definition of Push and pull information flows are irrespective of the accuracy of any user model). Based on the above definitions we can identify the following information flows within the scenarios described in section 1.1:

- In scenario A although the information is PUSHED to me, John deliberately travels to receive the voucher, thus the information is effectively translated into a PULL.
- In scenario B although the information is PUSHED to most people in the store, to Mrs Brown the information is PULLED because she initiated the dialogue.
- In scenario C while all exhibits PUSH information into the museum space the exhibit to which the user is interested in and decides to engage with is transformed into to information PULL.
- In scenario D although both the popcorn and the additional promotional material were both sent to me as a result of my original questionnaire, the arrival of the popcorn was expected (information PULL) whereas the additional material was not (information PUSH).

3.2 Representing PUSH and PULL in the Spatial Model

The diagrams below show how scenarios A,B,C and D (described in section 1.1) can be illustrated using the spatial model.

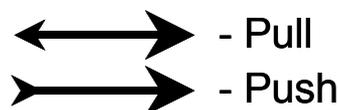


Figure 3: depicts the key we use to show Push and Pull data stream, both information flows here are from left to right.

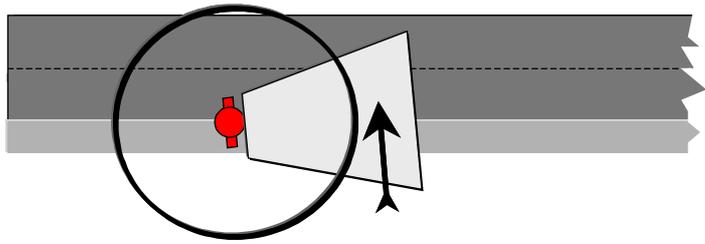


Figure 4: Using the spatial model to describe scenario A.

Figure 4 illustrates how the information directed from the music store is PUSHED into the focus of a passer by.

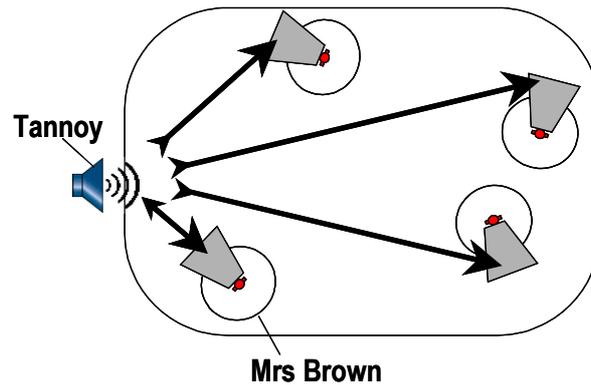


Figure 5: Using the spatial model to describe scenario B.

Figure 5 illustrates how to the others in the department store the information is PUSHED into their focus whereas for Mrs Brown the information is PULLED.

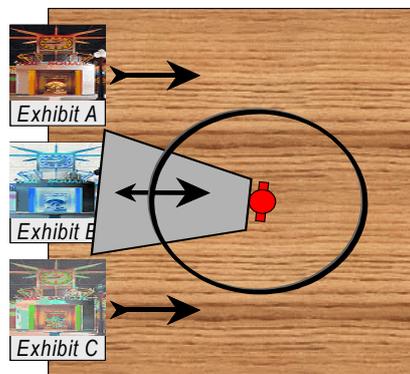


Figure 6: Using the spatial model to describe scenario C.

Figure 6 illustrates how an exhibit, from a range of exhibits PUSHING information, is translated into a PULL situation because the user has intentionally engaged with it.

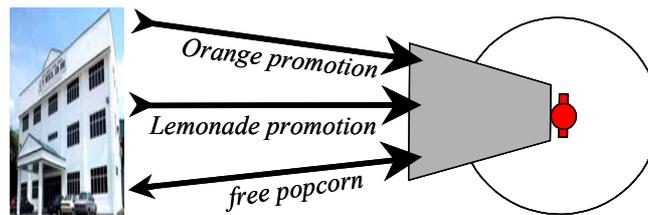


Figure 7: Using the spatial model to describe scenario D.

Figure 7 illustrates how, despite expecting a particular piece of information (PULL), we in fact received additional and unexpected (PUSHED) information.

3.3 The Notion of Impact leading to Task Interruption

Clearly, two different information presentations may have the same nimbus but very different levels of impact on the user's focus. For example a short beep versus a long shrill alert (at the same level of volume) might have the same nimbus but the character of the information dissemination is clearly different. More specifically, the latter sound is far more likely to interrupt the user's attention. The key implication of this is that the greater the impact on the user's focus, the greater the likelihood of user annoyance arising from the interruption to his or her current task [3].

4. Future directions

One of the most intriguing possibilities for this spatial analysis of information dissemination concerns the description (and subsequent run-time discovery) of information presentation devices. So for example, a presentation device can be described based on the magnitude of its nimbus and its impact on the users' foci. For example, a 'Tannoy' playing loud music versus a traditional poster display has: (1) a larger nimbus and (2) a greater impact on the users' foci.

To illustrate how such descriptions could be used, consider, for example, the configuration of presentation devices in a museum for supporting group tours. Such a configuration might be different depending upon whether or not other groups were located in the museum. More specifically, if other groups were present then the use of audio presentation might be less appropriate. Although this is clearly common sense, a description of the audio and visual devices within the museum would enable the configuration to be automatically reconfigured based on the number of coexisting tour groups. Moreover, using the notion of impact (described in section 3.3) the configuration could be further fine-tuned to meet the desired effect.

5. Conclusions

In this paper, we have considered the notions of information PUSH and information PULL. We have also considered the benefits of using a spatial model to represent such information flows and the potential for task interruption and annoyance to the user based on the impact of the information flow on the user's focus.

From our analysis we draw the following conclusions:

- It is useful to consider a design space that maps out, for a given presentation device, to whom the information is directed (public vs. private) and who the information reaches (public vs. private).
- It is possible to usefully exploit existing spatial model theory in order to define areas of influence for 'presentation' devices.
- When the user intentionally engages with a PUSH based information source the information flow transforms into information PULL. Hence PUSH data that becomes PULL data is generally acceptable, whereas PUSH data that does not become PULL data will tend to promote annoyance (in the form of undesirable noise).
- Furthermore, there is a need to identify situations where PUSH/PULL transformations occur, this may be direct (scenario C) or indirect (scenario A).
- There is significant potential for using this approach to support the ad-hoc creation and configuration of distributed messaging/presentation systems.

6. References

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3. Stringer M, Eldridge M and Lamming M. "Towards a deeper understanding of task interruption". p,26-27, Proc. Situated Interaction in Ubiquitous Computing (ed) Albrecht Schmidt, CHI 2000 (2000)