

A conceptual framework for understanding and improving adolescents' exposure to Internet-delivered interventions

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SUMMARY

Although exposure is crucial to improve the public health impact of Internet-delivered interventions, it appears that in practice exposure to such interventions is low. Therefore, a conceptual framework, which incorporates elements of user experience of websites, is applied to Internet-delivered health behaviour change interventions aimed at adolescents

and results from previous explorative research are incorporated. This framework, described from the point of view of an intervention's development team, can be used in practice to optimize user experience and therewith improving exposure rates to Internet-delivered interventions and increasing the number of revisiting users.

Key words: Internet-delivered interventions; exposure; user experience; health promotion

INTRODUCTION

The huge increase in access to the Internet has initiated an expansion of Internet-delivered health behaviour change interventions, for example aiming to promote consumption of fruits and vegetables, smoking cessation and restrictive alcohol consumption (Bernhardt and Hubley, 2001). Evidence from efficacy trials indicates that exposure rates to such interventions are quite low (De Nooijer *et al.*, 2005) and in real life exposure rates may be even lower (Evers *et al.*, 2005). A conceptual framework for understanding and improving adolescents' exposure to Internet-delivered interventions will be introduced.

Exposure, or paying attention to the intervention content as well as active use and

elaboration of the intervention components, is necessary because attention is a prerequisite to establish desired behaviour change (McGuire, 1985). In terms of Internet-delivered interventions, three different aspects of exposure can be distinguished: (i) accessing the intervention website, i.e. a first visit, (ii) staying on the intervention website long enough to use and process the information and (iii) revisiting the intervention website. The latter only applies to interventions which are developed to be visited multiple times since there is a possible dose-response relationship between the number of visits and behaviour change outcomes of these interventions (Verheijden *et al.*, 2007). With regard to staying *long enough*, it is hard to indicate a desirable length of time, since this differs per intervention. Furthermore, there may also be a

difference in the time needed between individuals, depending on their capability to process information. Therefore, staying long enough is defined as the time which an individual needs to process the information provided at a specific intervention website.

We focus on interventions aimed at adolescents because many health-risk behaviours are acquired during adolescence and track into adulthood, thereby affecting not only current health but also health in later life (Kelder *et al.*, 1994). In contrast to patients looking for treatment or medical information, adolescents without any chronic disease are not likely to be internally motivated to search for behaviour change interventions in the domain of health promotion (De Nooijer *et al.*, 2005). Furthermore, the current generation of adolescents grew up with the Internet and is more open towards new possibilities offered by this medium (Leung, 2003). They use the Internet differently compared to adults (Fox, 2006). Their main online activities are instant messaging, gaming, downloading and visiting social-networking websites (Gross, 2004), whereas adults use the Internet mainly for e-mail and information seeking (Jackson *et al.*, 2005). Therefore, factors associated with exposure probably differ between adolescents and adults. This distinction between adolescents and adults appeared to be valid, since results from previous explorative research regarding exposure differed for both age groups (Crutzen *et al.*, 2008a).

Aim

The aim of this article was to propose a useful tool, for the development process of Internet-delivered interventions, which aims to improve exposure rates and increase the number of revisiting users. A conceptual framework related to website design in general, as described by Garrett (Garrett, 2002a), is applied to Internet-delivered health behaviour change interventions aimed at adolescents and previously explored factors will be contextualized (Crutzen *et al.*, 2008a, 2008b). A closer look at these factors reveals that they can all be related to the concept of user experience. According to our definition, user experience includes the total time span of a visit to an Internet-delivered intervention and refers to how a person acts and what a person thinks and feels during and after a visit. User experience

relates to all three aspects of exposure since a positive user experience during and after the first visit is a prerequisite to revisit an Internet-delivered intervention and for staying long enough to complete the intervention.

Garrett's concept of user experience

Garrett (Garrett, 2002a) distinguishes five planes [surface, skeleton, structure, scope and strategy (Figure 1)] to conceptualize user experience. On the *surface*, the user perceives the visual design which relates to the visual presentation of interface elements (e.g. typeface, images and navigational components). This does not only relate to what is perceived as aesthetically pleasing, but also how effective the design supports decisions made at the other planes. The *skeleton* primarily concerns the arrangement of interface elements (e.g. placing important elements, such as navigation menu and search bar, consistently) and is a concrete expression of the more abstract *structure* of a website which defines how the intervention will function (e.g. options involved in performing and completing tasks). In other words, structure defines how various features and functions of the intervention fit together (e.g. visual materials and interactive features). The structure gives a shape to the *scope* which covers what these features and functions are. The scope is fundamentally determined by the *strategy* of a website and incorporates not only what the intervention wants to establish (e.g. behaviour change), but also what the user needs are.

The issues one has to deal with during intervention development are positioned on a continuum varying from very concrete (surface, top) to very abstract (strategy, bottom). The user is first confronted with the surface of an Internet-delivered intervention. However, from the point of view of intervention development, the starting point is the lowest, more abstract, plane. Plane by plane, from the bottom to the top, the decisions of an intervention development team become more concrete. Decisions on a lower plane have an influence on the choices available on higher planes. Dependencies run in both directions, however, with decisions made on higher planes sometimes forcing a re-evaluation of decisions on lower planes. Therefore, during intervention development, work on a higher plane can start, but never finish, before work on a lower plane has finished

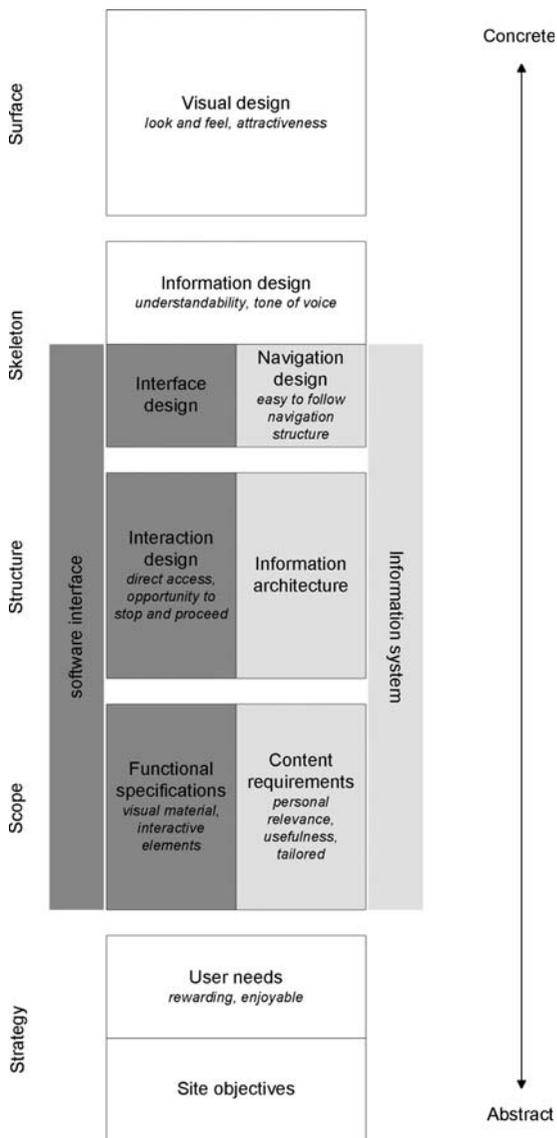


Fig. 1: The elements of user experience (Garrett, 2002a) and their related factors (in italics) that resulted from previous explorative research (Crutzen *et al.*, 2008a; 2008b).

(Garrett, 2002a). All planes should be addressed to optimize user experience and therewith improving exposure to Internet-delivered interventions.

Elements of user experience

Each plane consists of elements which Garrett (Garrett, 2002a) denominates as the elements

of user experience (Figure 1). Some of these elements are related to an Internet-delivered intervention as an information system (Figure 1; light grey). This does not only concern gathering information, but also the ability to interact with an information system. This ability to interact with an information system is an important reason why Internet-delivered interventions are attractive to deliver tailored information (De Vries and Brug, 1999). On the other hand, interaction with an information system also requires a software interface which enables this interaction. Therefore, other elements are related to the development of an Internet-delivered intervention's software interface (Figure 1; dark grey).

Our point of view is that of an intervention's development team and, therefore, the starting point will be the lowest plane.

Strategy

Site objectives

Since the focus is on Internet-delivered behaviour change interventions, 'behaviour change' seems to be the easy answer when asked to explicate the site objective. However, a good objective should be formulated 'SMART' (Specific, Measurable, Attainable, Realistic and Timely) and thus include statements on what will change specifically in a specified population, how much it will change and by what period of time. This could be specified in terms of behaviour or its determinants (Bartholomew *et al.*, 2006); for example, a 20% increase of adolescents' (12–17 years) knowledge about healthy alternatives for unhealthy food within 3 months after release of the website. Knowledge is used here as an example, but the Internet can also be used to teach behavioural skills or to increase motivation. The time frame and amount of expected change, regarding behaviour or its determinants, must be empirically justifiable (Bartholomew *et al.*, 2006). Furthermore, it is important to keep the feasibility of the site objective in mind. In our example, the Internet is used as a suitable delivery mode for an objective which is related to increasing knowledge regarding nutrition behaviour. However, nutrition behaviour, for example, is influenced by intrapersonal (i.e. food preferences), social (i.e. family eating habits) and cultural factors (i.e. culture is often

expressed through food), as well as factors in the physical environment (i.e. availability of healthy food) (Reinaerts *et al.*, 2008).

User needs

User needs at the strategy plane do not refer to needs with regard to health or health behaviours, but with regard to experiencing the use of an Internet-delivered intervention. Two needs which resulted from previous explorative research are experiencing the use as (i) rewarding and (ii) enjoyable (Crutzen *et al.*, 2008a; 2008b). Those needs should be related to the site objectives which will be illustrated when we apply the framework later on.

Scope

What exactly will be developed has to be defined on the scope plane. An intervention's functionality relates to its software interface, while its content relates to an intervention as an information system. However, in gathering requirements for both an intervention's functionality as well as its content, user involvement is highly important (Garrett, 2002a).

Functional specifications

If you ask users what they require, they mention all kind of features which can possibly be provided on an Internet-delivered intervention (Crutzen *et al.*, 2008b); both visual materials (e.g. graphs, videos and pictures) as well as interactive features (e.g. tests, forums, games, etc.). However, during development, the format of a piece of content should be in line with its purpose (Garrett, 2002a) and the intervention itself should not be a conglomeration of all possible features. A feature should be proven effective and not be available at an intervention for the sake of being available.

Content requirements

Although the purpose of an Internet-delivered intervention's content should be in line with its objectives (as defined on the strategy plane), it also needs to be personally relevant, useful and tailored (Crutzen *et al.*, 2008a; 2008b). For example, previous research indicated that the content should be tailored to a user's intention to change behaviour, to improve exposure to an Internet-delivered intervention (Crutzen *et al.*, 2008c). Furthermore, theoretical methods that

can influence change in determinants should be identified as well as conditions under which a given method is most likely to be effective (Bartholomew *et al.*, 2006).

When gathering requirements for an intervention's functionality and content, these requirements should be in line with the strategy defined on the lower plane. Sometimes it is necessary to revise your strategy if your requirements fall outside the scope. If that is the case, however, it probably indicates that the development team jumped into gathering requirements too soon (Garrett, 2002a).

Structure

Interaction design

Interaction design concerns the options involved in performing and completing tasks (Garrett, 2002a). Although this is a very broad research field (Rimmer, 2004), two factors with regard to interaction design resulted from previous explorative research: the user needs to have (i) direct access to the intervention and (ii) the opportunity to stop at any moment and to proceed at a later time without information from earlier steps being lost. In practice, however, it is not always possible to realize this, since some interventions require visitors to log on or to finish a module before it is possible to stop. Furthermore, it should somehow be registered at which point in the intervention the user has stopped. If there is no log on procedure, this must be done through the use of IP addresses (The numeric address of a computer connected to the Internet.) or cookies (Cookies provide a means for a web server to induce a client to store information about itself which can subsequently be called up by the web server when required.). Since a personal computer (PC) can have a dynamic IP address and the same IP address can be linked to several computers, this method is not recommended. Cookies, on the other hand, are stored on a user's computer, but the use of them can be switched off and a revisiting user will not be recognized when using another computer. Furthermore, both methods are only able to trace computers which can be used by multiple users.

Information architecture

Information architecture deals with the options involved in conveying information to a user. It

is concerned with creating schemes that allow users to move through intervention content efficiently and effectively. Although this also holds for more static media with a linear structure, e.g. print (Kools *et al.*, 2007), it is even more important for an interactive medium with a non-linear structure (e.g. the Internet), since there are more possibilities to move through content delivered through such a medium. The information architecture should not be precisely tuned and fitted to the existing content of an intervention, but needs to be flexible enough to accommodate changes or additions (Garrett, 2002a). The most effective way to represent the structure is through the use of an architecture diagram in which conceptual relationships are documented. More information about how to create such a diagram—called visual vocabulary—can be found elsewhere, but in general it should be small and self-contained (Garrett, 2002b).

Skeleton

The skeleton plane consists of three elements which are closely bound together.

Interface design

If it involves providing users with the ability to *do things*, it is interface design. Interface design is all about the arrangement of interface elements to enable visitors to interact with the intervention (Garrett, 2002a). Notably, no factors with regard to the interface design resulted from previous explorative research, despite the ongoing debate in the literature about its paradigms, principles and methods (Lin *et al.*, 2006). However, some basic guidelines need to be kept in mind [e.g. placing important elements, such as a menu, consistently (Koyani *et al.*, 2006)].

Navigation design

If it involves providing users with the ability to *go places*, it is navigation design. The navigation design of any website must accomplish three simultaneous goals. It should (i) provide users with a means for getting from one point to another on the website, and communicate the relationship between (ii) the elements it contains and (iii) its content and the page the user is currently viewing (Garrett, 2002a). Attempts might be made to have an easy to follow

navigation structure (Crutzen *et al.*, 2008a), which implies that it is supposed to be part of usability testing during development of an intervention (Stoddard *et al.*, 2006).

Information design

If it involves *communicating ideas* to the user, it is information design. Neither interface design nor navigation design can be fully successful without good information design to support them (Garrett, 2002a). Two main criteria, resulting from previous explorative research, are that information is (i) understandable and its (ii) tone of voice appropriate for adolescents (Crutzen *et al.*, 2008a; 2008b).

Surface

On the surface plane you have to determine how the arrangement of the skeleton plane should be presented visually (Garrett, 2002a). Previous research has shown that people are very quick (50 ms) in forming an opinion about webpage visual appeal (Lindgaard *et al.*, 2006). Eye-tracking can be a useful method to decide which elements of an intervention attract attention (Pan *et al.*, 2004). According to Garrett (Garrett, 2002a), however, such sophisticated methods are not always necessary. Simply asking users which elements attract attention will maybe never capture all the nuances that eye-tracking equipment can provide, but it is perfectly suitable to get a first impression about which elements do attract attention.

Applying the framework within the field of health promotion

Several tasks are involved in the development process and all planes should be addressed to optimize user experience. Conform Bartholomew *et al.* (Bartholomew *et al.*, 2006), we make a distinction between theory-based methods and practical strategies *and* the intervention itself.

Strategy

On the strategy plane, the development team of the Internet-delivered intervention needs to define site objectives and identify user needs. Research tools like surveys, interviews or focus groups are most suitable for gathering user

needs (Garrett, 2002a). We use the site objective 'a twenty percent increase of adolescents' (12–17 years) knowledge about healthy alternatives for unhealthy food within 3 months after the release of the website as an example on the individual level to illustrate the use of the conceptual framework during the development process.

Scope and structure: theory-based methods and practical strategies

First, functional specifications and content requirements need to be specified, for example through focus group interviews (Dijk *et al.*, 2007). Together with user needs, they might be linked to each other *and* to the site objectives. In our example, the intervention's objective is to increase knowledge. If users want to increase knowledge in an enjoyable way, the development team needs to focus on the entertainment aspect. However, if users want to find information as quickly as possible, this should be the main focus of the development team. These needs should be translated into functional specifications (including appropriate methods). If users want to increase knowledge in an enjoyable way, a game (using active learning) could be an appropriate tool. However, if users want to find information as quickly as possible, a FAQ (Frequently Asked Questions) seems more appropriate. Content requirements are even more directly linked to site objectives. In our example, the focus is on increasing knowledge. Although this may seem evident, the intervention content should then also focus on knowledge and not on other determinants which are not defined in the site objectives. The second task is to define the structure of the intervention, resulting in a visual vocabulary. Extended information about constructing such a visual vocabulary can be found elsewhere (Garrett, 2002b).

Skeleton and surface: intervention

The first task is to design and test the information. An important aspect to keep in mind while designing the information is the literacy level of the intervention's target group. Since many people with limited reading skills do not seek help with reading tasks (Bartholomew *et al.*, 2006), information should be adapted to the target group. Useful instruments are available to

determine the target group's literacy level with regard to skills (Baker *et al.*, 1999) or ability to interpret information (Smerecnik and Mesters, 2007). The second task is probably the moment where health promoters should hand over their activities to people who are more competent in interface and navigation design and have more technical and design experience. We recommend involving the technical and design staff in the intervention's development team right from the start to facilitate cooperation with health promoters. The technical and design staff create a prototype which, conversely, should still be compared with the original health promotion goals. This prototype lays the foundation of the last task: fine-tuning the intervention. Even if all the previous tasks are executed in an optimal way, this final task is still important to lift the intervention to a higher level. On the surface plane, it is all about detail: a slightly darker background, larger typeface, more narrow buttons and so on. Towards the end of the development process, the focus is more and more on the aesthetic sense of user experience.

DISCUSSION

The conceptual framework described above is a useful tool during the development process to aim for a positive user experience during the first visit and therewith improving exposure rates and increasing the number of revisiting users. Although there are other sources available on how to develop a good website (Beaird, 2007; Quick, 2007), these are more practical step-by-step guides and are not based on a theoretical framework such as Garrett's.

The division into neat boxes and planes is a convenient way to think about user experience (Garrett, 2002a). However, those elements interact with each other, which indicates the complexity of user experience. To improve user experience, all these elements should be addressed and the focus should not be on merely a single element. Therefore, it is also hard to change one of these elements once the intervention is finished. This shows, once again, that one needs to think about user experience *before* and *during* the development process of an Internet-delivered intervention.

Garrett's work has been applied to Internet-delivered behaviour change interventions *aimed at adolescents* and related to factors that

resulted from previous explorative research and potentially determine exposure regarding this specific target group. Probably, other factors can be relevant for other target groups (e.g. children and adults). The conceptual framework in itself, however, is useful for all Internet-delivered interventions.

It is also worth noting that several subcultures exist within the target group of adolescents (e.g. nerds and skaters). Identification with these subcultures is associated with differences in health behaviours (Van der Rijt *et al.*, 2002; Verkooijen *et al.*, 2007) and the Internet can contribute to identity construction through affirmation, reflection, reinforcement and negotiation (Guzzetti, 2006). Subculture-related differences should be taken into account while identifying user needs (at the strategy plane) and could carry on to higher planes (e.g. functional requirements at the scope plane). It is imaginable, for example, that adolescents who identify themselves with a more expressive subculture might prefer a discussion board to share personal information, while those who are more reserved might prefer consuming instead of sharing information.

Future perspectives

Previous explorative research (Crutzen *et al.*, 2008a; 2008b) was an important first step to identify factors that might improve exposure to Internet-delivered interventions. Future research, however, could (i) test *if* and *how* these factors improve exposure and (ii) possibly identify even more factors. The conceptual framework presented in this article can therefore be extended. Furthermore, the framework must be seen as a tool during the development process of Internet-delivered interventions. Utilizing this framework could provide insight into its effectiveness in terms of increased exposure rates, since these are crucial to improve the public health impact of Internet-delivered interventions.

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