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Place Metaphor in Digital Television

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Studies of digital television for distance learning —Interactions and expectations

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Abstract
We report findings from two usability studies of digital television (DTV). A preliminary study was undertaken with eight subjects. The final study had thirty subjects. It was found that content and interface elements should be evaluated in terms of *concrete* and *conceptual nearness* with respect to all parts of the DTV experience. Additionally, several features of the DTV application interface were salient in user evaluations: navigation and structure, choice of content, level of engagement, interface display and timing, responsiveness, and multimedia design.

Definitions
In this paper a Digital Television Package (DTP) is seen as consisting of three parts: the Digital Television Equipment (DTE) which includes a remote control and a set-top box, the Digital-TV show (DTV show), and the Digital-TV Application (DTA), e.g., an interactive service or a set of services for use with a DTV show. The DTA is in turn composed of content (DTA content) and a user interface (DTA interface) through which the content is accessed. The DTA is implemented by programmers using a DTA Software Development Kit (SDK). Lastly a DTP can be said to be in one of two states: TV mode or interface mode. On the one hand, if a subject is watching a TV show, then this person is using the DTP in TV mode. On the other hand, if the subject is interacting with the DTA interface then the subject is using the DTP in interface mode. These defined terms can also be found in the glossary at the end of this paper.

Introduction
DTV use remains scarce in Sweden despite governmental and commercial efforts to market the technology. There are many possible reasons for why the DTV-adoption rate is low. From the developers' perspective, the design constraints imposed by available DTA SDK:s and DTE:s severely limit the range of possible applications. DTV technology has simply not developed to a point of meeting neither the expectations of designers nor those of programmers. The situation is reminiscent of that which print-oriented design firms faced a few years ago when they were asked to design web sites. Art directors and web programmers became frustrated because many ideas could not be realized with suffient quality on the web. Now, DTV designers and programmers struggle with similarly difficult and limited technologies haunted by compatibility, flexibility and bandwidth issues (see the discussion section).

Moreover, developers lack a solid foundation of literature and guidelines pertaining to digital television interface design. DTA designers often turn to

design principles and metaphors from text-TV, the Internet (the web in particular) and multimedia at large for inspiration. Multimedia applications generally extend the basic desktop framework by providing refined methods of interaction, i.e., highlighting and sound cues (of course many recent desktop-interfaces are multimedia applications per se). At this point in the history of DTV it is still unclear, however, what interface styles works and under what circumstances. Other application areas of human-computer interaction are better researched with respect to interfaces. The world of personal computers, i.e., is dominated by direct manipulation [Schneiderman '82] desktop-style interfaces. Whether or not (depending on use conditions) the desktop-style interface is suited for DTA:s is a question open for debate. Many TV viewers have little or no experience with desktop-style interfaces (or PC:s for that matter).

The research presented here hopes to make a contribution, partly by taking the interface style as an issue open for debate. The two explorative studies reported from here were undertaken to guide UR, a government funded educational broadcasting institution, in designing interfaces and applications for distance-learning DTV. Project management at UR realized that it's experience with Swedish text-TV (similar to UK teletext) and analogue-TV programming was a good, but not optimal, base for constructing DTV interfaces and applications. In order to construct a better base for DTV-interface design, UR decided on conducting a series of usability studies.

Study Set-Up

Equipment

A Sagem™ development DTE (figures 1-4) was used for the studies. Such a DTE looks similar to an ordinary Sagem™ DTE, but has added functionality. It is used by UR OpenTV™ developers and can be programmed with a standard PC running an OpenTV™ development tool kit (OpenTV™ SDK). The development DTE and the development tool kit allows developers, not only to develop DTA:s, but also to test DTA:s in conjunction with simulated DTV shows. During such simulations, the DTA is downloaded from a PC to the DTE set-top box. The DTV show, however, is too large to fit in memory and must be streamed over a parallel cable to the DTE set-top box. So far DTE set-top boxes used in Sweden have very limited memory capacities, often less than a megabyte of RAM. The SAGEM box used by UR lacks a hard drive and has, effectively 200K of RAM available for content. This is to be compared with the standard memory configuration of todays PC:s which is 256 Mb of RAM and about 40 GB of disk space.

Specifications	UR DTE	Standard PC
RAM Memory	Total 800 K, 200 K available for content	128 MB
Hard disk	None	40 GB
Processor speed	Very low	High

Bandwith	56K	56K-100 Mbit
Screen resolution	720*576 pels total with safe usable area of 560*384 pels for moving images.	800*600 to 1600*1200 pels (most are capable of 1024*768 or higher resolutions)
Scanning method	Interlaced	Progressive scan
Pointing device	Four-directional-touch buttons	Free directional pointing devices
Web browser	HTML 3 compliant, no added features.	HTML 4 compatible. Added features: scripting, Java, Active X, Plugins, SSL, cookies

The DTA interface was an early attempt from UR to create an easy-to-use interface that would allow users to read texts and look at pictures. The DTA interface was displayed in full-screen mode, i.e., the size of it could not be modified and it covered the entire screen when showed. The interface had two components: a navigation frame on the left and a content frame on the right. This layout closely resembles that one most commonly used by web designers. The DTE remote control allowed users to: navigate the DTA interface, display DTA content, and switch between the DTV show and the DTA. The users were not aware that they were interacting with a simulation; they saw an ordinary television set with a set-top box. They were only told about the simulation after the study.

Subjects

A first pilot study was carried out in the spring of 2001 in order to rapidly evaluate the design developed using OpenTV™ at UR (figures 5-6). Eight subjects participated in the pilot study were they tried a DTV package. The subjects were assigned to four user trials with a pair of subjects in each pair. The pairs consisted of: males in their mid-twenties (2 pairs) middle-aged females (1 pair) middle-aged husband and wife (1 pair). The pairs were formed by subjects who knew each other (watching television together was natural).

Procedure

Each pair in a trial was presented with a written scenario. They were told to imagine themselves as being part of a study group on digital media. Furthermore, this imagined group met weekly to discuss different applications of digital media. Next week they were going to discuss the particular application presented to them. They were asked to explore the “digital-TV service” so that they could report on it at the meeting with the study group. The experimenters then left the room to allow the subjects to explore the simulated DTP on their own and disucss their experiences more freely. The trials were filmed and the subjects were asked to fill out a questionnaire after the trial was over. Lastly, the pairs were also interviewed.

After reviewing the results of the preliminary study with UR, the final study was also carried out with: 30 subjects, age range 20-50, and approximately 40% female. The first study was found to work well, and the setup of the second study was the same as in the first. The findings of the second study were in support of the first study. Throughout the two studies, four areas/dimensions of pressing issues emerged. These areas/dimensions were crudely put: interface display and timing (how should the DTA interface be used in conjunction with the DTV show?), multimedia readiness (can subjects use multimedia interfaces?), interface and content (can subjects distinguish between interface and content?), and the active-passive dimension (is the subject interactively disposed or crudely put a "couch potato"?). This last dimension is not meant to capture anything but the overt behaviour of the subjects, i.e., covertly they may be figuring out income taxes or conceiving ideas for novels, but this would not classify them as active according to our schema. Our dimension is meant to capture the degree to which they overtly manifest a disposition to interact with a DTP.

Results

DTA display and timing

The most apparent problem that the subjects in the studies faced was with the display and timing of the DTA. The DTA appeared on top of the DTV show and covered it completely. This was cognitively burdensome for the subjects who could not keep up with the DTV show while exploring the DTA. That they missed what happened in the DTV show while exploring the DTA was perceived as annoying and many thought this rendered the DTA useless. Some suggestions were given as to how it might be possible to display both the DTA and the DTV show at once. The most popular suggestion was the window-in-the-corner solution, e.g., that the DTV show could be put into a small window on top of the DTA. Some also suggested that the DTA could be made semi-transparent and put on top of the DTV show. Neither of these solutions was possible however. The OpenTV™ licence that UR had did not permit the window-in-the-corner solution. This particular solution required another, more expensive, software licence. The semi-transparent solution would not work well with images. It has been used for text-TV in Sweden and some of the subjects were familiar with viewing semi-transparent text sheets on top of moving images, but the situation is different with a multimedia interface on top of moving images. Apart from in exceptional cases, it would be too difficult to distinguish foreground from background.

DTA and the active-passive dimension

Some subjects were highly engaged with the DTA package and autonomously explored all the parts of the DTA interface. Others were much more passive. Those who were passive had difficulties in getting started with the DTA and spent most of the time watching the DTV show. These latter subjects would only after some time had passed raise concerns about the novelty of the DTP, e.g., what added value it brought. They were simply waiting to be entertained in a novel way and when this did not happen, they became puzzled.

Some subjects also had difficulty in distinguishing the DTA application from the DTV show, i.e., they did not see them as clearly distinct components. Moreover, since they failed to distinguish clearly between the DTA and the DTV show they were also unsure of when they could interact with the DTP.

DTA and multimedia readiness

Some subjects revealed surprising general difficulty with the DTA interface, i.e., difficulties that were not localized to specific functions or components of the DTA interface. Subjects were unable to quickly understand general design solutions of traditional multimedia, i.e., moving selection indicators (hi-lights), running a selection, and navigating in hypermedia. These subjects sometimes revealed considerable difficulty and mental strain in getting started using the DTA. Moreover, once they did get started, interaction with the DTA was tainted by cognitive strain and confusion.

DTA content

The content of the DTA had been chosen so as to provide more information than was available in the DTV show, e.g., it expanded on the presented subject matter. Most of the subjects were dissatisfied with the choice of content in the DTA. The subjects did not report that the content was of low quality per se, but that it was unfitting. Within the context of the DTP, the content did not work well although it was conceptually close. Many subjects also thought that there was too little content and desired a much richer information environment.

DTA Responsiveness

It has been found that users generally are disturbed when software applications do not respond quickly to the user input [Guynes '88]. Many subjects in the study confirmed this finding by complaining about the slow and jerky interaction experienced with the DTA. Koller et al have also found slow responsiveness to be disliked by DTV users [Koller et al '97].

Discussion

As has been pointed out [Ju et al '94] the conditions of use for digital television are different from that of the PC. Interacting with DTA:s, users may: be several meters away from the television set, lack an accessible working surface, be in a dark room, be in a noisy environment with food, kids and multiple users. Moreover traditional TV screens are of poor quality.

DTA Screen utilization

TV screens generally have a resolution of approx 720*576 pels (picture elements) or lower which is considerably less than most modern small computer monitors capable of 800*600 pels. Moreover, of the 720*576 pels on the TV screen, only 544*376 are safe to use for content [Quesenbery & Reichart '01, INT Media '01]. TV monitors are also viewed from a far greater distance than a computer monitor. Because of the above two factors (among others) TV screens are poorly suited for small text and small images. A DTA interface, however, is a potentially complex gateway to audio/video text and interactive services, i.e. messaging, polls etc. These factors make efficient utilization of screen space important when designing the DTA interface. The cognitive burden that a DTA imposes on viewers makes it empirical that the DTA interface is designed correctly. Thus poor design practices such as wasting screen space and not using sufficient contrast must be avoided. For example, in the UR DTA, almost half of the screen space was taken up by navigation controls. If some of that space had been used for content instead, then the users would have spent less time/energy navigating between content pages. It is difficult to present too much information on a single TV screen (using appropriate sized fonts, spacing between paragraphs, and non-scrolling pages) since the resolution is so low and the distance to the screen is relatively large.

Thus even if the navigational apparatus is minimal, the amount of information that can be made intelligible on a singe TV screen is small. Innitiatives regarding higher resolution television HDTV have been around for over a decade years now, and when HDTV arrives, the interface design rules will change [Sandbank '01]. For the next years, however, designers will have to live with standard TV resolutions that have not improved much since the late 1950:s.

DTA Multimedia

DTA:s surpass the limits of traditional Swedish text-TV based applications in that they resemble traditional multimedia applications. The resemblance is not perfect however, for DTA multimedia is generally of lesser quality than traditional PC-based multimedia. As mentioned erlier, the television screen is not ideally suited for complex interfaces and the hardware performance of DTV set-top boxes is drastically substandard to that of standard PC:s.

Also, multimedia interfaces do not necessarily make the software intuitive or easy to use. In many cases it is taken for granted that a sort of "multimedia readiness" is prevalent among people (examples are, apart from DTA:s, certain ticketing machines at train stations airports and many web sites). People who have little or no experience with traditional multimedia on standard PC:s are in a troublesome situation with DTA:s. Not only because of their lack of understanding of rudimentary multimedia interaction principles, but also because they find themselves interacting with second rate multimedia applications. Todays DTV applications are often characterized by jerky navigations and slow content update. These performance issues depend largely on the low bandwidth with which DTA:s send and receive data, and on the poor memory and processing capacities of DTV set top boxes. For those who have never used multimedia before, and come into contact with it through todays DTA:s, the experience may be like that of a first time music student who has to play a toy instrument that is badly tuned—not very inspiring.

The current state of the art of DTE:s put developers in a dilemma. While they might recognize the possible gain of designing new and novel interfaces for DTV, they also see the practical problems involved in such endeavors. On the one hand, if they develop simple interfaces modeled largely on traditional web sites (with e.g., navigation frame on left, content frame on right) they can be fairly confident that the design will at least work in practice. On the other hand, web-style interfaces may not be the best or even suitable for DTV.

DTA and the active-passive dimension

If users do not actively explore a DTA, then who is to blame? The designers, or the users? Against the background of having watched TV without interactive components (or very limited such components) for many years it may seem natural for many people to simply "wait for the entertainment". Of course, the designers (and producers) may claim that people simply need to learn about the possibilities of using DTV packages. Thus people need to educate themselves about DTV just as about any other major technological innovation such as the telefon, radio or non-interactive TV. Still, if people want to sit back and be passive, to simply assimilate whatever is "on the tube"", then "channel surfing" might be just about all the interactivity that they desire. It is also difficult to characterize the active-passive dimension correctly with regards to DTV. For what do we mean by people being passive in front of a television?

Overtly, they may seem passive, while being covertly active. This latter point may seem obvious, but it is worth stating since the expression "passive TV viewers" seem to have aquired a negative connotation. It is easy to forget that interactivity is not an end in itself and that it has both overt and covert dimensions. What is suggested here is that there is no easy solution to the question of designing for the active-passive dimension. TV history suggests, however, that it may be worthwhile to explore interfaces that makes it easy for users to interact if they wish to. Such interfaces may, for instance, prompt the user to interact using imagery and sound. More exploratively inclined users may be annoyed with such guiding features, especially if they cannot be turned off easily.

The challenge that todays DTV settings pose on the TV viewer is that the viewer aquire, at least to some degree, the skills of average PC user. The viewer must become more of user.

Characteristics	Viewers (TV)	Users (PC)
Active/Passive (overt)	Passive	Active
Multimedia readiness	Poor	Good

This movement from viewer to user means that the viewer must become more overtly active and aquire minimal multimedia readiness.

TV-show content and DTA

It was mentioned that some users had problems distinguishin the DTA from the TV-show content. On one interpreation, this is a problem for inexperienced users. On another interpretation, however, it is a problem for confused designers. If the users do not separate content from interface then perhaps designers could learn how to design interface and content so that there is no clear separation. For lack of better words, one might call this sort of design content enmeshed interface design. One study of DTA interfaces also supports enmeshing content and interfaces in concluding that interface metaphors for DTA:s should be semantically close to the DTV content [Koller et al 97]. Economically speaking it is better to use a single interface for many different TV-shows, but in a "gedanken expriment" we may postulate infinite resources and ask ourselves what interface would be best. Is it one that enmeshes and blends with the content or one that is clearly separate from it? This question cannot be answered without further research.

DTV and the Internet

As a public distance eduction institution, UR is interested in using a variety of means by which they reach their audience. Traditionally UR has been working mostly with radio and television. During the last few years, however, UR has turned also to the Internet as a means of extending their reach. Moreover, the Internet is not viewed by UR as an isolated channel for communication, but as one that could potentially be systematically integrated with DTV (and other communications channels). It was hoped that the study would provide information that could help answer strategic questions regarding the DTV-Internet integration process. UR hoped to discover if the subjects viewed DTV

and the Internet as natural to integrate or as best kept separate. Perhaps the subjects would give them new insights in how to think about DTV and the Internet as part of their communicative toolset. It was surprising to note that the subjects usually conversed extensively during the trials and the interviews they did not spontaneously bring up the subject of the Internet. When explicitly asked about the usefulness of the Internet in conjunction with DTV their answers were generally brief and without much enthusiasm. Should this hinder UR from pursuing the integration of DTV and their Internet presence? One could argue that an integration of DTV and the Internet has so many obvious benefits that the subjects in the study simply cannot grasp for one reason or another, i.e., that the subjects are confused and do not understand the possibilities involved with integrating DTV and the Internet. On such a view, UR should not only educate through content, but also through teaching their subjects effective means of learning, i.e., through novel use of DTV and the Internet. This might prove to be difficult, however, because of the overt passive nature of many DTV viewers. If it turns out that UR:s DTV viewers are (on average) more overtly passive than UR:s Internet users then the two information channels may not integrate well. To further clarify, if UR:s Internet and DTV users belong to two hitherto largely mutually exclusive groups then integration might fail because of the different mentalities of the two groups. One group likes to take in information in an overtly passive way, while the other likes to actively seek it out.

Conclusion

A DTV package is a complex system. It consists of many different parts that need to interoperate with eachother, i.e., DTS (remote and set-top box), DTA (interface, content), and DTV show. Not only is it complex to design, but it is also inherently complex for the user. The cognitive complexity involved in keeping track (at least peripherally) of a stream of moving images and sound while navigating an information space of texts and images made itself evident in the study. It is evident that better designs should be sought. It may not be a solution to present the DTV show in a small window on top of the TV show. This would still involve heavy cognitive load. Perhaps what is needed is not a solution with regards to the problem of presenting the DTA and the TV show in parallel. Perhaps what is needed is a dissolution. Is it necessary to present the DTA and the DTV show in parallel? Our suggestion is to explore sequential ways of presenting the DTA and the DTV show. Thus if the DTA was available some time before and after the DTV show, then users could access the DTA at their convenience. Another solution would be freeze the DTV show while the DTA is being displayed. Such solutions may not be possible today. However, if sequential ways are clearly superior to parelell ways, then perhaps further research can show this and help steer the development of technology in the right direction.

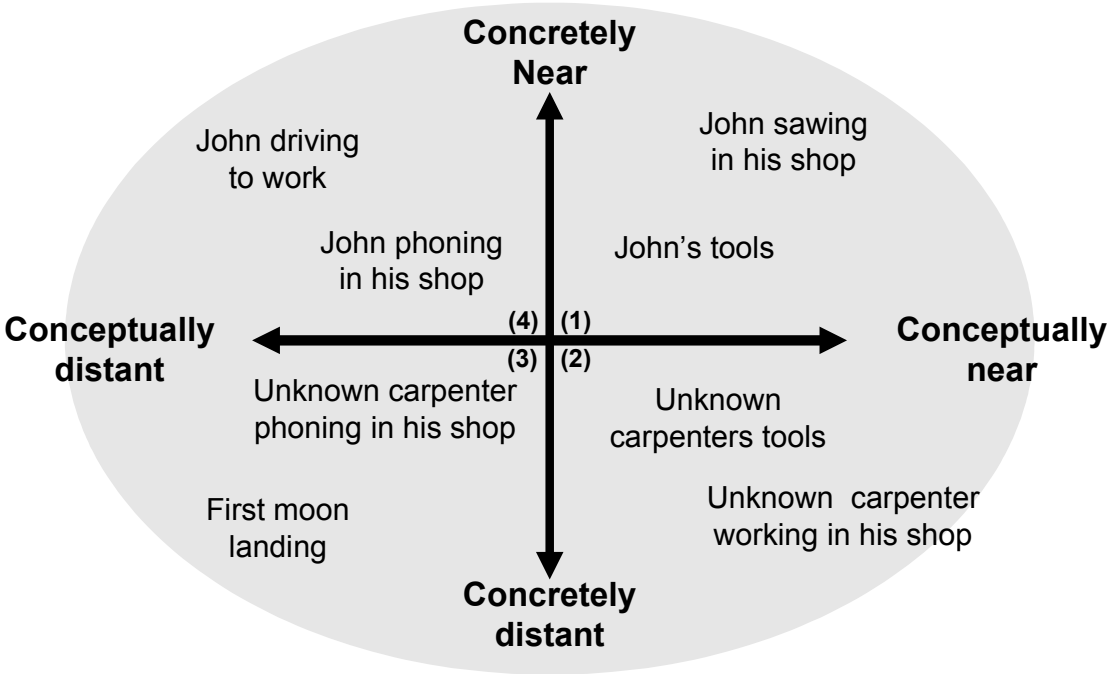
Content

It was reported earlier in this paper that the content of the DTA was ill received although it was both conceptually strongly coupled and of acceptable quality per se. This might seem almost paradoxical. There is, however a simple explanation for why the subjects reacted the way they did to the DTA content. During interviews it became clear that the subjects wanted a particular kind of “content nearness”. This nearness can be summarized (for want of a better expression) as DTV show concrete nearness. Such nearness can be distinguished from DTW show conceptual nearness. These two nearness

expressions, while simple, are in need of clarification because of their unfamiliarity. Something is concretely near to a DTV show if it brings up and elaborates on the concrete things, settings or people within the DTV show. So if a person is depicted in a DTV show as "John the carpenter" in his carpenter shop, then content that is concretely near would involve John the carpenter and his carpenter shop. In contrast, content that is conceptually near would not have to treat of John the carpenter or his carpenter shop. Conceptually near content could simply treat of carpentry in the abstract or other carpenters and/or carpenter shops. The subjects in the show were generally in favor of content that manifested concrete nearness and they only advocated bringing in content manifesting conceptual nearness if it was particularly valuable (i.e., contact information, and pointers to further information). One way to summarize this is to say that in absorbing the content of the DTA, the subjects were more willing to make concrete associations to the particulars of DTV shows rather than engage in abstract or conceptual associations.

DTA attractiveness

We suggest a way to make DTA:s more attractive. The traditional approach has often been to include various appealing graphics [Westerlink '98]. However, it was found that pictographical enhancement of a TV-guide was preferred by only half the subjects [Westerlink '98]. Our suggestion is that careful attention not only be given to the appearance and metaphorical meaning of included graphics, but that included graphics be evaluated in terms of concrete and conceptual nearness. Concrete and conceptual nearness will let the viewer accommodate more easily to the DTA since little is demanded mentally to do so. The viewer accommodates mentally to the TV-show, the DTA-interface and the DTA-content in unison.



In the above graph, optimal accommodation occurs in the first quadrant, we may call it the accommodational quadrant. It is only in this quadrant that the DTA elements are both concretely and conceptually near.

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Appendix I—Glossary

DTP–Digital Television Package
: The combination of DTE (Digital Television Equipment) with a DTA (Digital Television Application) and a DTV show.

DTA–Digital Television Application
: An interactive service or set of such services designed for use with a DTV show. A DTA consits of content and a user interface.

DTA SDK–Digital Television Application Software Development KIT
: Software used by programmers for implementing digital televison applications.

DTP TV mode
: A mode in which the user views a DTV show but does not interact with the DTA user interface.

DTP Interface mode
: A mode in which the the user interacts with the DTA user interface.

Appendix II—Figures

Figure 1 - The Sagem remote control

Figure 2 - The Sagem set-top box (front)

Figure 3 - The Sagem set-top box (back)

Figure 4 - The DTP-development environment

Figure 5 - The DTA interface with content (show about houseboats)

Figure 6 - The help funtion of the DTA-interface

Appendix III—Study Questionaire (next page)

DigitalTV-Studie
—Scenariopresentation & Frågeformulär

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Scenariopresentation

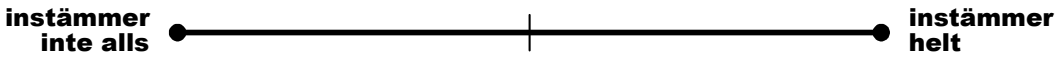
Du och din kompis deltar i en studiecirkel där ni diskuterar olika elektroniska media som t ex TV och radio. Alla i studiecirkeln har fått en uppgift till nästa sammankomst. Nästa gång ni ses kommer ni att diskutera digitalTV och programmet ”Bo i husbåt”. Till detta program hör en digitalTV-tjänst. Ni kommer att diskutera denna nya form av tjänst och hur den passar ihop med TV-programmet. Utforska digitalTV-tjänsten noga och titta på programmet så att ni kommer väl förberedda.

Frågeformulär för digitalTV-tjänsten

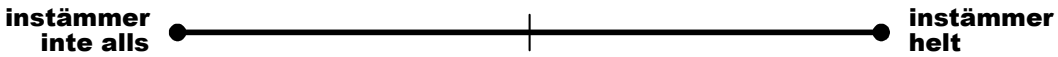
1) Det är lätt att förstå hur innehållet är organiserat

2) DigitalTV-tjänsten är fängslande

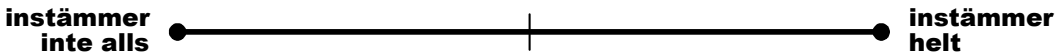
3) Det går lätt att skaffa sig en överblick av innehållet



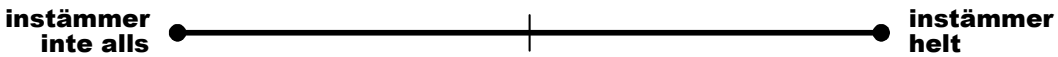
4) Innehållet känns bra



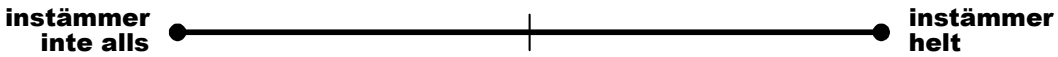
5) DigitalTV-tjänsten är lagom omfångsrik



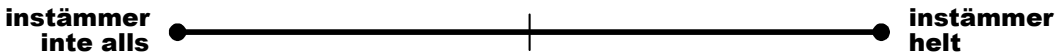
6) Presentationsformen bör används även för andra program



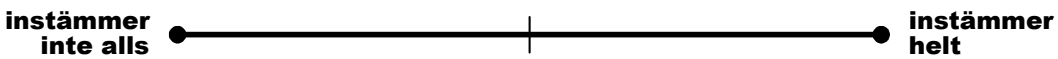
7) Jag kände mig överväldigad av informationen



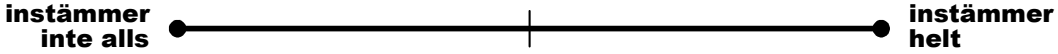
8) Början och slut framgår tydligt



9) Det är lätt att navigera i DigitalTV-tjänsten

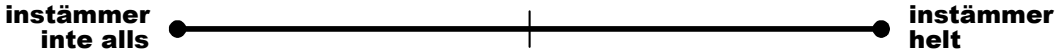


10) DigitalTV-tjänsten är värdefull för mig som tittare

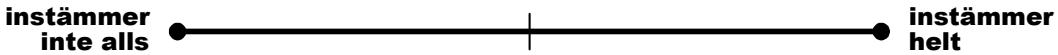


11) DigitalTV-tjänsten ger TV-programmet ett större sammanhang

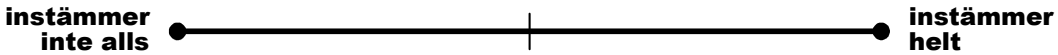
12) DigitalTV-tjänsten har den information jag vill ha



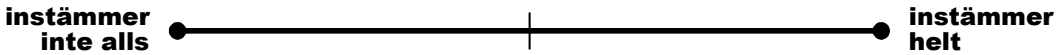
13) DigitalTV-tjänsten har en behaglig ton



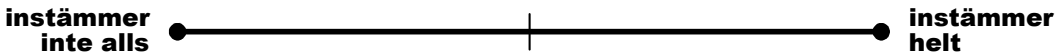
14) DigitalTV-tjänsten är inbjudande



15) DigitalTV-tjänsten är lagom kompakt



16) DigitalTV-tjänsten är oförutsägbar



17) Rita en skiss över digitalTV-tjänsten

18) Beskriv digitalTV-tjänsten med egna ord

19) Vad tycker du om digitalTV-tjänsten utseendemässigt?

20) Vad tyckte du om?

21) Vad tyckte du inte om?

22) Vilka svårigheter upplevde du?

23) Hur fungerade fjärrkontrollen för att styra digitalTV-tjänsten?

24) Saknade du något i digitalTV-tjänsten

25) Bakgrund

Kön

☐Man
☐Kvinna

Utbildning

☐Grundskola
☐Gymnasium
☐Universtitet/högskola

Erfarenhet av dataspel

☐Ingen alls
☐Liten
☐God
☐Ganska stor

TV-tittande

☐Någon timme i veckan
☐En timma/dag
☐Två timmar/dag
☐Tre timmar/dag
☐Fyra timmar/dag
☐Mer än fyra timmar/dag

TV-mottagning

☐Marksänd TV (traditionell TV med takantenn)
☐KabelTV
☐Parabol
☐Digital kabelTV
☐Digital parabol
☐Annan form av TV-mottagning:_____

Text-TV-tittande

☐Inte alls
☐Varje månad
☐Varje vecka
☐Varje dag

Tittarpreferenser

☐Romantik
☐Action
☐Komedi
☐Sport
☐Faktaprogram
☐Barn/ungdomsprogram

26) Information för uppföljningsfrågor

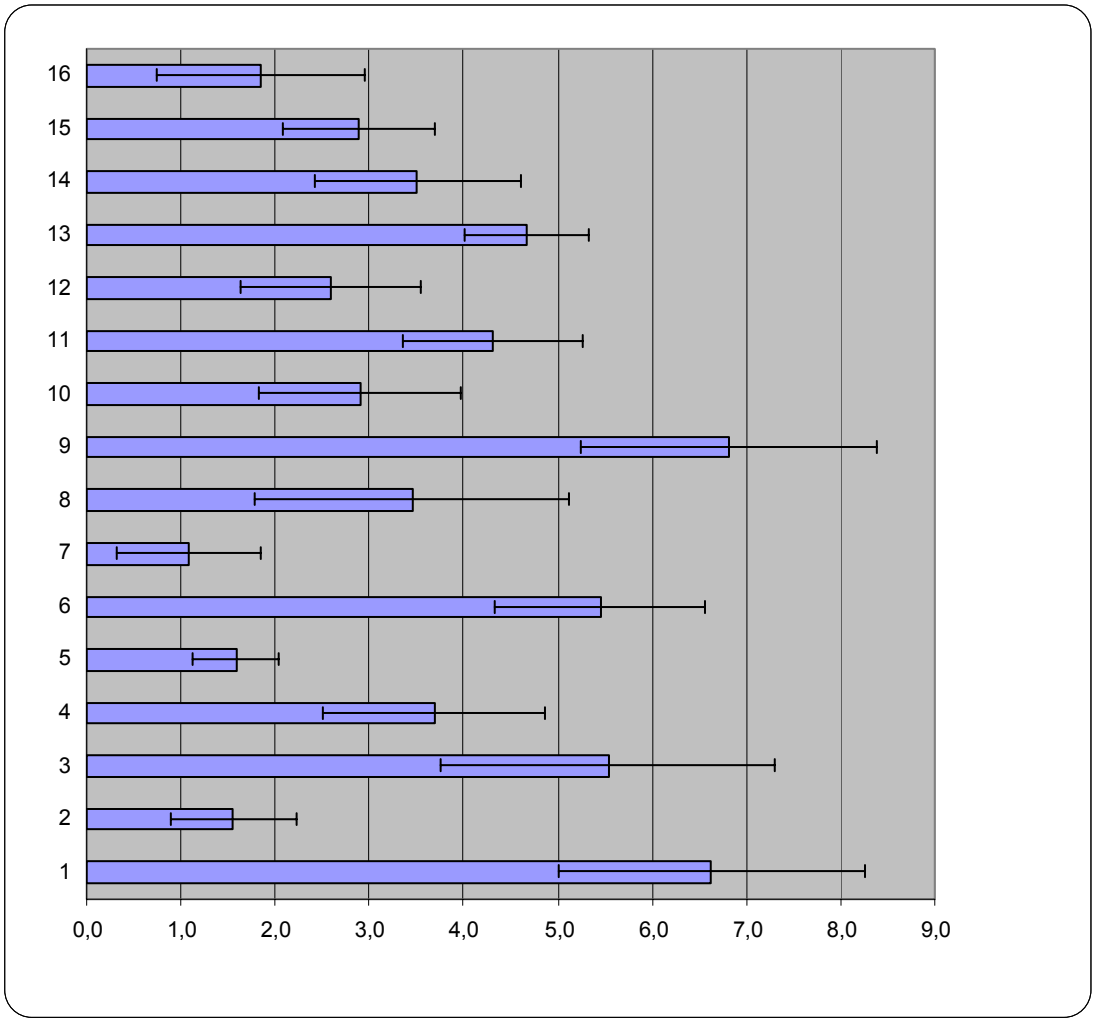
Förnamn

Efternamn

E-postadress

Appendix IV—Complete Results (quantitative)

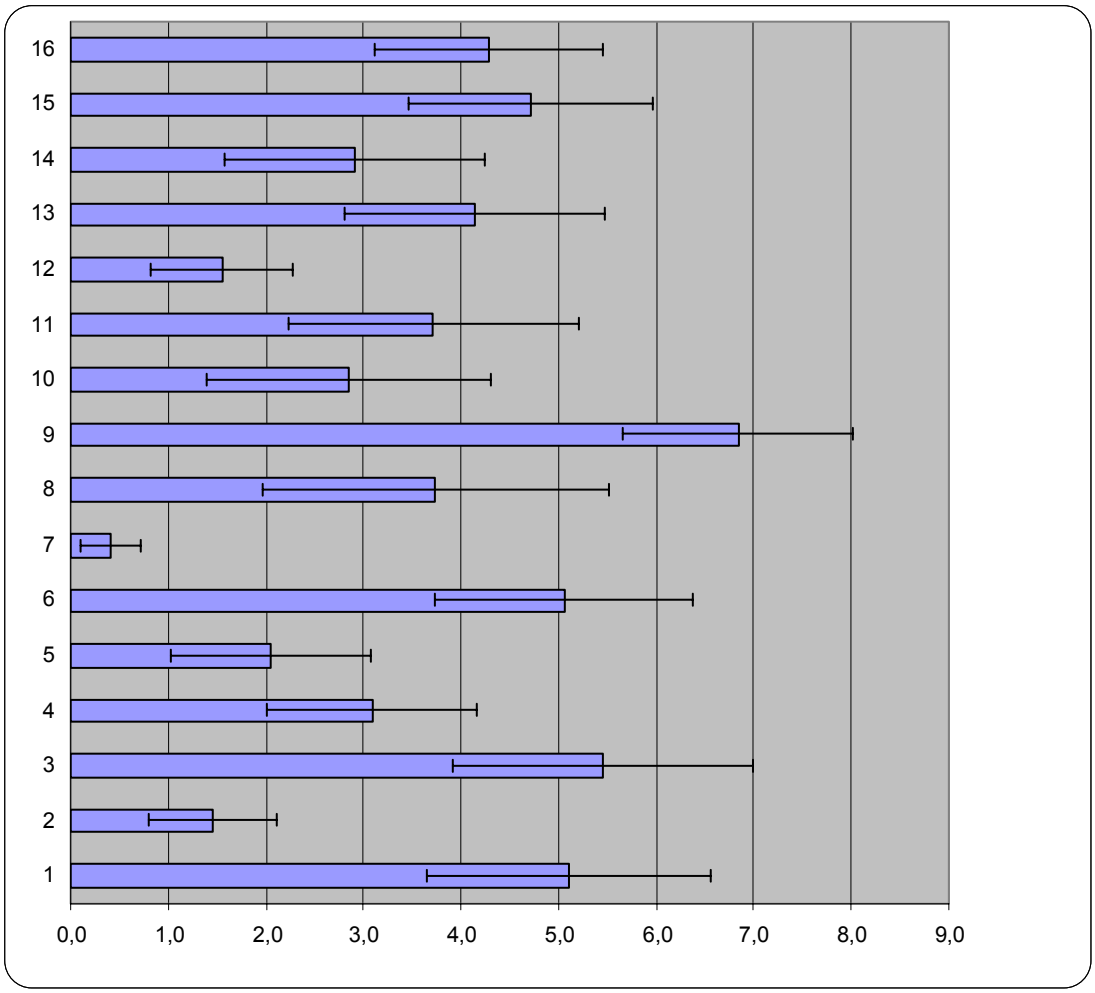
Condition: "House boat"
(10 subjects, averages plotted with standard deviations, scale ranging from 0 to 9)



English translation of questions 1-16

1) It is easy to understand how the content is organized
2) The DTV-service is captivating
3) It is easy to get an overview of the content
4) The content feels ok
5) The DTV service has a suitable scope
6) The form of presentation should be used for other programs also
7) I felt overwhelmed by the information
8) Where to start and end is easily determined
9) It is easy to navigate the DTV-service
10) The DTV-service is valuable to me as a viewer
11) The DTV-service puts the TV program in a greater perspective
12) The DTV-service has the information that I want
13) The DTV-service has a comfortable tone
14) The DTV-service is inviting
15) The DTV-service is suitably compact
16) The DTV-service is unpredictable

Condition: "Collective living"
(10 subjects, averages plotted with standard deviations, scale ranging from 0 to 9)



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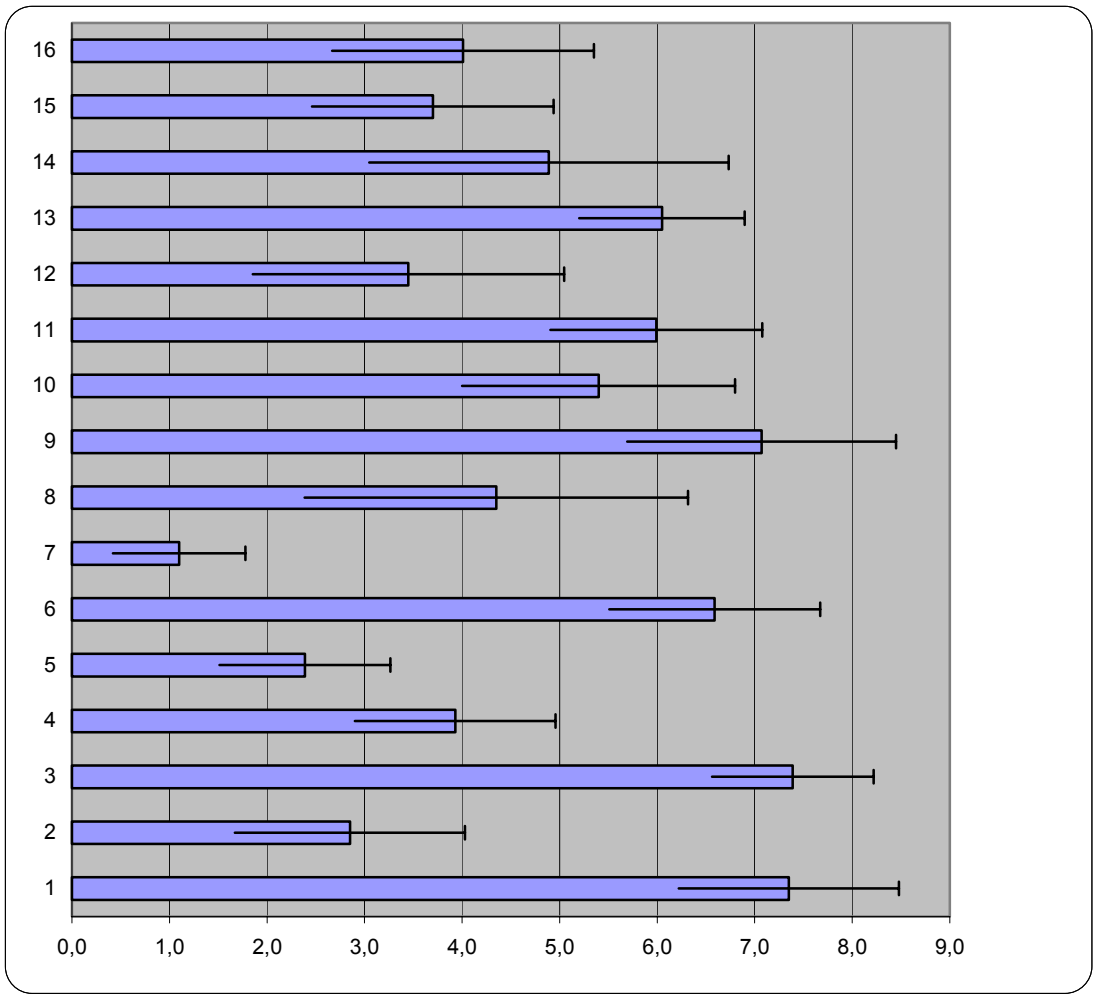
Condition: "Future housing"
(10 subjects, averages plotted with standard deviations, scale ranging from 0 to 9)



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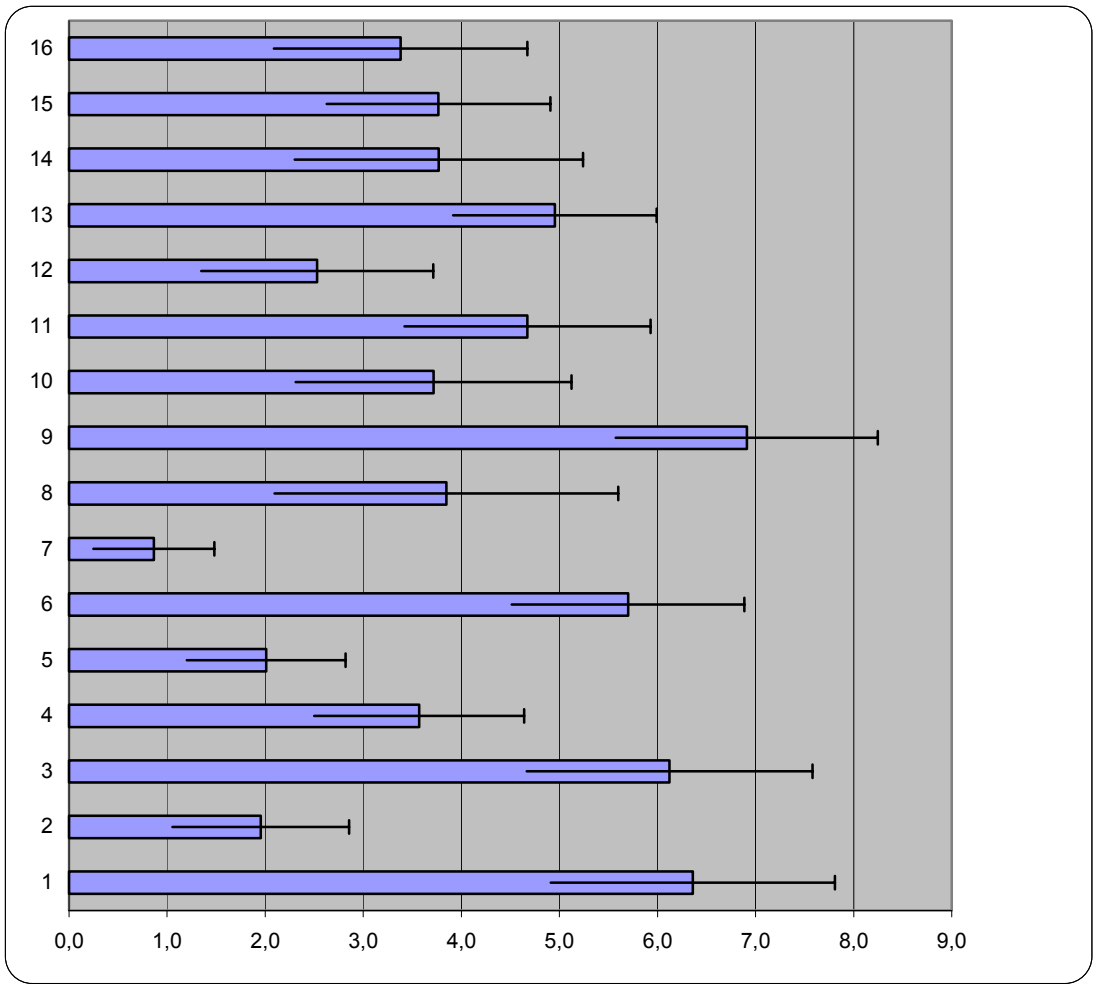
Averages for conditions: "House boat", "Collective living" and "Future housing"
(30 subjects, averages plotted with standard deviations, scale ranging from 0 to 9)



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