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The development of the Karolinska Institutet Rapid Ease of Use Mapping (KIREUM) for technologies

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Abstract: This paper describes the development of a new, easy-to-use tool which we named KIREUM (Karolinska Institutet Rapid Ease of Use Mapping of technology). It was created with the intention of providing a rapid measurement that could a/ assist health care professionals make decisions on what technological artefact or service would be easiest for an (older) adult with or without cognitive impairment to use, and b/ provide guidance to designers regarding ease of use when designing technology for all, keeping the activity where the artefact or system is intended to be used in mind. The development procedure started with the definition of the construct to be measured. Items were defined based on findings from empirical studies of what makes technologies harder or easier to use. The tool has been revised based on feedback from three expert panels. The current version consists of 13 items measuring ease of use of technological artefact or services.

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1 Introduction

Technology plays an increasingly important part in our everyday lives in the digital age, and designing technology that has a good match to users is vital. Several models have elaborated on how the best fit can be achieved between technology and users, for example the Technology Acceptance Model (TAM) (Venkatesh & Bala, 2008), and the Matching Person and Technology model (MPT) (Sherer & Craddock, 2002). As early as 1993, Nielsen argued that many different aspects contribute to making a piece of technology usable. It should be subjectively pleasing, easy to learn, easy to remember, efficient to use and result in few errors. Nielsen's definition (1993) emphasises ease of use as a central aspect of usability, which in turn will influence the usefulness of the technology – that is, how well the technology can be used to meet the goals of a user in an activity. As Norman (2005) later suggested, focus on the activity rather than on particular users when considering design might add benefits.

From studies in our research group we have gathered empirical knowledge of what makes everyday technologies easier or more difficult to use for older adults with and without cognitive impairments in everyday activities. To make this knowledge accessible to the wider community of research and practice, such as providers of supportive technology in health care and designers of technology, we have constructed an easy-to-use tool KIREUM – The Karolinska Institutet Rapid Ease of Use Mapping of technology.

The aim of this presentation is to describe the development of the KIREUM, a tool created with the intention of providing a tool that could rapidly a/ assist health care professionals in taking decisions on what technological artefact or service would be easiest to use for an (older) adult with or without cognitive impairment, and b/ provide guidance to designers regarding ease of use when designing technology for all, keeping in mind the activity where the artefact or system is intended to be used.

2 Methods and preliminary results

2.1 Development of items based on results from empirical studies

The KIREUM was developed mainly based on findings from two research projects. One study of observed abilities to manage everyday technologies in older adults with and without cognitive impairments resulted in a hierarchy of less and more challenging technologies (Malinowsky et al., 2011). This hierarchy was later analysed with the aim of describing why some technologies were more difficult than others and what factors might contribute to a technology being more or less challenging to use (Patomella, Kottorp, Malinowsky, & Nygård, 2011). The results revealed that technologies used less than once a week and those having a complex interface were more difficult to use. The latter is in agreement with Lewis, Langdon and Clarkson's study of microwave oven interfaces (2008). A more in-depth analysis of the factors that make a technology more or less challenging to use was thereafter undertaken (Patomella, Kottorp, & Nygård, 2013). The results revealed that technologies that required a greater number of actions, and certain actions to be taken in a specific sequence were more difficult to use. Feedback from the technology was important for the ease of use, and if feedback was given through several sensory stimuli the technology was easier to use.

Another study examined how technology could support people with stroke or dementia in their everyday life activities (Lindqvist, Larsson, & Borell, 2015). They concluded that the way information required for the activity was presented by the technology was an important feature for usability. As well as access to a manual. When technologies had to be charged with money or power this meant an increased risk of failures, i.e. decreased usability/ease of use. Finally, their analysis revealed that when the technology can be run by other remote users, this also has a potentially positive impact on usability and ease of use.

These empirical findings together with the environmental docility theory (Lawton & Nahemow, 1973) were the foundation for the development of the KIREUM. This theory tells us that a more complex environment presents more challenges for a person, particularly when individual capacities are deteriorating.

The development of the KIREUM was also guided by the theories emphasising ease of use as an important aspect of usability (Nielsen, 1993; Venkatesh & Bala, 2008), and the activity in which the technology is to be used (Norman, 2005). In contrast to the definition of ease of use in the Technology Acceptance Model (TAM) (Venkatesh & Bala, 2008), the KIREUM determines the general ease of use of a piece of technology, not as perceived by a specific individual as in the TAM. In other words, ease of use in the KIREUM is technology-anchored, in contrast to the person-anchored definition of the concept in the TAM.

2.2 Development procedure

The development of the items in the KIREUM has been an iterative process based on a model presented by Spector (1992). The model included five steps, see Figure 1 where we have taken the first three steps so far.



Figure 1: Item development process

First, we defined the construct to be measured as *ease of use of a technological artefact or service*. After that we discussed the response choices that could be relevant for that construct. We decided that the response choices should be related to more or less ease of use, see Table 1. We then started to identify features from the research findings presented in the previous paragraphs, i.e. items that could capture ease of use.

Table 1 Example of two items/questions from the KIREUM

Example of items/questions	Response choices
Is it required that actions are done in a specific order when using the technology?	No/Preferred/Some/Yes all actions
How many different parts/components must be handled in order to use the technology?	One/ Two/ Three or more

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The initial version of the KIREUM had 18 items, but after consulting expert panels the item pool was reduced to 13 items. Items were rejected if they were redundant or if they did not clearly relate to the construct ease of use. The panels consisted of in total 52 experts with background in occupational therapy, engineering and administration. Most of the experts were active researchers. The items in KIREUM represent six different categories: Frequency of use (1 item), Sequences in the performance procedures (2 items), Feedback and interaction (4 items), Artefact/service in relation to environment or place (2 items), Maintenance and adaptation (3 items), and finally Description of the artefact/service (1 item). The next step in constructing this tool would be to have it administered by a pilot sample of respondents. After that the item's validity and reliability can be investigated in a larger sample (Spector, 1992).

3 Discussion

The clinical relevance of KIREUM would be to have a tool that could be used when prescribing or recommending new technologies to clients, making sure that the technology's challenge is a good match with the client's ability level. Two methodological aspects are worth particular consideration. First, the empirical material that was used in creating the KIREUM was mainly gathered among (older) adults with and without cognitive impairment. Consequently the features in the tool are connected to ease of use in a cognitive sense, rather than a physical sense. However, as the current general knowledge of physical aspects of ease of use is more developed than knowledge regarding cognitive aspects, we hope that the KIREUM will add to our general body of knowledge concerning usability of technology. Secondly, we do not yet know to what extent the features chosen as items in the KIREUM will be valid for assessing technology's ease of use for other age groups. The process of investigating such issues has just begun.

3.1 Acknowledgements

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