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VICON

Virtual User Concept for Inclusive Design of Consumer Products and User Interfaces

Deliverable Report

D 4.5: Evaluation Procedure Handbook

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Deliverable abstract	This deliverable describes the evaluation procedures to be conducted for the evaluation of the VICON system through the product designers, as well as the evaluation of the VICON reference products through the beneficiaries.

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Abbreviation	Definition
CAD	Computer Aided Design
PLM	Product Lifecycle Management
UCD	User Centred Design

Executive Summary

This deliverable describes the evaluation procedures to be conducted for the evaluation of the VICON system. Next to a more technical evaluation of the VICON system by the product designers, at least 2-3 reference products which were designed and prototyped with the help of the VICON system shall be evaluated with the beneficiaries. Accordingly the evaluation handbook consists of plans to carry out a detailed ethnographic research (similar to the end user field study described in D1.1 [2.]) on a group of elderly users who have a range of mild-to-moderate physical impairments. The methodology behind the research consists of a combination of interviews and observational techniques. The aim is to investigate the main usability problems in comparison to those identified in WP1 and reported in deliverable D1.1[1]. At the end it shall be possible to quantify how is the impact of VICON onthe accessibility and usability features of designed products. Furthermore there are plans to involve product designers in the evaluation process of the VICON system in order to investigate to what extent the VICON system is able to achieve an added value within the product development process (PLM), in terms of facilitating and improving the design tasks.

1 Introduction

This deliverable focuses on the development of an evaluation plan of the VICON system.

Before the real evaluation can begin a procedure handbook is being presented in this document. The handbook will describe the detailed procedures that are to be undertaken for evaluating the virtual user model with real end users. It may be seen as a guideline and it will specify:

- Evaluation criteria,
- Sample of users involved and a justification for the selection of the sample,
- Description of tests to be performed (these test scenarios provide a clear reference to the project objective they correspond to).

Key criteria and task areas to be included in these assessments will be selected by a combination of background research, expert opinions, focus groups and observational research techniques.

The evaluation plan consists of two parts:

- The evaluation plan by the product designers
- The beneficiary evaluation plan

1.1 Plan for evaluation by the designers

The evaluation by designers will be carried out by the VICON industrial partners Arcelik and Doro. As mentioned in earlier deliverables, the product designers are the direct target users of the VICON system. In the field test with designers we will follow the descriptions in VICON deliverable 3.1 (D3.1: System Architecture and Interface Specification) [3.], where the VICON system consists of three phases,(a) the sketch phase, (b) the design phase and (c) the evaluation phase. The single steps of the described scenarios in the following will be conducted in one of the different phases of the VICON system and not in every one. The aim of these evaluations is to validate the usability and technical validity of the results of the VICON components. There are two main approaches for implementing the evaluation plan that are dependent upon the availability of the fully integrated VICON system. At availability the designers will use the VICON tools and recommendations to achieve inclusive products in order to create physical end user product prototypes. Alternatively, the industrial partners DORO and ARCELIK will provide already available products, such as an inclusively designed mobile phone, as well as a mobile phone which includes drawbacks. Using the VICON system with these designs, VICON should come up with similar design recommendations and evaluation results as designers who are experienced with inclusive design. Afterwards, the designers will produce a report and answer questionnaires about the usability, validity and efficiency of the VICON system (see Figure 1).

Each single entity is represented by a set of attributes and referred to as variables.

Each variable has its domain of definition, which is specified by a data type and a certain range (an upper and a lower boundary). A variable can take values within this range.

Before a designer can use the VICON system, there must be at least one concrete element (instance) created (instantiated) for each entity. Creation means in particular assignment of certain values to the variables. E.g. an instantiation of the Virtual User entity means creation of a user profile.

The creation of the entity-elements is a task for a VICON-system-administrator (designer), which is a dedicated person equipped with the admin-login data for the VICON system. The administrator can make changes to the model by editing the Knowledge Base (ontology) via the AdminApplication.

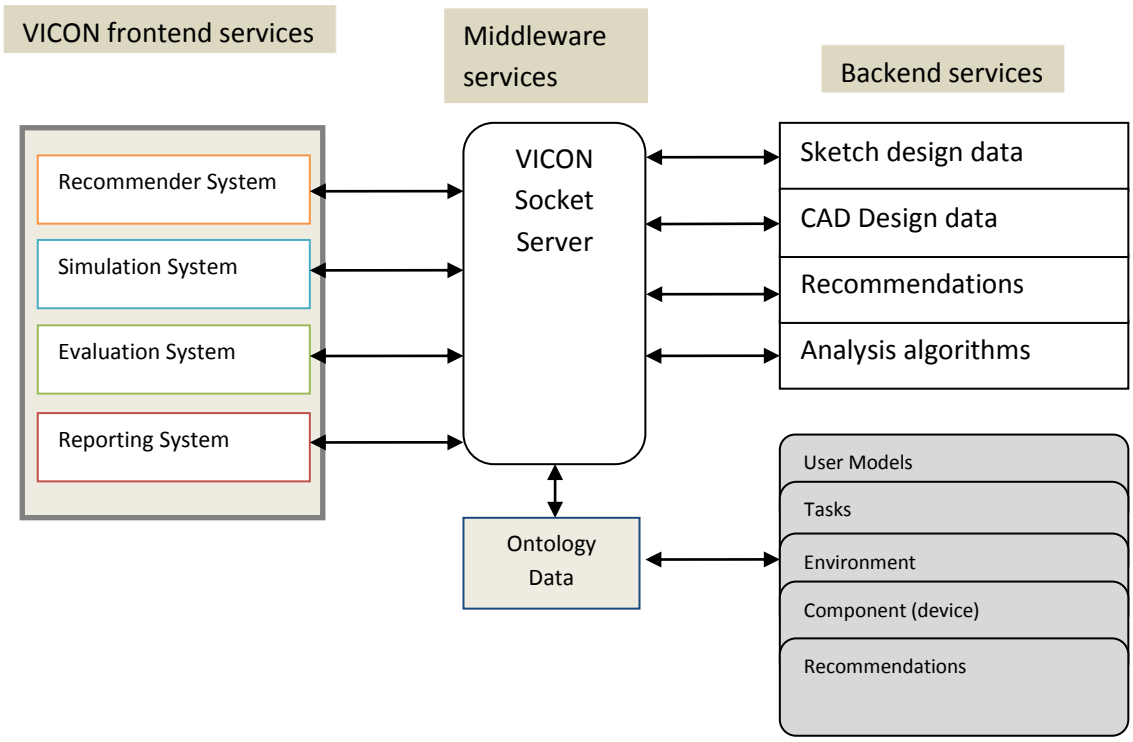

Figure 1: Overview VICON services

After the entities have been instantiated, the values of their attributes can only be changed by editing the ontology. Thus from the user perspective each entity-instance is described by constants. E.g. the environments attributes of a given kitchen profile are constant. The single exception of this rule is the component model, which possess a certain set of attributes to be set (annotated) by users, i.e. these attributes can change their values dynamically. Each component type (e.g. Display or Press Button) has its own set of such "dynamic" attributes. They are declared by the administrator and should be assigned with values by the designer via the Annotation tool of the CAD Design component within Siemens NX.

During a designer sketches a product, the recommendations computed by the Sketch subsystem are supporting him/her. The recommendations are computed from the preselected user profile, environment and task.

At a certain period of time the designer starts creating a 3d model in Siemens NX and uses the CAD Design subsystem to get the recommendations from the ontology. Furthermore the designer can and should use the CAD Design subsystem for annotating the components of the 3d model. The VICON-system would then be able to filter the recommendations by the component type and show recommendations only for the selected component.

The Evaluation subsystem expects that the designer specifies a virtual user, an environment and a task by selecting them from a list. Depending on the task the user may further be asked to select one component, e.g. if the task "Press a button" is selected, one "Press Button" from the group of press buttons should be chosen. During the evaluation a performance analysis for the given product is performed. As a result of the evaluation the user gets a Boolean answer weather the product is usable under given circumstances or not as well as a differentiated performance indication.

The ontology provides the common information basis for the three subsystems. The information exchange is realized by the VICON Status File (VSF). In particular at the end of the Evaluation the VSF contains a Boolean indication of the success and further performance details.

1.2 Beneficiary Evaluation Plan

In the beneficiary evaluation section, the evaluation of the Virtual User Model (VUM) will be primarily executed by the following VICON partners: NCBI, RNID, UoB and FIT. As the end users of the envisaged reference products, the beneficiaries will take part in usability evaluations of the emerged and available products. In the case of UK and Ireland, the user group samples shall be similar to the user groups chosen for the field study in D1.1. In Germany, UoB will organize a group of approx. 25 beneficiaries which are connected to one of the associated partners, respectively Bremer Heimstiftung e.V. The evaluation shall then be conducted by UoB with support of FIT. Under the circumstances that emerged user interfaces (developed with the VICON system) are available, the purpose of the evaluation will be to find out if with VICON emerged prototypes are more or less inclusive than products designed without using the VICON system. Alternatively, already available products of a washing machine, a mobile phone, and a remote control shall be used throughout the evaluations with the beneficiaries. In this case the purpose is quite similar, with the only difference that the feedback gained from the user evaluation shall be compared to the results gained from the evaluation phase of the VICON system after a virtual evaluation of the respective product designs.

2 Evaluation methodology

The methodology for the evaluation is explained more clearly through a comprehensive description of the target user groups. A description of stage 1 with the recruitment of beneficiaries and a plan of the London Workshop will be provided complimentarily. In stage 2 the field trials will be described, through a washing machine scenario, mobile phone scenario and a remote control scenario.

2.1 Target Users

To evaluate the user experience of the overall VICON system, two user groups need to be considered (See **Fehler! Verweisquelle konnte nicht gefunden werden.**).

User Group	Description	Tasks
Product designer	Design the products in the usual PLM (Product Lifecycle Management) using typical tools in different phases like sketch tools and CAD tools	- Create sketch designs of the product, use VICON to attain recommendations - Create CAD designs of the products; Use VICON to

		attain recommendations - Evaluate designs - Answer questionnaires
Beneficiaries	Senior Citizens with mild to moderate impairments, similar to the group settings described in Deliverable D1.1 [1.][2.].	- Participate in the tests - Interact with the consumer products - Answer questionnaires – (See Appendix A: Questionnaires)

Table 1: Description of the VICON target user groups

2.1.1 Stage 1 - Recruitment of Beneficiaries

Beneficiaries (elderly users of consumer products) will fall into four main groups; those with one moderate impairment such as in vision, hearing or manual dexterity; and those with mild to moderate impairments in vision, hearing and manual dexterity. All beneficiaries will be aged 65 years or older. It is intended to include 6 -12 people with each of these combinations in order to identify key usability issues and provide sufficient evidence. Beneficiaries will be recruited were possible from previous field trials (T1.3). New beneficiaries (ages 65 years and older) may also be recruited if deemed necessary. The final number of beneficiaries and the number of testing locations is in the planning stage and will be finalized before starting the tests.

2.1.2 London Workshop

In addition to field trials, a workshop will be held in London in 2012 to which beneficiaries and VICON associate partners shall be invited. The workshop will serve as a forum to conduct additional expert usability evaluations on the end products, complementing independent beneficiary usability evaluations being carried out by NCBI, UoB, FIT and RNID in their respective countries. It may also be used as an opportunity to invite associated partners to take part in expert evaluations on behalf of their respective countries.

2.2 Stage 2 - Field Trials

The following scenarios described below (see sections 2.2.1 2.2.2 and 2.2.3) will rely heavily on the components implemented within the VICON system. The Field trails consists themselves of two separate tests:

1. Field tests with the beneficiaries
2. Field tests with designers

The test participants will be asked to perform key tasks from one scenario that cover important aspects of the VICON system in at least one of the three phases of the VICON system. All participants from the same user groups (see section 2.1) will perform the same tasks according to the individual scenario.

2.2.1 Washing Machine Scenario

Designer ***A*** previously designed a washing machine which proved quite popular in Europe, but market research revealed that older people, in particular, found it difficult to use. Designer ***A***'s company wants to solve this problem, as recent statistics had revealed that a large percentage of households in Europe consisted of older people living alone or with an elderly partner. Realising that the company is missing out on a considerable percentage of its target market by not addressing the design requirements of older people, Designer A suggests using VICON to evaluate the existing washing machine model and to make design improvements.

The market research on the existing washing machine revealed that the most common problems related to the physical interaction between the user and the machine and that operation of the buttons and the door placed too much strain on the user. So Designer ***A*** uploads the existing CAD drawing of the washing machine and evaluates the design with the existing user profile 'Mark'. 'Mark' is the profile of an elderly man with mild/moderate hearing, visual and manual dexterity impairments. He experiences some stiffness in his fingers.

The VICON system identifies that 'Mark' has difficulty opening the door of the washing machine, as it requires more force than he is able to provide. Consequently Designer ***A*** re-evaluates the design of the clasp on the washing machine door, making it larger so that it is easier to grasp and making it more responsive when pressed, reducing the force required to successfully operate it. Designer A also changes the hinge on the door so that it moves more freely and remains open without the user having to continuously hold it back.

Next, Designer ***A*** evaluates the design with the user profile 'Gandalf'. 'Gandalf' is the profile of an active older gentleman who has moderate/severe hearing loss, moderate visual impairment and moderate arthritis in both hands. The arthritis does not stop him doing things but can cause him discomfort, especially in cold weather, so he often wears gloves. 'Gandalf' experiences difficulty operating the buttons on the machine, as he has difficulty locating them by touch and once located they require too much force to operate. Designer ***A*** consequently increases the colour contrast between the button colour and the colour of the surround, increases the size of the buttons and increases the amount by which they protrude from the façade. Designer A also reduces the force required to press the buttons to as low as possible.

As 'Gandalf' has difficulty in cold environments, Designer ***A*** finally places the washing machine in the basement of the virtual environment and reduces the room temperature. On doing this, Designer ***A*** discovers that now, due to lowering the force of the buttons to as low a setting as possible, 'Gandalf' accidentally presses the buttons when feeling for them and starts the washing machine before he is finished selecting the desired settings. Designer A consequently increases the force to a level high enough that 'Gandalf' does not accidentally press them when feeling for the correct button, but low enough that they can be operated by a user with a moderate manual dexterity impairment.

Once Designer ***A*** has finished testing the new design in a range of environmental conditions and with a range of virtual users, a more reliable prototype can be developed for user testing with real users.

2.2.2 Mobile Phone Scenario

Designer ***B*** is developing a new mobile phone which will be made available on the mainstream mobile phone market. Designer B wants the product to be as accessible and usable as possible to as many people as possible, while at the same time looking attractive and appealing to customers. Designer ***B*** sketches a new design idea and uploads it onto the computer.

As Designer ***B*** marks up the sketch he assigns the appropriate labels to the various user interface components. As he does so, design recommendations are provided by the VICON system to warn him well in advance about potential usability issues with each component and to ensure that he addresses these issues at the earliest possible stage. The cost of making changes increases exponentially as the design reaches the later development stages, so Designer B wants to identify and address as many usability issues as possible at this earliest stage.

Once Designer ***B*** gets into the next phase of the design project, he further develops the design and starts to conduct virtual user tests of the user interface. Since he wants this new mobile phone to be as universally designed as possible, he tests the design with all of the preset virtual user profiles and in a range of virtual environments. Designer B has decided to design a touchscreen phone, so most of the buttons and controls are onscreen.

In the 'dim lighting' environment setting Designer ***B*** finds that the user profile 'Dorothy', who has worn glasses all her life and has recently developed age-related macular degeneration, has difficulty with the visual display. In dim lighting 'Dorothy' is unable to read the text on the screen, so, based on the design recommendations provided by the VICON system, Designer B maximises the default size of the text with the space available, provides an option to manually increase the text size, and maximises the default colour contrast of the on screen text. Designer B also includes an automatic feature in the phone, which increases the brightness of the screen under low lighting conditions. When the user returns to a brighter environment, the screen will automatically reduce the brightness setting, to conserve the battery power.

In the 'bright lighting' environment setting Designer ***B*** finds that the user profile 'Mark' has difficulty with glare from the screen. The automatic brightness setting feature which had been installed to suit 'Dorothy' was in fact causing problems for 'Mark'. Designer ***B*** consequently changes this automatic feature so that it can be turned on or off by the user. To suit the issues of glare that 'Mark' experiences, he sets the default text to the highest contrast possible, so that the text will still remain as legible as possible, even when the screen brightness is at a lower setting. He also includes a range of alternative colour settings, which the user can select to suit his or her own preferences.

The user profiles 'Eileen' and 'Mark' both have problems hearing the phone ringing or beeping when a call or message comes in. Designer ***B*** researches particular alert sounds which are optimal for people who are hard of hearing or for people who are in noisy environments, and provides a variety of clear audio alerts and ring tones to choose from. The clear ring tones are labelled as such, so that the user is aware that they are available.

Designer B continues to work through the various components in this way until the issues with each user profile and environment are identified and design solutions are developed.

By addressing these usability issues at such an early stage, Designer ***B*** is more confident moving onto the user testing phase with real users.

2.2.3 Remote Control Scenario

Designer ***C*** has been researching the usability of remote controls and is aware that people in general find remote controls too complicated and have too many different controls in their homes. She wishes to create a remote control design that eliminates unnecessary complexity but at the same time still provides all of the functions that customers expect and want. She also wants to capitalise on the recent success of the smartphone industry.

Designer ***C*** researches (a) the core functions that users want in a remote control and (b) what functions are essentially redundant, wasting space on the control and leading to an overly cluttered user interface. Once she identifies the features that she wants included, Designer ***C*** creates two new designs, ensuring that both designs have those essential features.

One new design is based on the traditional remote control, familiar to most households. The second design is based on smartphone applications and she hopes that it may be possible for customers to buy and install the software on their smartphones as well as offer customers the option to buy the hardware with the software preinstalled.

She uses the VICON system on both designs at the sketch phase. Since a lot of the same basic user interface features are present on both designs, the system flags a lot of similar usability issues. However some very different issues are also flagged, unique to each design.

Some of the unique issues identified with the traditional design include, for example, being able to quickly distinguish (both visually and by touch) different groups of buttons that have different functions, such as the numeric buttons versus the navigation buttons.

One feature that Designer ***C*** includes in the smartphone-style remote control is audio output and she wants it to provide spoken instructions to the user, to create a more personal and interactive gadget. When she puts the design through the VICON system, however, it identifies a major usability issue, in that ‘Eileen’, ‘Mark’, Dorothy’ and ‘Gandalf’ all have difficulty hearing the audio output, and so they are unable to use the remote control at all or they repeatedly make incorrect selections. Designer ***C*** is keen to keep the audio output feature, but wants to provide an alternative way to provide users with a useful product that does everything they need it to do. This route will have to be an attractive alternative, or she will be excluding a considerable percentage of potential customers before the product even goes to market!

Designer ***C*** explores alternative designs, using the information provided by the VICON system as a guide, and decides to include in her final design a combination of options which provide audio, visual and tactile feedback. Users are able to customise the set-up of the product for their own particular needs. Designer C just needs to ensure that the set-up function itself is usable by all potential customers, or they will be unable to set the remote control up in the first place before they can begin to use it.

Designer ***C*** uses what she has learned in designing the smartphone-style remote control to update the design of the traditional remote control, to include a combination of audible, visual and tactile feedback where feasible.

A considerable amount of user testing with real users is required at the prototype stage, but Designer ***C*** is relieved to have identified a major usability issue early on in the design process and believes she has enhanced the user interfaces of both products as a result.

2.2.4 VICON Evaluation Phase Methodology

From the above described scenarios for the washing machine and the mobile phone the following tasks has been selected to be tested within the VICON evaluation phase:

- Hear a signal tone
  - mobile phone (hear a call/message signal)
  - washing machine (hear the tone signal that the wash has finished)
- Press a button
  - mobile phone
  - washing machine
  - remote
- Load / Unload the washing machine (reaching & lifting)

Table 2 relates the selected tasks, the input product components & elements and the impairment groups. It also indicates input information needed for the evaluation computation.

Impairments	Task	WM	MP	Component Input Data
Hearing loss	Hear the signal tone	Speaker	Speaker	Volume, Frequency range, Position, Direction
		Alarm tone	Alarm tone	Volume, Frequency
Nearsightedness /Farsightedness (myopia/	Press a button	Button	Button	Labeling size (font size), Button

hyperopia) Color blindness				Dimensions, Position, Orientation, Font color, Background color
		Display	Display	Dimensions, Position, Orientation, Font size, Font color, Background color, Brightness
Manual Dexterity	Press a button	Button	Button	
	Load / unload of WM (reaching / lifting)	Washer Drum	-	Position, Depth, Orientation of the openning

Table 2: VICON Evaluation Phase description

In addition to the component input data, there are user profile data and the environment data needed as input for the product evaluation regarding each task.

Furthermore there are certain functional relationships existing between the entities. E.g. the behavior of a virtual user (described by a user profile) in a certain environment (described by an instance of the Environment model) is determined by such a functional relationship.

The most of the variable are described in terms of quality levels (No, Slightly, Moderately, Strongly). It is highly critical for providing a meaningful evaluation to map these abstract values on certain domains which can be quantified.

2.2.5 Test Setting and Material

In order to appropriately achieve the evaluation objective, the evaluation will rely on the VICON system to be used, namely the system which is deployed at the facilities of the industrial partners ARCELIK and DORO.

The tests with the designers will be performed at each pilot site: in Sweden at DORO and in Turkey at ARCELIK. The usage of VICON by the industrial partners ensures that a broad range of conditions will be considered in the tests.

The test with the beneficiaries will consider elderly users from different countries with combinations of mild to moderate disabilities. These tests will be carried out in Ireland, UK, Germany an in Turkey (t.b.c). An additional advantage is that cultural diversities (e.g. in usage of the envisaged consumer products) will be covered. Various environments shall be utilized in order to gain the most comprehensive answers out of the evaluation scenarios. The evaluation scenarios will be based on the scenarios already used in Deliverable D1.1 [1.][2.]

2.2.6 Evaluating end products: Did VICON lead to better designed end products?

This will have two different types of evaluation: (1) 'VICON evaluation', which involves evaluating existing or newly developed CAD designs using VICON as an evaluation tool by designers and (2) 'Beneficiary evaluation', which involves evaluating the physical end products or prototypes, that were existing or created using VICON, with beneficiaries (people aged 65 years and older).

Three versions of each product could potentially be evaluated: (1) 'Old design', which refers to existing products previously developed by DORO or ARCELIK, (2) 'Inclusive design', which is a new version of that product developed using inclusive design guidelines and (3) 'VICON design,' which is a new version of that product developed using VICON.

			VICON evaluation	**Beneficiary evaluation**
	Product	**Product version**	Evaluation Format: Run VICON Software on product designs	Evaluation Format: Usability Evaluation of prototype with beneficiaries aged 65 years and older

1	Remote Control	Old design	CAD drawings	Product
2	Remote Control	Inclusive design	CAD drawings	Product
3	Remote Control	VICON design	CAD drawings	Product
4	Mobile Phone	Old design	CAD drawings	Product
5	Mobile Phone	Inclusive design	CAD drawings	Product
6	Mobile Phone	VICON design	CAD drawings	Product
7	Washing Machine façade	Old design	CAD drawings	Product mock-up
8	Washing Machine façade	Inclusive design	CAD drawings	Product mock-up
9	Washing Machine façade	VICON design	CAD drawings	Product mock-up

Table 3: Evaluation Steps

2.3 Stage 3 - Analysis

The tables below describe the proposed method for analysing the data collected during the evaluations of the designs and end products. The first table is a summary of the comparisons that could be done, the second table elaborates on the five comparisons (A-E) described in the first table. It should be noted that these evaluations will be repeated for three products/CAD drawings (mobile phone, washing machine, and remote control).

	Old Design	**Inclusive Design**	**VICON Design**	
CAD drawings	Compare	Compare	Compare	**D**
Product	Compare	Compare	Compare	**E**
	A	**B**	**C**	

Table 4: Design types

Comparison	**Description of Comparison**	**What is Being Compared?**	**Detailed description**
A	Old Design comparison	CAD drawing vs. Product	In this comparison VICON will be used as an evaluation tool to identify accessibility problems with the CAD

			drawing and we will test the product with beneficiaries. We will compare the results of each evaluation to see if they identified the same or different accessibility issues.
B	Inclusive Design comparison	CAD drawing vs. Product	In this comparison we will use VICON as an evaluation tool to identify accessibility problems with the CAD drawing and we will test the product with beneficiaries. We will compare the results of each evaluation to see if they identified the same or different accessibility issues.
C	VICON Design comparison	CAD drawing vs. Product	In this comparison we will use VICON as an evaluation tool to identify accessibility problems with the CAD drawing and we will test the product with beneficiaries. We will compare the results of each evaluation to see if they identified the same or different accessibility issues.
D	CAD drawing comparison	CAD drawing v CAD drawing v CAD drawing	In this comparison we will use VICON as an evaluation tool to compare the design of three different CAD drawings.
E	Product comparison	Product v Product v Product	In this comparison we will evaluate three different versions of the same product with beneficiaries.

Table 5: Analysis Methodology

2.3.1 Hierarchical Task Analysis (HTA)

HTA as described in the VUMS cluster deliverable D1.6.4 [1.][4.] will be utilized in many stages of VICON so in the evaluation phase. The Hierarchical Task Analysis (HTA) [1.][7.] was a pioneering

method of task analysis. It was primarily aimed at training users to perform particular tasks. On the basis of interviews, user observation, and analysis of existing documents (e.g., manuals, documentation), HTA describes tasks in terms of three main concepts: tasks, task hierarchy, and plans. Tasks are recursively decomposed into subtasks to a point where subtasks are allocated either to the user or the user interface, thus becoming observable. The task hierarchy statically represents this task decomposition. The decomposition stopping criterion is a rule of thumb referred to the $p \times c$ rule. This criterion takes into account the probability of a no satisfactory performance and the cost of a no satisfactory performance (i.e., the consequences it might produce).

Since the task hierarchy does not contain any task ordering, any task should be accomplished according to a plan describable in terms of rules, skills, and knowledge. A plan specifies an ordering in which subtasks of a given task could be carried on, thus acting as a constraint on task performance.

A plan is provided for each hierarchic level. Although the plan is an informal description of temporal relationships between tasks, it is one of the most attractive features of HTA, as it is both simple and expressive. Plans are very close to textual description or to the activity list of traditional task analysis. One advantage of plans is that they do not create any artificial tasks, as some formal notations force analysts' to do to avoid ambiguous specification.

On the other hand, because plans are informal, it is not possible to apply automatic checking of properties such as consistency and reachability.

Any task can be expressed in terms of goals that are reached when the corresponding task is accomplished. Each goal has a status (i.e., latent or active) and conditions to be satisfied. The advantage here in HTA is that goals are independent of the concrete means of reaching them. Therefore, for each goal at any level of decomposition, for each goal, several different operations for reaching the goal can be imagined and specified. Each operation is consequently related to a goal (or goals) and is further specified by the circumstances in which the goal is activated (the input), the activities (action) that contribute to goal attainment, and the conditions indicating the goal has been attained (feedback).

HTA provides a graphical representation of labelled tasks and a plan for each hierarchic level explaining the possible sequences of tasks and the conditions under which each sequence is executed.

2.4 Objectives of the Evaluation

The project objectives are that the VICON, and the various phases based on it, will be evaluated via the involvement of potential end-users and other relevant stakeholders. Conclusively, the specific objectives for the VICON evaluations to be conducted at the DORO and ARCELIK are to:

1. ascertain the end-user experience of the VICON developments. Here the end-users are designers and the beneficiaries are impaired elderly users. The experiences to be evaluated include:

a) The accessibility and usability of the VICON prototypes

b) To make comparative assessment of provision supported by the VICON.

2. elicit what factors would impinge on product developer decisions to adopt the VICON Framework approach or its constituent components.

3. evaluate the implications of adoption of the VICON Framework and services on product developers workflows and technical systems and visa-versa.

3 Reporting of Results

The results of the analysis of end products with beneficiaries will be presented D4.4 Focus Group Report, which is due at the end of Month 26 (end of Feb 2012).

The findings of the Evaluations will be reported in D4.3 Evaluation report on how convenient it is to use Virtual User Model and adapted prototype (M26). The analysis of end user evaluations will employ both quantitative and qualitative measures. Quantitative measures to be reported include those associated with the analysis of the questionnaires provided to designers and users about their use/impressions of various VICON services. Other quantitative elements to be reported on through the evaluations will result from the analysis of the in-lab usability/accessibility trials with developers.
The output from these investigations will be both summative and formative in nature. They will represent summative evaluations in that they will demonstrate to what degree the VICON prototypes represent a successful meeting of the objectives of the project. They will also represent a formative output that will inform further development in the final phase of the project and will be used to inform the future of the of the VICON approach beyond the project.

4 Ethical issues

It is vital that user relevant information is carried out to the highest levels of ethical consideration for all participants. To this end in this and subsequent work, especially when building user models and profiles, the VICON consortium will ensure that ethical issues are observed, making special emphasis in preserving the anonymity and privacy of users.
NCBI is co-ordinating the Ethical Issues Management for VICON and is representing VICON in the VUMS Cluster on ethical issues. At a National level, UoB is dealing with ethical issues management for Germany, RNID for UK and NCBI for Ireland.

During Ethical Issues Management in VICON, the following resources were referred to:

- British Psychological Society Code of Conduct: Ethical Principles for Conducting Research with Human Participants (http://www.bps.org.uk/the-society/code-of-conduct/support-for-researchers_home.cfm)
- Ethical Review in FP7: European Commission Guidance for Applicants – Informed Consent (ftp://ftp.cordis.europa.eu/pub/fp7/docs/informed-consent_en.pdf)
- Ethical Review in FP7: European Commission Guidance for Applicants – Privacy (ftp://ftp.cordis.europa.eu/pub/fp7/docs/privacy.doc)

Ethical Issues in VICON are divided into two phases: before user testing and during user testing.

Before User Testing

Issue 1: Ethical Sourcing of Users

RNID, NCBI, FIT, and UoB will primarily source the end-users from their own database. Ethical principles of respective organisations will be followed when sourcing individuals for the field trials.

Issue 2: Potential Risks of Subcontracting Work to an External Company

One sub-contractor will take part in VICON. The sub-contracting company, Ergonomidesign, not only fosters a long and reliable relationship to DORO, but has proven to be fully committed to DORO's assignments. Ergonomidesign fully complies with ethical issues. This is additionally ensured within the subcontract with Ergonomidesign, where it is mentioned that compliance to ethical issues is guaranteed by the sub-contractor.

During User Testing

Issue 3: Debriefing

Following the research it is important to debrief the user. In the case of VICON a final verbal description of the nature of the investigation was provided, in case anything required clarification, a final opportunity was given to the user to ask questions.

Issue 4: Consideration of the Consequences of the Research

In VICON it is necessary for investigators dealing with user to consider the ethical implications and psychological consequences for the participants in their research. The investigation will be considered from the standpoint of all participants; foreseeable threats to their psychological well-being, health, values or dignity will be eliminated.

Issue 5: Consent

Whenever possible, the investigator will inform all participants of the objectives of the investigation. The investigator will inform the participants of all aspects of the research or intervention that might reasonably be expected to influence willingness to participate. The investigator will explain all other aspects of the research or intervention about which the participants enquire. An Informed Consent Form will be completed by participants prior to testing.

Issue 6: Welfare and dignity of the participants.

Investigators should realise that they are often in a position of authority or influence over participants who may be their students, employees or clients. This relationship must not be allowed to pressurize the participants to take part in, or remain in, an investigation.

The payment of participants must not be used to induce them to risk harm beyond that which they risk without payment in their normal lifestyle. Users involved in the field trials were offered a gift (e.g. gif voucher) as a form of thank you for their participation.

Issue 7: Debriefing

When the data have been collected, the investigator will provide the participants with any necessary information to complete their understanding of the nature of the research. The investigator will discuss with the participants their experience of the research in order to monitor any unforeseen negative effects or misconceptions.

Issue 8: Withdrawal from the Investigation

At the onset of the investigation investigators will make plain to participants their right to withdraw from the research at any time, irrespective of whether or not payment or other inducement has been offered. The investigator must attempt to ensure that participants know of their right to withdraw.

In the light of experience of the investigation, or as a result of debriefing, the participant has the right to withdraw retrospectively any consent given, and to require that their own data, including recordings, be destroyed.

Issue 9: Confidentiality

Information obtained about a participant during an investigation is confidential unless otherwise agreed in advance. Participants in the research have a right to expect that information they provide will be treated confidentially and, if published, will not be identifiable as theirs. All participants will be assured of this.

Issue 10: Protection of participants

Investigators have a primary responsibility to protect participants from physical and mental harm during the investigation. Normally, the risk of harm must be no greater than in ordinary life, i.e. participants should not be exposed to risks greater than or additional to those encountered in their normal lifestyles.

Participants will be informed of procedures for contacting the investigator within a reasonable time period following participation should stress, potential harm, or related questions or concern arise despite the precautions required by the Principles. Where research procedures might result in undesirable consequences for participants, the investigator will detect and remove or correct these consequences.

Where research may involve behaviour or experiences that participants may regard as personal and private the participants will be protected from stress by all appropriate measures, including the assurance that answers to personal questions need not be given. There will be no concealment or deception when seeking information that might encroach on privacy.

Issue 11: Observational research

Studies based upon observation must respect the privacy and psychological wellbeing of the individuals studied. VICON requires that the participants give their consent to being observed. The nature of the observation will be made clear to the participants prior to the user trials.

Issue 12: Giving advice

During research, an investigator may obtain evidence of psychological or physical problems of which a participant is, apparently, unaware. In such a case, the Investigator has a responsibility to inform the participant if the investigator believes that by not doing so the participant's future well-being may be endangered.

If, in the normal course of psychological research a participant solicits advice concerning educational, personality, behavioural or health issues, caution should be exercised. If the issue is serious and the investigator is not qualified to offer assistance, the appropriate source of professional advice should be recommended.

If a user is identified as having a mild hearing impairment (based on the result of the RNID online hearing test) that they were not previously aware of, the investigator should suggest that the individual asks the advice of their GP the next time they attend and request a hearing check.

5 Conclusion

This deliverable presented the plan for conducting the evaluation phase of the VICON project. The evaluation will be based on the VICON prototype, which includes the software modules of VICON as well the end products designed according to the findings of the VICON environment.
The three phases of the design cycle supported by VICON, within which designers can design accessible consumer products, based on the recommendations given to them during the design phases.

The Evaluation will be performed along the following lines:

- Designer evaluation, to test the VICON components and their suitability for supporting designers in the entire design lifecycle
- Beneficiaries experience evaluation, to test the end products, in the frame of the UCD approach followed in the VICON project
- Operatively, the evaluation will be conducted at up to four pilot sites, located in Ireland, UK, Germany and Turkey

6 References

[1.] VICON D1.3: Virtual users in a human-centred design process
[2.] VICON D1.1: End user and environment field study
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[4.] VUMS Cluster D1.6.4: User Model Interoperability Requirements
[5.] R. Orpwood, J. Chadd, D. Howcroft, A. Sixsmith, J. Torrington, G. Gibson, G. Chalfont; Designing technology to improve quality of life for people with dementia: user-led approaches; Univ. Access Inf. Soc.; vol. 9 (3); pp. 249-259; 2010.
[6.] J. Nielsen; Usability Testing, in G. Salvendy (ed.), Handbook of Human Factors and Ergonomics, Second Edition, John Wiley & Sons, New York, 1997.
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7 Appendix A: Questionnaires

VICON user field research User no. : ……..

Mobile phone

[The purpose of this section is to ascertain the experience of the user with mobile phones in general and their comfort and confidence when trying a new phone]

1. Do you have a mobile phone?

2. What make/model?

3. For how long have you used mobile phones?

4. How often do you use your mobile phone? Every day / once a week / once a month / other

5. What do you use your mobile phone for? (describe their typical use)

(e.g. calls, texts, calendar, reminders, camera etc.)

6. How often do you change mobile phone? (describe as much as possible the history of their mobile phone use)

Environment

Please describe in as much detail as possible

Consider:

- *What type of room*
- *Size of room*
- *Heat*
- *Light*
- *Other things in the room*

Participant

Wearing Corrective lenses (glasses or contact lenses) / hearing aids / Other ……..

VICON user field research – Using the mobile phone

Go to a normally lit room. The user may stand or sit for these tasks – let them choose which is the most common situation for them when using their mobile phone.

1. Turning the phone on and off

Task 1: Please turn the mobile phone on

Observation

Consider:

- *Ease of access to control*
- *Button size*
- *Force required*
- *How they hold and operate the phone*

1.1 Was it easy for you to turn the phone on? Yes / No

Comments

1.2 Did you have any problems? Yes / No

Comments

1.3 Did you have any discomfort? Yes / No

Comments

Task 2: Please turn the mobile phone off

Observation

Consider:

- *Ease of access to control*
- *Button size*
- *Force required*
- *How they hold and operate the phone*

1.4 Was it easy for you to turn the phone off? Yes / No

Comments

1.5 Did you have any problems? Yes / No

Comments

1.6 Did you have any discomfort? Yes / No

Comments

2. Making a voice call

Task 3: Ask them to turn the phone on again

Please call this number 1800 365 000

Observation

Consider:

- *Keys*
- *Displays*
- *How they hold and operate the phone*

2.1 Was it easy for you to make this call? Yes / No

Comments

2.2 Did you have any problems? Yes / No

Comments

2.3 Did you have any discomfort? Yes / No

Comments

3. Receiving a voice call

Task 4: Go into another room, call the mobile phone and have a short conversation.

"I shall call the phone, please accept the call and we shall have a short chat"

Observation

Consider:

- *Ease of receiving the call*
- *Keys*
- *Displays*
- *How they hold and operate the phone*

3.1 Was it easy for you to realise that you were receiving a call? Yes / No

Comments

3.2 Did you have any problems? Yes / No

Comments

4. Performance during a voice call

Is the user: wearing hearing aids / not wearing hearing aids

Comments

Task 5: Please call this number again 1800 365 000 and listen to it

4.1 Is it easy for you to hear the speech? Yes / No

Comments

4.2 Is it easy for you to understand the speech? Yes / No

Comments

4.3 Did you have any problems? Yes / No

Comments

Task 6: Please adjust the volume until you have the best loudness and clarity for this call

Is it easy for you to adjust the volume? Yes / No

Comments

Did you have any problems? Yes / No

Comments

Did you have any discomfort? Yes / No

Comments

Task 7: Now, please listen a little longer at this ideal setting

How would you describe the volume?

☐ Loud ☐ Satisfactory ☐ Quiet

Comments

How would you describe how clear the speech sounds?

☐ Very clear ☐ Satisfactory ☐ Unclear, it sounds muffled or distorted

Comments

5. Sending an SMS text message

Make sure that the user regularly send and receives SMS text messages – if not go to section 6

5.1 Do you normally use predictive texting? Yes / No

Carry out the following tasks with/without predictive text in accordance with their normal use.

Task 8: Please send this message:

'Are we still going to the Galway races?'

To: 087 6645 618

Observation

Consider:

- *Number of errors*
- *When/how corrections are made*
- *Keys*
- *Display*
- *How they hold and operate the phone*

Time taken to complete this task ……. *Min* …… *Sec*

Number of mistakes made …… *Describe*

5.2 Was it easy for you to write and send this text message? Yes / No

Comments

5.3 Did you have any problems? Yes / No

Comments

5.4 Did you have any discomfort? Yes / No

Comments

6. Receiving an SMS text message

Task 9: Send the participant this message:

'Yes that's a great idea. Shall we drive or go by train?

Ask them to please accept and read the message

Observation

Consider:

- *Number of errors*
- *When/how corrections are made*
- *Keys*
- *Display*
- *How they hold and operate the phone*

Alert

What type of alert do they use? Ring only / Vibrate only / Ring and vibrate / other : ……..

6.1 Was it easy for you to know that you had received a text message? Yes / No

Comments

6.2 Was it easy to open and read this text message? Yes / No

Comments

6.3 Did you have any problems? Yes / No

Comments

6.4 Did you have any discomfort? Yes / No

Comments

7. Keys and controls

Main number controls

7.1 Do you think the number keys are large enough for you? Yes / No

Comments

7.2 Do you think the number controls are spaced apart enough? Yes / No

Comments

7.3 Did you have any problems using the number keys? Yes / No

Comments

7.4 Did you have any discomfort when using these controls? Yes / No

Comments

7.5 Did you have any problems with the labelling on the controls? Yes / No

Comments

Other controls

Consider all other types of control, i.e. volume controls on side, function and menu controls

Control	Is it large enough?	Is it spaced far enough apart from others?	Did you have any problems when using?	Did you have any discomfort when using?	Did you have any problems with the labelling?
	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No

8. Main display

Carry out this task in both the normal room and either outside or in a brightly lit room with the user standing up

Task 10: Please look at the menu items on your main display, read the previously sent text message and start dialling a telephone number

8.1 Is the main display easy for you to read? Yes / No

Comments

8.2 Do you understand the icons or descriptions? Yes / No

Comments

8.3 Did you have problems using the main display? Yes / No

Comments

8.4 In relation to the display, what are the good points and drawbacks?

Good points	Drawbacks

9. Adding contact details to the phonebook

Ask if they use their phonebook, if not go to section 10

Task 11: Please add these details to the phonebook

James Murphy 01 218 3479

Observation

Consider:

- *Understanding of process*
- *Use of menu system*
- *Number of errors*
- *When/how corrections are made*
- *Keys*
- *Display*
- *How they hold and operate the phone*

Could it be completed successfully? *Yes / No*

Time taken to complete this task ……. *Min* …… *Sec*

Number of errors made ……..

9.1 Was it easy for you to do this? Yes / No

Comments

9.2 Did you have any problems? Yes / No

Comments

9.3 Did you have any discomfort? Yes / No

Comments

10. Recharging the phone

Task 12: Please put the phone on charge

Observation

Consider:

- *Ease of connecting*
- *Grip issues*
- *Force*
- *Dexterity issues*

10.1 Was it easy for you to put the phone on charge? Yes / No

Comments

10.2 Did you have any problems? Yes / No

Comments

10.3 Did you have any discomfort? Yes / No

Comments

11. Other Features and Final Comments

11.1 Explore any other features on the phone that you have not yet looked at.

11.2 How does this phone compare to your own mobile phone?

11.3 Describe the key features of the phone that you most like.

11.4 Describe the key features of the phone that you least like.

8 Appendix B: VUMS Cluster Glossary of Terms

Term	Explanation
User Model	An (abstract) User Model is a set of user characteristics required to describe the user of a product. The characteristics are represented by variables. The user model is established by the declaration of these variables. It is formally described in a machine-readable and human-readable format. An instantiation of the user model is a user profile.
User Profile	A User Profile is an instantiation of a user model representing either a specific real user or a representative of a group of real users. It is an instantiation of an (abstract) User Model and it is formally described in a machine-readable and human-readable format. A user profile can be employed to generate adaptive user interfaces or simulations.
Virtual User	A Virtual User is a representation of a user based on a User Profile. It includes components, which are able to interact with other virtual entities e.g. virtual products or software applications. VU's intended for simulation purposes represent the human body as e.g. a kinematic system, a series of links connected by rotational degrees of freedom (DOF) that collectively represent musculoskeletal joints such as the wrist, elbow, vertebra, or shoulder. The basic skeleton of the model is described usually in terms of kinematics. In this sense, a human body is essentially a series of links connected by kinematic revolute joints. Each DOF corresponds to one kinematic revolute joint, and these revolute joints can be combined to model various musculoskeletal joints.
Environmental Model	An Environmental Model is a formal machine-readable set of characteristics used to describe the use environment. It includes all required contextual characteristics besides the user model, the interaction model, the device model, the product and related user tasks.

Device Model	A Device Model is a formal machine-readable representation of the features and capabilities of one or several physical components involved in user interaction. It is important to carefully discriminate between user and device model as they are two kinds of models. The device model expresses capabilities of the device. A given device can be used by many different users and a given user could use different devices. By carefully separating the different functionalities of device modelling and user modelling in design scenarios it will be easier to enumerate the attributes for each model and from them develop the matching function and attributes of the adaptation process.
User Agent	A User Agent is any end user software (like browser, or other user interface component) that can retrieve and render application content and invoke requests to the User Agent Capabilities Model to modify the application content.
User Agent Capabilities Model	A User Agent Capabilities Model is a formal machine-readable representation of the capabilities of the user agent related to user interaction.
User Interaction Model	A User Interaction Model is a machine readable representation of the interaction behaviour of an application. The interaction model is maintained UI-agnostic, which means it is independent of the concrete format of user interface output- and input data. Interaction model is often also referred to as abstract user interface model, like for example UIML, UI Socket, XForms, etc. It should be noted that the Interaction model can be used for adaptation of Human Machine Interfaces (HMI) and for simulating the use of an application /product with a virtual user.
Context Model	A Context Model is a machine-readable representation of information that can be used to characterize the situation of an entity. An entity is a person, a place, a device, or a product that is considered relevant to the interaction between a user and an application, including the user and applications themselves. All the different models that are employed within the VUMS cluster to capture information about users, devices, the environment, and the application are contributing to the overall context and can be

	considered as (part of) a context model.
Simulation	Simulation is the process that enables the interaction of the virtual user with the application model within an artificial environment. The simulation can be real-time or off-line. Real-time simulation can be performed autonomously or manually, where the operator can interact with the environment from a 1st or 3rd person perspective. Accessibility assessment and evaluation can be performed automatically or subjectively by the operator.
User Model/Profile Validation	User Models are always simplified descriptions of the user. Validation is the process to determine whether the model is an appropriate representation of the user for a specific application. For a mathematical model it needs a statistical validation process. If the model is non-mathematical then it should be validated through qualitative processes.
Adaptive User Interface	Adaptive User Interfaces are user interfaces that adapt their appearance and/or interaction behaviour to an individual user according to a user profile. In contrast to adaptable user interfaces, which are modified by a deliberate and conscious choice of a user, adaptive user interfaces automatically initiate and perform changes according to an updated user profile.
User Interface Design Pattern	A User Interface Design Pattern is an approved user interface solution to a recurring design problem. User Interface Design Patterns have a formalized description. For the use in adaptive user interfaces, design patterns have a representation in form of reusable software components which can be put together to complete user interfaces during run-time.