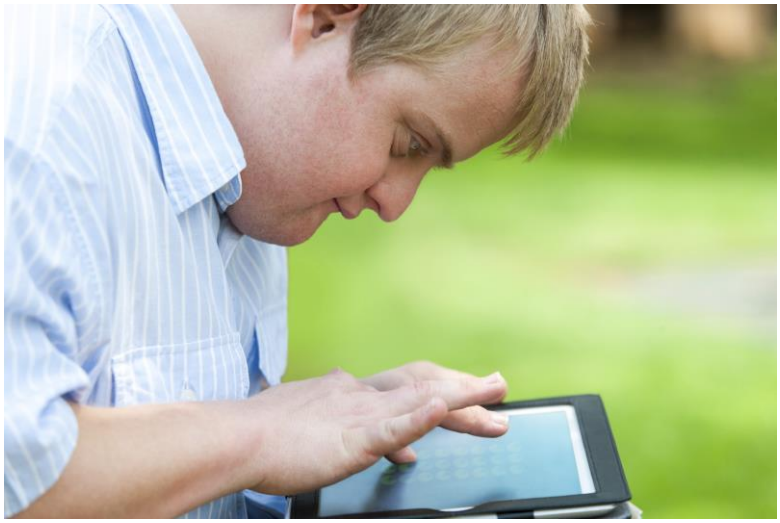
POSEiDON

Pers**O**nalized **S**mart **E**nvironments to increase **I**nclusion of people with **DO**wn's sy**N**drome

R2 – review 3

Personalisation in POSEIDON



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Contents

Executive summary

The purpose of this document is to present the personalisation mechanisms in the POSEIDON-system. Personalisation in POSEIDON is anchored in the fundamental end user needs and preferences of POSEIDON's target group: persons with Down syndrome.

Personalisation has been an important issue since the inception of the project. Personalisation in POSEIDON means that we are aiming to meet the needs of the individuals in ways that are comfortable and easy to use for them and therefore provide a good user experience. The abilities may vary significantly for people with Down syndrome. For the primary end users, the personalisation may also mean ordinary ICT-related accessibility and implementation of special features to meet their abilities in best possible ways.

The primary end-user and the carers can do the POSEIDON personalisation. The primary end user can do fairly simple personalisation task at the mobile device.

We provide a POSEIDON web. Through this, the carer, often family carers but also formal carers and other stakeholders, can configure the whole POSEIDON system to the benefit of the individual primary end user.

The carer can produce content for the POSEIDON system in form of symbols, pictures, photos, videos, sound and text. The carer can define routes for the navigation app and can augment the route with illustrating pictures, photos, text and spoken messages. The calendar is an important reminder and communication service for the primary end user in POSEDION. The carer can define the elements of the calendar and how it should be presented for the primary user, depending on the primary user's skills and abilities. The carer can give additional information to each event in the form of photos, videos and text, e.g. a video showing how to pack the school bag for tomorrow or a reminder to wear warm clothes if the weather is cold.

In POSEIDON, we strive for realisation of accessible solutions on all POSEIDON platforms (web, apps on smartphones or tablet PCs etc.). Accessibility can be viewed as the "ability to access" and benefit from some system or entity. The concept focuses on enabling access for people with special needs, or enabling access using assistive technology. We will provide colour palettes and a set of symbols and icons for persons with learning disabilities. This way, we make it easier for the carer to personalise the POSEIDON services to fit the abilities of the user.

1. Introduction

The main objective of the POSEIDON project is to exploit ICT as an instrument to increase the quality of life and support a more independent life and inclusion in the society for people with Down syndrome. The whole idea with POSEIDON addresses the target outcome (a) from the work programme:

> *"Accessible and intuitive solutions for personalised interfaces to smart environments and innovative services designed for all, including people at risk of exclusion – notably persons with disabilities, with low levels of digital literacy/skills, and older persons."*

The purpose of this document is to present the personalisation mechanisms, including the context awareness features in the POSEIDON system, to present the anchorage of these in the scientifically documented user profiles and learning capabilities of people with Down syndrome, and finally to draft the additional options for personalisation of POSEIDON. This document should be studied in connection with Deliverable D5.1 (V4), Section 4.4, in order to fully understand which personalisation support is offered by the POSEIDON framework.

This document presents our work to meet these requirements – according to the projects team's expert and scientific knowledge – in a most manageable way for the target group of primary end users.

This report has also a connection to the design guideline of POSEIDON. The purpose of first version of POSEIDON design guidelines was to kick off the prototype development with "family resemblance" between the different parts of the system, and to create a minimum level of visual clarity embedded in the first versions of software for end users. During the user-centric activities in the project, an understanding of the special accessibility and design requirement is continuously evolving. After Pilot 2, these guidelines will be totally revised, taking into account the learnings. The POSEIDON guidelines will then be published as part of the framework and development platform for any party to bring useful apps for people with Down syndrome, into being. The final guidelines will *not only* encompass accessibility guidelines as known from e.g. the W3C organisation's[1] guidelines, but explain how to meet the special needs, skills and capabilities of people with Down syndrome.

In addition to the POSEIDON approach to personalisation as explained in the reminder of this document, the end users should familiarise themselves with accessibility and personalisation options that are provided by software and hardware providers[2], such as browser accessibility, and device accessibility features, and for example different sets/systems of symbols (MAKATON[3], Boardmaker[4], PECS, Clicker[5], Widgit[6]) that support people with reading and learning difficulty. These are not covered in this report.

2. Intellectual capability of people with Down syndrome

Personalisation in POSEIDON means we are aiming to meet the needs of individuals with Down syndrome in ways that best suit their learning profile and ensures an optimum user experience. The abilities may vary significantly for people with Down syndrome. For the primary end users, the

[1] https://www.w3.org/TR/WCAG20/ and https://www.w3.org/WAI/mobile/
[2] E.g., accessibility features of Windows: http://windows.microsoft.com/en-us/windows/what-accessibility-features-windows-offer#1TC=windows-7&section_2
[3] http://www.makaton.org/aboutMakaton/
[4] http://www.mayer-johnson.com/boardmaker-software
[5] http://www.cricksoft.com/uk/products/clicker/home.aspx
[6] http://www.widgit.com/symbols/ and Communicate in Print (using Widgit symbols) http://www.widgit.com/products/inprint/index.htm

personalisation may mean ordinary ICT-related accessibility and implementation of special features to meet their abilities in best possible ways.

In particular, we are focussing on an interaction design that takes into consideration the target group's requirements that relate to vision, fine motor abilities and intellectual ability (especially reading, writing, and comprehension). These are well explained in publications and on specialist websites that offer Down syndrome-specific knowledge, for example www.downs-syndrome.org.uk. Below, a short resume:

The following learning characteristics can be considered typical of most children with Down syndrome[7]:

- Visual learning style – visual processing and visual memory skills are strengths.
- Reading is usually a relative strength, compared to oral language.
- Number can be an area of difficulty; focus should be on functional maths that is useful for everyday living
- Social understanding and non-verbal communication are strengths.
- Hypotonia – reduced muscle tone causes difficulties in movement control (both fine and gross motor skills can be delayed).
- There is a significant risk of auditory and/or visual impairments, around 50 % of children with Down's syndrome have some form of hearing impairment (sensorineural hearing loss and conductive hearing loss) and about 70 % of children with Down syndrome need to wear glasses by the time they start school. Even with corrective prescription individuals with Down's syndrome have difficulty focuses 'at near'.
- Specific speech and language profile – receptive language is usually superior to expressive language.
- Auditory short-term memory and auditory processing an area of weakness. Auditory memory difficulties should be compensated for by the use of visual supports and prompts wherever possible (signs, pictures, words).

There is also a list of implications from the learning profile at the same website[8], the most important for POSEIDON being the above-mentioned auditory memory weakness. More profound explanation on these aspects can be found in Down Syndrome Education International[9]. The importance of paying appropriate attention to learning styles and adaption by people with Down syndrome is additionally underlined by Down syndrome learning expert Sue Buckley in her publication 'Meeting the educational needs of children with Down syndrome: Keys to successful inclusion'[10].

Implications of these for POSEIDON are taken into account in the selection of personalisation and context awareness features and the design of these, as explained in Chapters 3, 4 and 5. In Chapter 6, we present POSEIDON's future prospects for personalisation.

3. Personalisation in POSEIDON

In a nutshell, personalisation in POSEIDON is about taking into account following knowledge about the end users, people with Down syndrome:

[7] Down Syndrome Ireland http://www.downsyndrome.ie/typical-learning-profile-of-a-child-with-down-syndrome/
[8] Down Syndrome Ireland www.downsyndrome.ie/implications-of-learning-profile/
[9] Development and learning http://www.dseinternational.org/en-us/about-down-syndrome/development/
[10] http://www.nfer.ac.uk/nfer/PRE_PDF_Files/02_28_01.pdf

Challenges

- They are often visually oriented end users.
- They may have visual and hearing impairment.
- They may have difficulty with fine motor skills.
- They may have difficulty with the short-term working memory.
- They may have difficulty with learning, conceptualisation, abstract thinking and problem solving.
- They may have a reading difficulty, and some do not read at all.
- The may have difficulty in the application of existing knowledge in new situations/contexts.

Strengths

- They can master many activities of daily life with appropriate support or through repeating training over an extended period.[11]
- They are often clever users of information technology such smart phones and tablet PCs.

The personalisation aspects of POSEIDON can be divided into three main categories: personalised content, preferences for apps, and other configuration. For personalised content, we have routes, calendar events and instructions, shopping lists, and video lists. For each of these, we in this document illustrate what content these can have (cf. the numbered list below). Media, including symbols, is an important part of this. It is important to note that interaction with content is always done in more than one application, so content is not tied to a specific app.

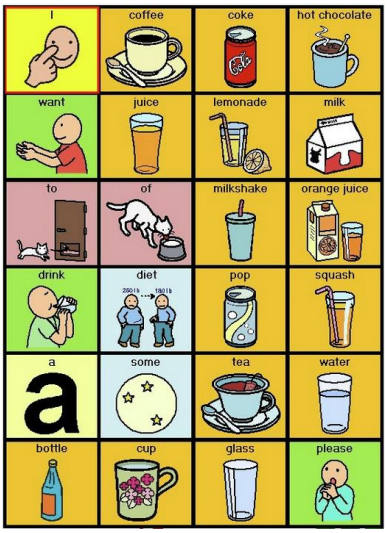
Below, we present the main personalisation options that have been implemented.

Content-related personalisation

1. **Supportive symbols in calendar events**: Some persons with Down syndrome have low reading ability. Multimodality is one of the cornerstones of the personalisation in POSEIDON. Carers who insert the events in the calendar may add symbols that for example bring the end user to supportive functionality, such as lists, videos etc.:

[11] This is very relevant, especially if we keep in mind that personalisation is always possible to change; either it can be less, because the end users trained a certain skill with the system and do not need anymore all personalisation. One example is fewer steps in the calendar instruction lists, or making the calendar prompts appear closer to the event.). Similar learning may also apply for the reading process where symbols are not necessary anymore, more words can be used, or it is enough just to show the back bag and not anymore *what* to pack. This is about increasing skills through POSEIDON, not becoming dependent on POSEIDON. Observing the development is an important task of the secondary user in order to adapt the personalisation to the right level. This can change during the usage of POSEIDON.

Symbols can be selected either from the POSEIDON's own symbol repository, or other symbol sets, e.g. pictograms that are commonly used for symbol *writing,* specially designed for communication with persons with intellectual disability[12] such as Makaton, Boardmaker, PECS or the like:



Uses of these types of symbol libraries require licence with subscription and are subscribed by schools and other institutions dealing with children/pupils with special needs.

Some end users need symbols, and other 'easy-to-read'-assistance. For some POSEIDON end users, easy-to-read text combined with POSEIDON symbols may be a sufficient solution (Easy-to-read is something for all people with learning problems[13].)

Carers who insert in the calendar appointments can also personalise the text items by choosing to write the text in 'ALL CAPS' and/or use dashes in long words, all depending on the reading ability of the person they are caring for.

[12] http://talksense.weebly.com/symbols.html

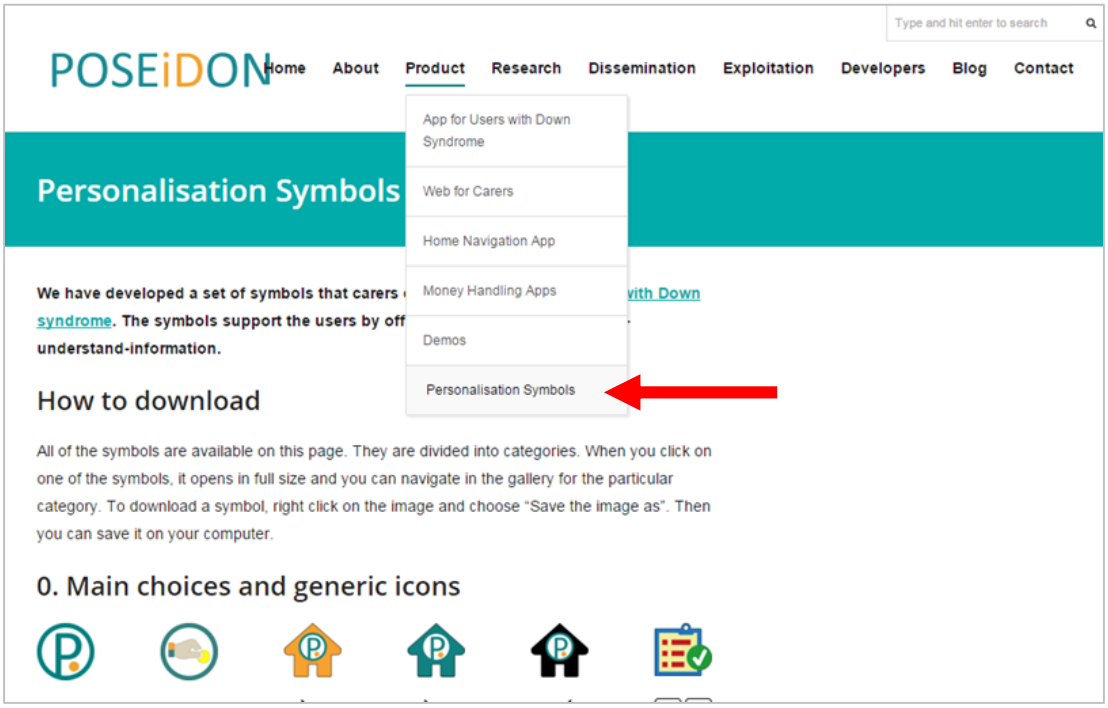
[13] http://easy-to-read.eu/?page_id=8 and http://www.leichtesprache.org/ and Information for all European standards for making information easy to read and understand http://www.inspiredservices.org.uk/Information%20for%20all.pdf

It is also possible to add video content to the apps as shown later in this document.

2. **POSEIDON's own symbol repository** has been developed to support carers' personalisation effort without access to licence-based libraries (above-mentioned). The use of the symbols can be manifold, from diverse calendar functionalities to different lists etc. Currently, the repository includes 8 categories of symbols that have been produced in the project:

    0. Main choices and generic icons
    1. Calendar
    2. Preferences and personalisation
    3. Status and commands
    4. Tasks and activities
    5. Items
    6. Map and navigation
    7. Money handling and gaming

The whole repository is available on the POSEIDON web on http://www.poseidon-project.org/product/symbols/:

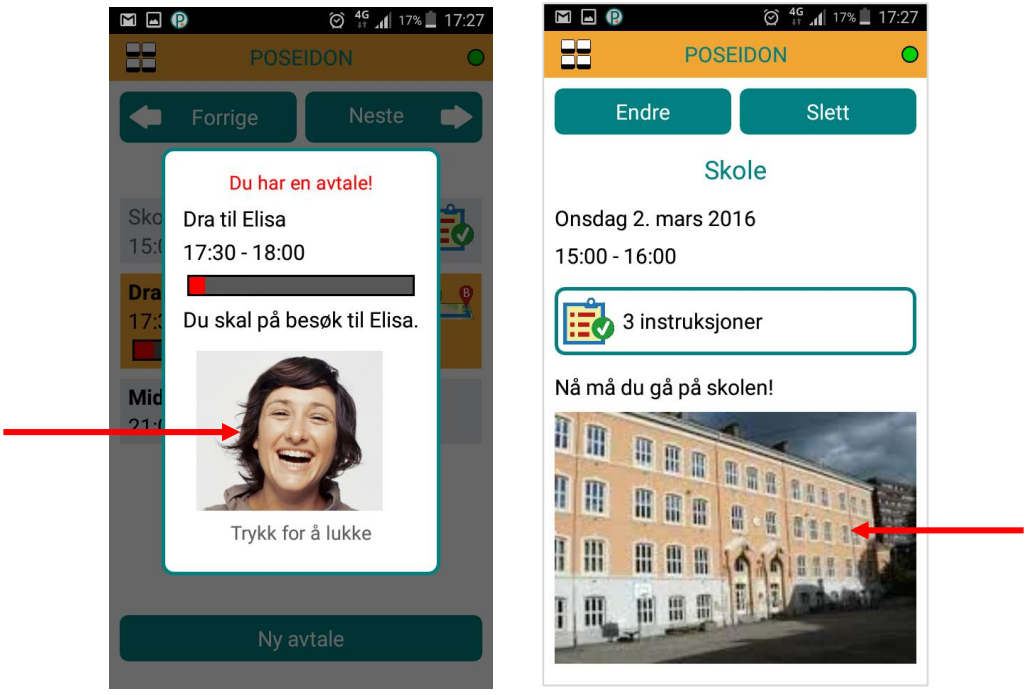


The symbols are visually clear and designed to create readable image also in small size, e.g. on a smartphone.

Example category: Tasks and activities

Each symbol can be expanded to full size, and they have a name:

3. In addition to the POSEIDON symbol repository, carers may **upload any picture material** that they have access to, e.g. on their own PCs, such as photographs or drawings. This is useful for example when a calendar event is about visiting a familiar person, or going to a place where visual recognition is helpful:



… or adding instruction list items to the event so that the end user recognises as her/his personal things to be taken along (e.g. when symbols are sufficient for recognition):

4. For end users who need an additional modality (in addition to text and symbols) in the calendar or navigation, application, carers can **record spoken messages or instructions**. This aspect of personalisation can compensate for the drawbacks of synthetic voice:

   - It is sometimes too fast.
   - Sometimes synthetic voice reads in a "funny" way vis-a-vis the spelling, is and is then not understandable to the person with Down syndrome.
   - The frequencies of it can be difficult, if the person has hearing difficulty.
   - Synthetic voices are not always available; they have to be down-loaded.
   - Synthetic voice applications may be too expensive for some families.

5. Yet another personalisation feature connected to the navigation app is the opportunity to **connect specific picture material and advice in the route** that is created step by step by the carer.

   For many persons with Down syndrome, conceptual and/or abstract information, such as maps and routes on maps, can be concretised and made highly personal according to their particular knowledge of the environment, and be concretised by providing route details that can be recalled by the end user in the real outdoors environment.

6. **Video material** is an example of advanced personalisable content that can be utilised to support the end user in different ways. Personal video clips can be added to the calendar similar to symbols, and also accessed through a list of videos[14]. For many persons with Down syndrome, carer-made video clips of procedural everyday activities may be to great support, especially according to possible *working memory difficulties and abstract information such as maps*. Example: Calendar tells to go to cinema. Video clip shows how to fetch the ticket from the ticket automate.

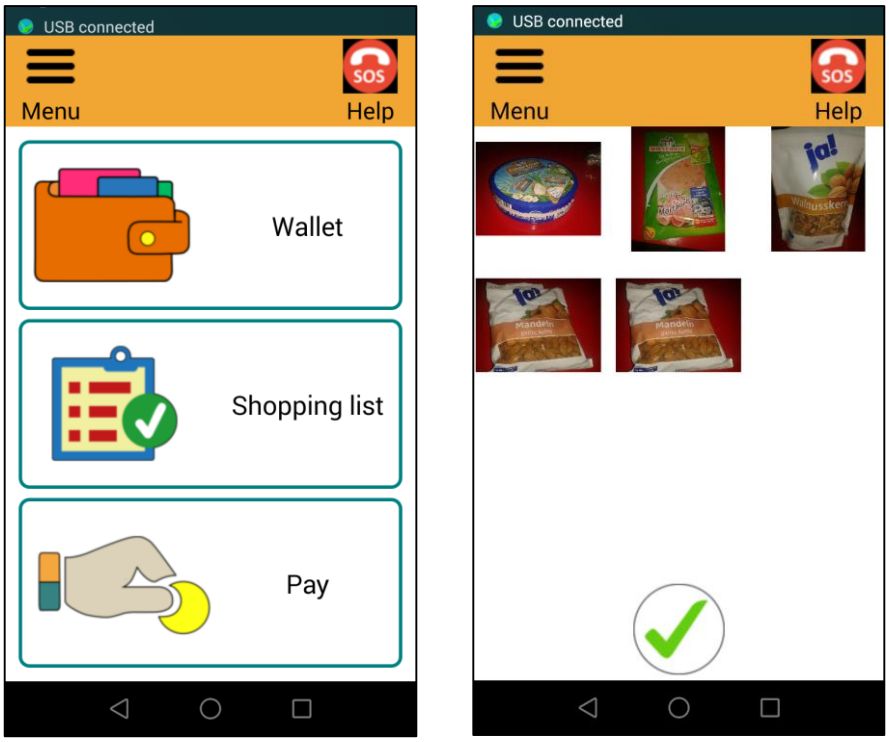
Other functionalities that support personalisation

7. It is possible to **define the timing of the reminding prompt** in the calendar. This is extremely important, because some cannot be reminded too long before an event/appointment, as they are fixed on the current task and are not able to do other things up to the event. Others need a reminder long time before, because it is necessary for them to know the exact plan, what is coming and when. These are opposite types of cognitive styles, but both exist.

8. The **list functionality** as such is an important functionality for personalisation. It can compensate for working memory difficulty and be used in a number of different situations, to include any items that support a particular end user (e.g. things to put in the school-bag, steps to take during the morning, shopping list[15], places to visit etc.).

   The personalised shopping list with products and prices is a very important aspect of daily coping and independence, in addition to the calendar functionality and navigation outdoors:

[14] The list of videos will appear on the home page of the POSEIDON mobile application as one of the main choices (see Chapter 6).
[15] The shopping app will appear on the home page of the POSEIDON mobile application as one of the main choices (see Chapter 6).



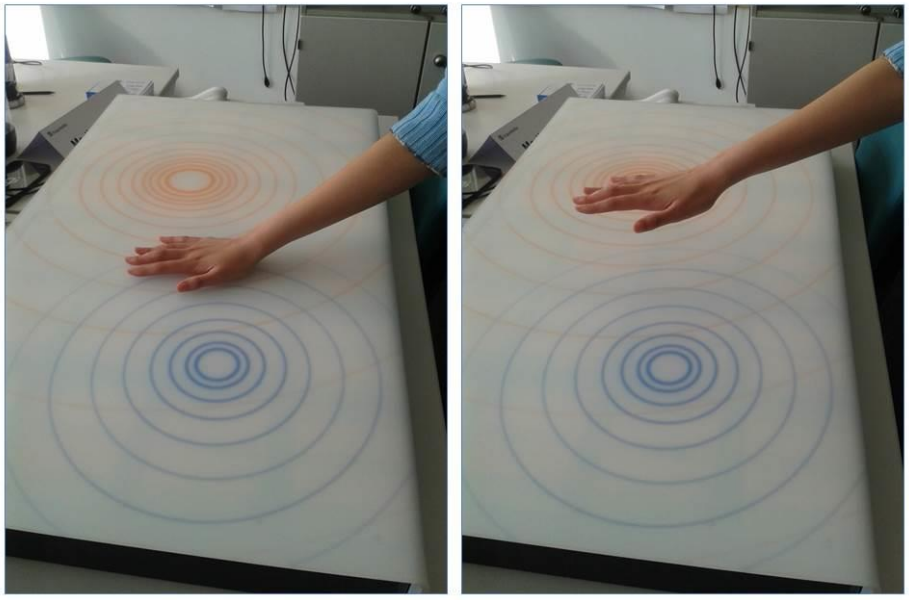
The two main personalisation aspects offered by the shopping app are:

- The ability to input into the virtual wallet exactly the coins and bills used for shopping.
- The shopping list is highly personalised since one can input own images and specific prices of the product.
- The shopping app supports personalisation.

9. Finally, a special instance of personalisation is **the interactive table itself**. In addition that this input device is directly connected to the training[16] and learning aspect of POSEIDON, it represents personalisation for users who, due to *fine motor difficulties*, will struggle with training on a smartphone or tablet PC.

The table offers three alternative interaction methods: knocking, touching and hovering (having the hand in the air). All these are implemented because we observed the need and discussed it with the secondary and tertiary users at the first seminar in Oslo where we also tried out different apps on tablets, the WII and a Kinect in order to understand the interaction constraints.

[16] By using the Money Handling Training app, the primary end user can train on handling money so that she is prepared for shopping, whereas the Money Handling Assistance is a mobile app that can support the end user on the spot – when s/he is out shopping.

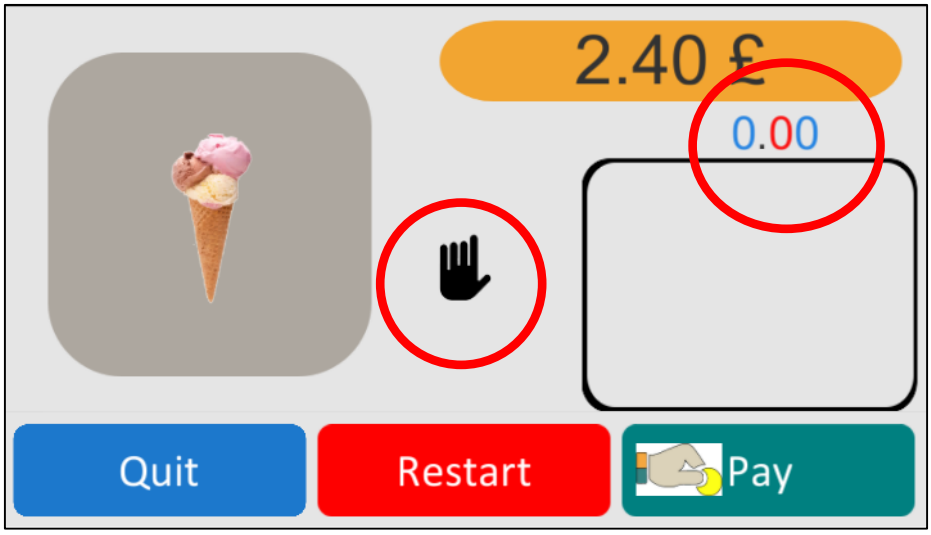


Touch **Touchless**

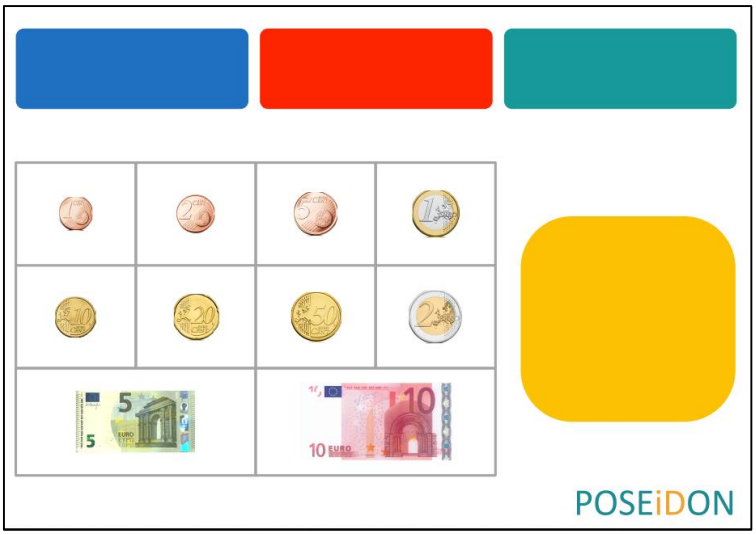
This interaction mode personalisation is implemented in an application for the interactive table: the Money Handling Training. Here through a preferences screen the interaction mode and some game specific settings can be selected.

These personalisation options are:

- whether to show the cursor or not
- whether to show the aiding sum or not
- for the hovering interaction to set the time needed for a button or field of the table to be selected



In addition to the interaction mode, the surface of the table can be adapted to the implemented application in form of an overlay.



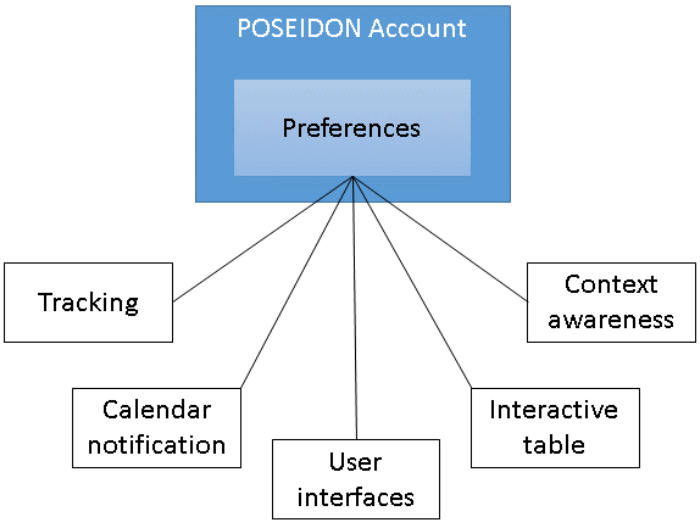
4. Application preferences

POSEIDON applications have settings and personal preferences to customise the application functionality. The POSEIDON development framework provides a central store for all such settings and preferences, for all POSEIDON applications. **This is part of the POSEIDON account, stored in the Smart-Platform part of the infrastructure**.

All applications do an authenticating transaction with the infrastructure, logging in as a POSEIDON user. They can then request the user profile of the POSEIDON account, where any number of preferences can be stored as key-value pairs. Applications can also update preference values, writing these back to the central store. New applications developed for POSEIDON should use this personal profile, and look at the preferences already defined, to reuse the relevant preferences and insure consistent personalisation across applications.

The figure below shows some of the preference categories in use in the prototype system:

- Tracking and calendar notification preferences are used by the mobile application.
- Web and mobile application have user interface preferences.
- The context awareness middleware and interactive table have their own preferences.



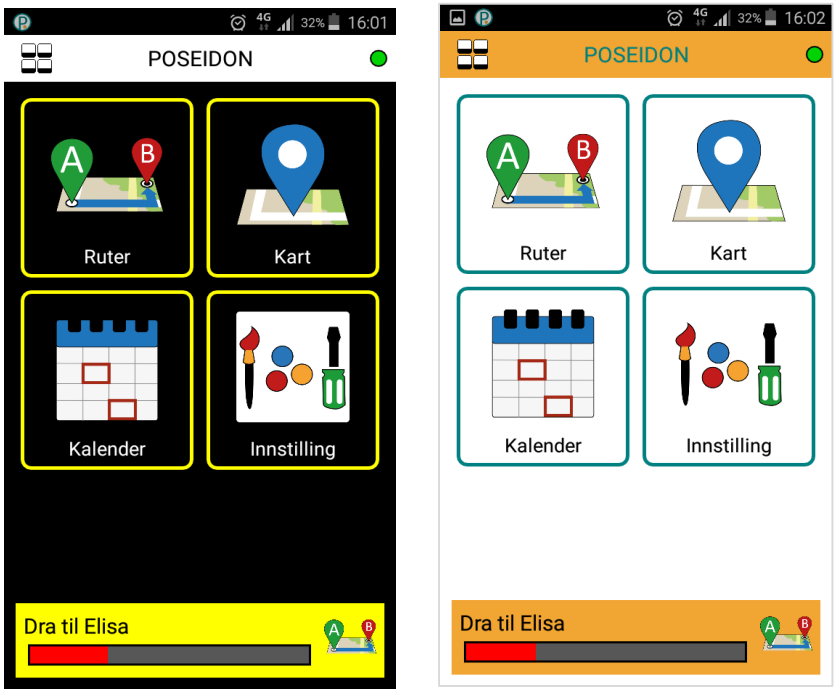
The web application for secondary end users (carers) is the main user interface for changing the preference values, allowing carers to manage preferences *remotely*, without needing to access the individual applications. Some preferences can also be changed locally, and some preferences should be directly controlled by the primary user (such as the privacy preference of whether to be tracked).

Preferences for mobile app

Here we describe the preferences of the POSEIDON mobile application prototype most relevant for personalisation. The app has other types of preferences as well. There is for example a setting for whether video streaming can use a mobile subscription or not, so that it can be limited to Wi-Fi to save on data cost. This is an example of a more technical setting.

Colour schema

POSEIDON palette or high-contrast palette: The POSEIDON application on smartphones offers two different colour schemas. Both are visually clear, but the high-contrast option may suit better for end users with visual impairment. This implementation is according to the advice from Maggie Woodhouse[17] from the Advisory Committee of POSEIDON, at a consortium meeting in London with main focus on vision impairments of people with Down syndrome.



Position tracking

In the POSEIDON mobile application, the primary user can choose to **switch the tracking feature (GPS) on or off**. When off, the application only uses GPS when doing navigation, and the position information is not sent to the POSEIDON infrastructure where it would be available to authorised users. When on, the application sends the position data to the infrastructure, and also positions the user at regular intervals when not in navigation. The position data is available in the web application, so that carers can monitor their users.

The preference setting is included in the POSEIDON end user's app, based on the project teams and Down syndrome expert's discussions we had with the primary, secondary and tertiary users at the second seminar in Mainz. It was explicitly stated that a balance between security and privacy should

[17] http://www.cardiff.ac.uk/research/downs-syndrome-vision-research-unit

be enabled: For some end users this may be a feature too demanding to comprehend or use, whilst others may well be able to utilise this option. An example of use is when adult end users do not want to be tracked by carers or helpers, and when they have the authorisation/competency to make this decision.

How often to get a 'GPS position fix' when tracking is enabled, is also a preference. This more technical setting is mainly to balance battery usage (getting a GPS position fix consumes some battery) with the need for accurate monitoring, and is set by the secondary user in the web application.

Calendar notification

How the application notifies the user of calendar events is a mix between how the event is defined and the application preferences for notification. The event itself may have reminders ahead of time. The application will always provide notifications at the reminder times. In addition, it can provide notifications at the start time of all events, regardless of whether they have reminders or not. Whether to provide start time notifications or not is a personal preference.

Notifications use the notification system of the phone, placing a notification in the notification bar and playing sound and vibration. Such notifications can be insistent or not. If insistent, the sound and vibration is constantly repeated until the notification is acknowledged. Otherwise, it typically only plays once (the details are phone-dependent). Whether notifications are insistent or not is a personal preference.

Preferences for context awareness are listed at the end of the next chapter.

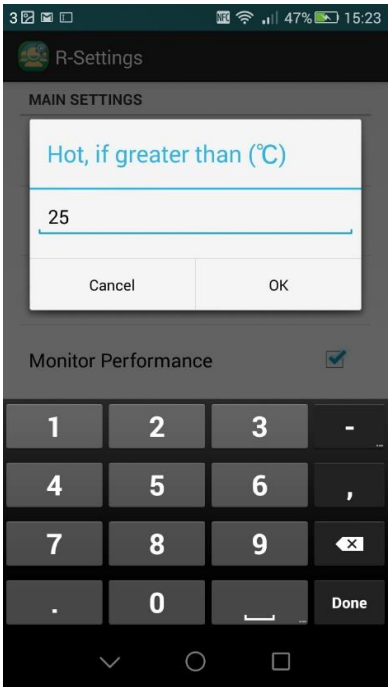
5. Context awareness in POSEIDON as part of personalisation

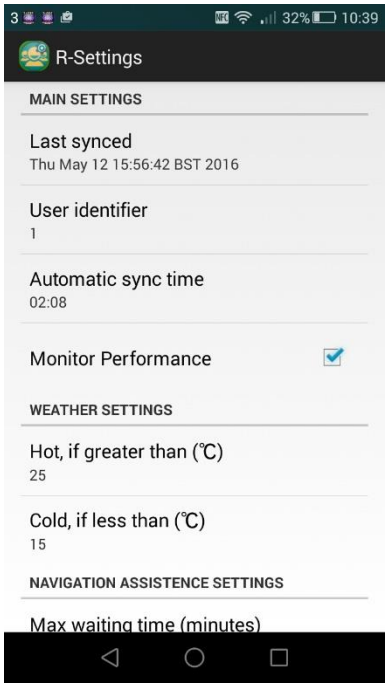
Using context awareness, the POSEIDON applications can adapt, and inform the user based on context of the user, device, and environment. These contexts rely on rules created by developers, which can control what the system will describe certain situations, for example if it is considered cold outside.

By being context-aware, an app can dynamically change either the content, or the behaviour of the application to suit a given situation. We gather the different situational data from different sources

including phone sensors, internet resources, and behaviours of the primary end users. This includes information about light levels, location, facing direction, weather forecasts, perhaps traffic one day (providing sources exist).

The data is put into a knowledge conceptualisation repository. Two main effects can be gained this way: (a) Reactiveness: Dealing with for example the user deviating for a route, or possibly waiting for a bus that does not arrive. (b) Proactiveness: Dealing with weather conditions are different locations, possibly looking at traffic conditions ahead of time before a journey commences. Other apps in the market are more static.





In traditional context-aware systems, rules and parameters are often static, and unknown to the user. Users though may experience or require differences in these rules, to better suit their personality, locality, medical conditions etc. Just like other parts of the POSEIDON, the context awareness should allow for personalisation, where possible. In the Context Reasoning Middleware, we allow for personalisation of different contextual parameters. For example, with the weather context, different users including those with fair skin could be more sensitive to hot weather. The secondary user can also set parameters to state the longest amount of time the primary user can be waiting at the bus stop e.g. This value can be changed depending on the seasons, as in winter it is not a good idea to wait too long outside. These personalisation options give greater control to the users to help tailor the context rules to their needs.

Currently, the POSEIDON system supports personalisation for the following contexts:

- **Weather**: User can set their rated hot and cold temperatures. We verify that hot temperature is always above the cold temperature.
- **Standstill**: User can set the maximum amount of time they can be relatively standstill. This is useful for when the user waits for the bus.
- **Deviations**: User can set the maximum number of small deviations in a route, before the user is offered assistance by the secondary user.

Other personalisable elements in the context reasoner include the ability of the user to select whether the data from the mobile device can be used by the learning and reasoning module, currently accessible on the POSEIDON Carers web. As the reasoner needs to occasionally synchronise its data with the POSEIDON services, the user can set an appropriate time in which to do this e.g when at home, and the phone is on charge.

When the context personalisations are altered, they are then set for the next time the context is needed by the system. In the event that the context affected is currently running, the context is restarted with the new preference.

Personalisation while giving users greater control, do present a verification issue regarding contexts. For example, the user could set the cold temperature less than the hot temperature. This confuses the semantics of the rules. Research is currently ongoing to consider a general purpose approach to verification, and context language extensions to support this.

Below, we show a short extract of the reasoner solution's text table which represent communication vis-à-vis carers. This is part of the personalisation feature of context awareness where carers set the parameters. In the final POSEIDON system, carers must set the parameter values for example for the weather settings and the navigation settings[18].

Weather settings	**Title for weather related settings**	**Innstillinger for været**	**Wettereinstellungen**
Hot, if greater than (C)	The temperature is considered hot, if the temperature is greater than the ...stated degrees	Varmere enn (C)	Warm, wenn die Temperatur höher ist als (°C)
Cold, if less than (C)	The temperature is considered cold, if the temperature is less than the stated degrees	Kaldere enn (C)	Kalt, wenn die Temperatur niedriger ist als (°C)
Specified hot temperature must be greater than cold	The hot temperature number entered must be greater than what is set for cold	Innstillingen for varmt må være høyere enn for kaldt	Die angegebene warme Temperatur muss höher sein als die kalte Temperatur.
Specified cold temperature must be less than hot	The cold temperature number entered must be less than what is set for hot	Innstillingen for kaldt må være lavere enn for varmt	Die angegebene kalte Temperatur muss niedriger sein als die warme Temperatur.
Navigation assistance settings	**Title for settings regarding navigation assistance settings**	**Innstillinger for navigeringshjelp**	**Einstellungen für Navigationshilfe**
Max waiting time (minutes)	The maximum time the user can be standing still for, in minutes	Lengst ventetid (minutter)	Maximale Wartezeit (in Minuten)
Max number of small route mistakes	The maximum number of times a user can make small deviations	Tillatt antall ganger for små avvik fra ruter	Maximale Anzahl an kleinen Abweichungen von der Route

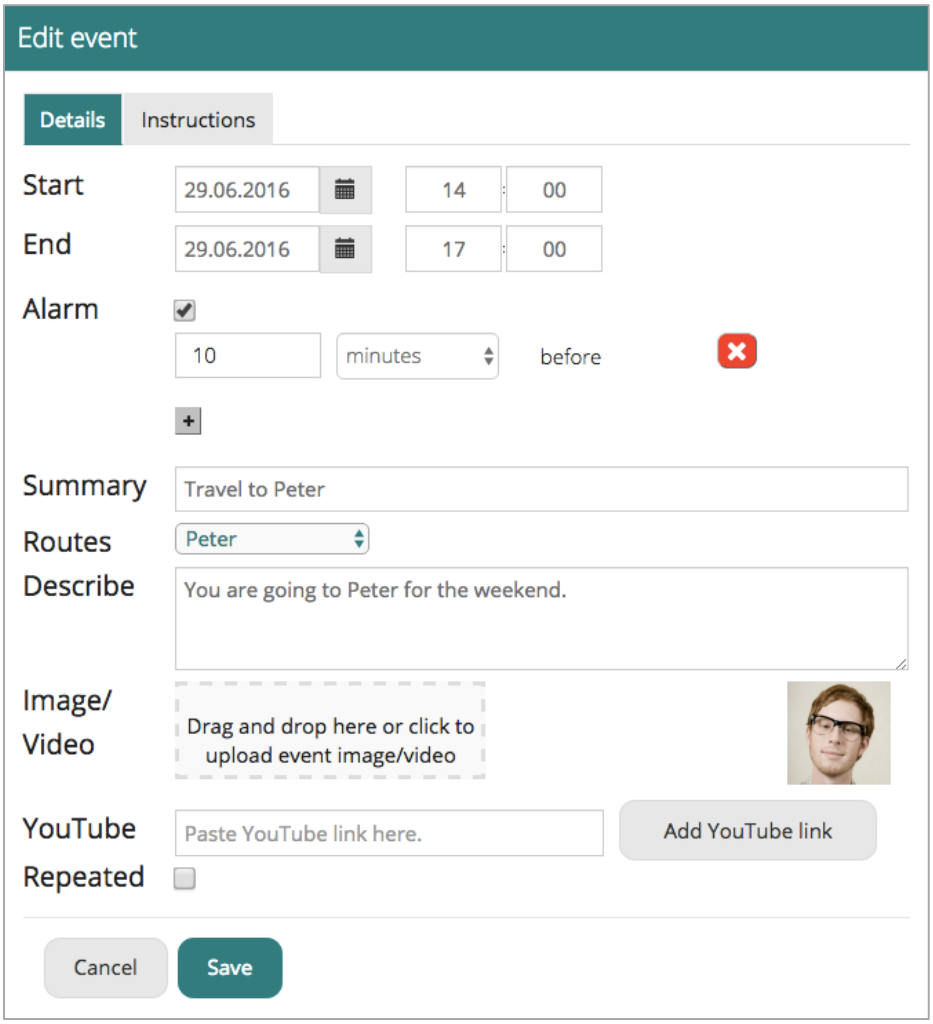
[18] The source code of the reasoner is Open Source, and documented as such. Additional documentation of the ontology and user modelling can be found in Deliverable D3.1, whilst the Open Source and reasoning engine is documentation is available in Deliverables D3.2, D5.1 and D5.4.

6. Personalisation on the POSEIDON web

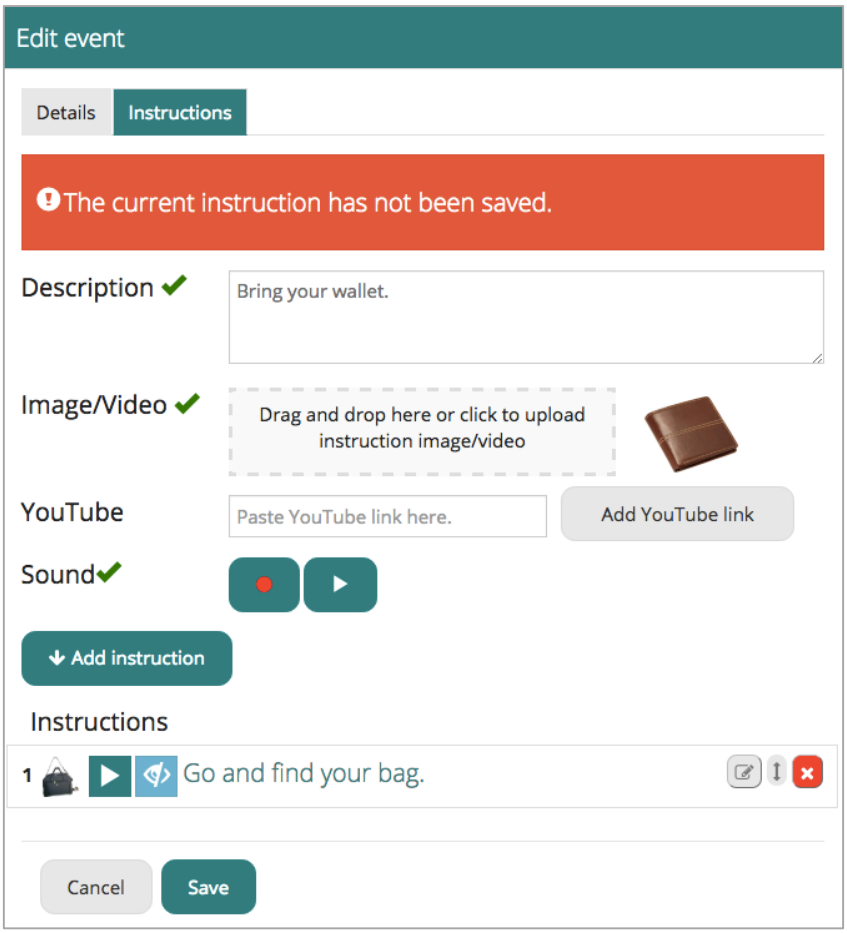
The POSEIDON web has been designed to accommodate the personalisation of primary end user's applications. On this website, the carer may adjust a number of features to fit the end user's individual requirements (vis-à-vis abilities) and preferences (even "likes or dislikes"). It provides customised calendar events, a shopping list, monitoring of the primary end user, video management, and a set-up functionality for the POSEIDON app and the context awareness.

Calendar

- Event: An event on the POSEIDON web is a customised remainder that is pushed to the end user application in order to ease the escort of the carers. In addition to normal event properties like starting/finishing time, description, summary, alarms, repeating rules. The POSEIDON calendar event also provides a multimedia description of the event, such as image/video and routes of the event if the event contains an outdoor trip. The video functionality supports both uploading videos directly or providing a YouTube-link.



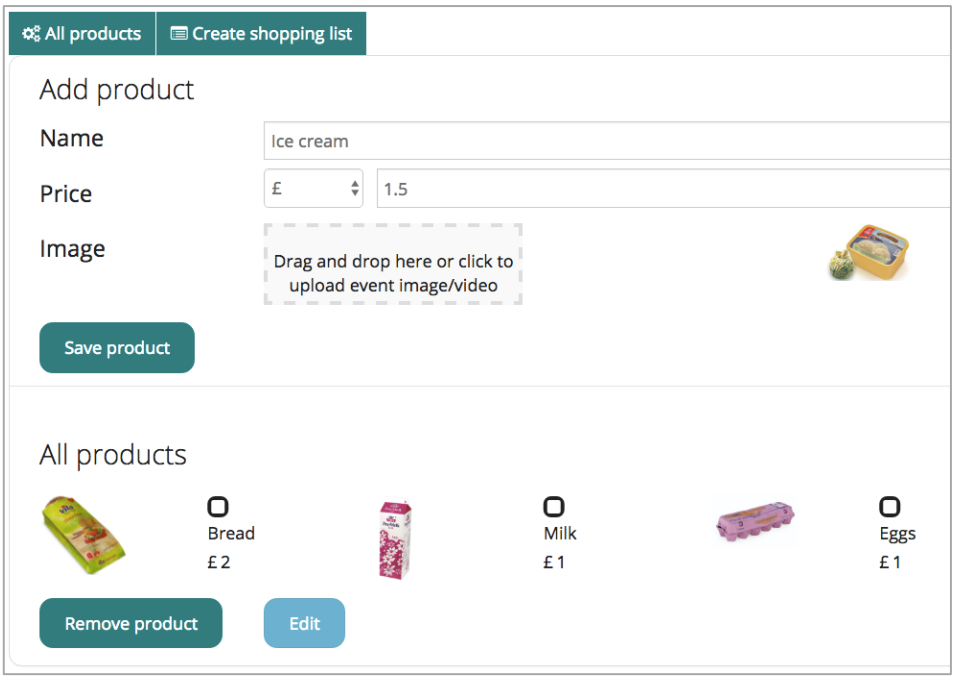
- Event instructions: An event may contain several steps or activities. The instructions of these activities can be provided through a text description, an image, audio speech, or videos. Videos can be either uploaded to the POSEIDON file server or provided through a YouTube-link.

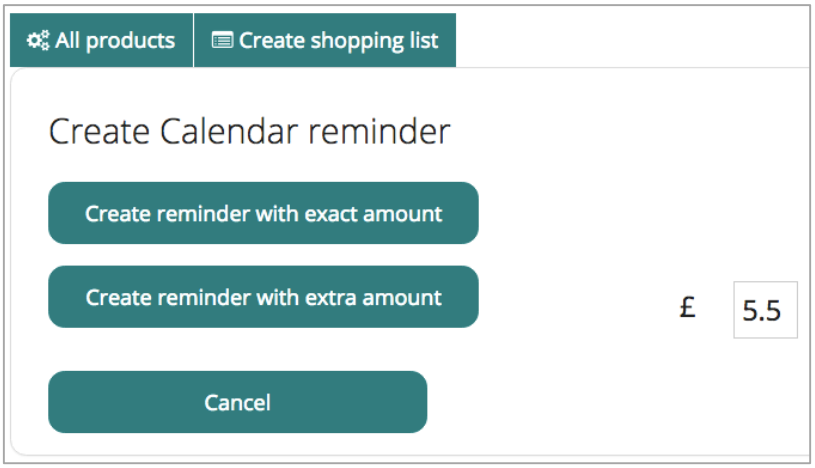


The POSEIDON calendar will push the events to the POSEIDON app which is then used by the primary end user.

Shopping

- The shopping component is personalised to the shopping needs of the primary end user. The carers can here conduct the necessary pre-work to upload product images, prices and quantities, and to store the information in the POSEIDON system. A training app has been developed and it can transport the information to the primary end user's app to accommodate his/her autonomous shopping activities.

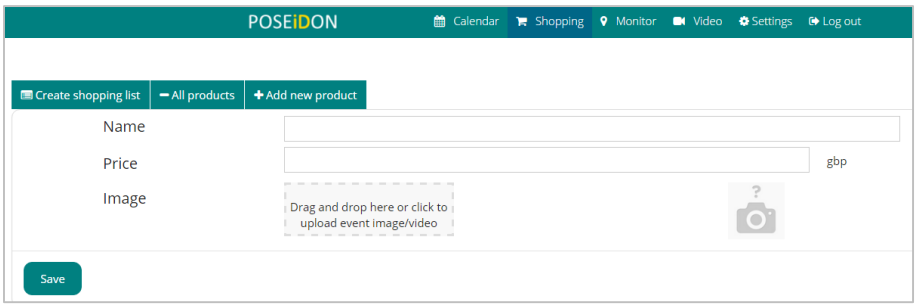




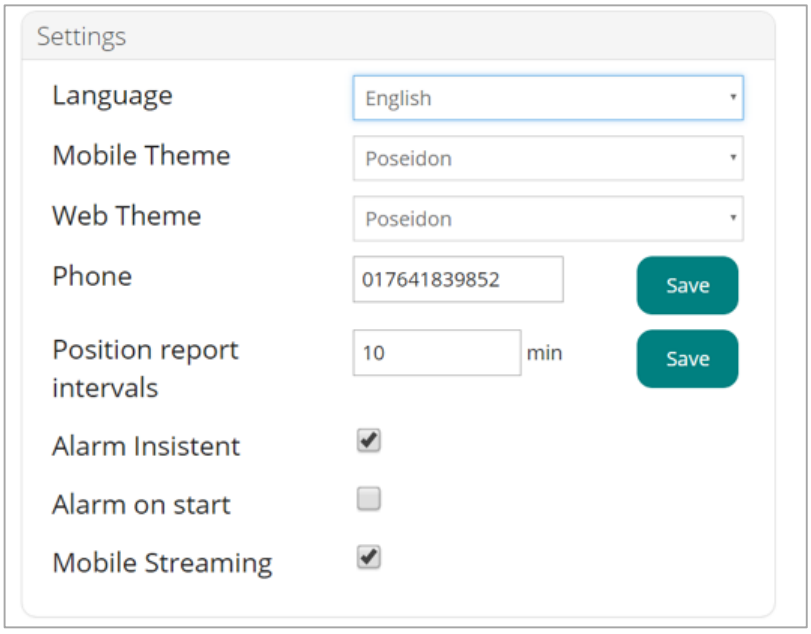
- Shopping list with a number of products including prices: The shopping component can create a shopping list, and after the creation of the shopping list, a calendar event can be added and further edited on the calendar component.

Video list

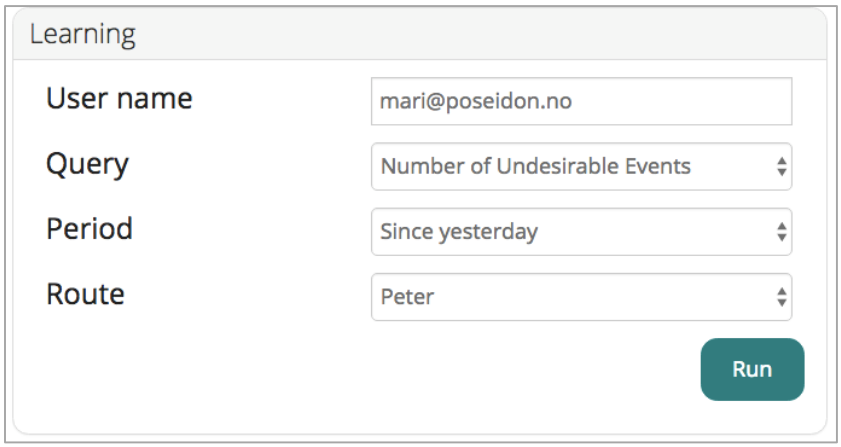
- Video: the video list supports user to upload videos both from local PC or from a YouTube-link to provide support or escort to the primary user.



- Settings: In the component for settings, the user can perform a list of personalisation activities: (a) personalise the mobile theme by choosing among the colour palette of the application (currently, the POSEIDON palette and high contrast palette are provided), and (b) configure the POSEIDON web theme (currently, the POSEIDON theme and a light green theme are provided). The personalisation of the application can also be performed here, e.g., to allow data-streaming on mobile network or not, or to provide a notification when an event starts in the primary end user's app.



- Learning and reasoning module: The POSEIDON web provides personalisation for context awareness monitoring, and it provides analysis of gathered data. This function in relation with the context awareness are called learning and reasoning module. For example, for the historical activity the primary user carried out, it can be concluded which route was carried out most successfully. The carer can select a series of properties for the learning module, e.g., select a time interval, and select a route to show how much time the primary user has spent on that particular activity.



Who does the personalisation?

Personalisation of POSEIDON can be performed by:

- **Primary end users**: Primary end user's own choices for example on the smartphone. Examples are use of voice output, and tracking (on/off), as both practical matters as well as those of self-conception and contact with parents/carers.
- **Carers**: POSEIDON web for management and personalisation of primary end user's applications.
- **End users and carers together:** The colour palette is an example of choices that can need to be set up in collaboration as it is about comparison of alternatives where the primary end user must select the best choice for her/him. (NB: Changing the colour palette by end users themselves is an option. For example, if the weather conditions are changing and the light is suddenly different, that the primary end user may want to change the contrast. Only a few end users would need help to do this.)
- **Carers, formal or informal**: Much of the personalisation is the responsibility of the carer (such as creating lists, recording spoken messages, creating video clips etc. The POSEIDON family of apps is being built active use of contextual information in order to improve the user experience, safety and privacy of the end user. It may be connected to such parameters as location, identity, activity/task, time and the device itself. These parameters must be set by the carer.

Carers must not necessarily be family carers, but can be teachers or supporting people or other helpers in institutions, or any other stakeholders who are involved in the caring or daily activity of the person with Down syndrome.

7. Preliminary findings in Pilot 2

One of the aims of Pilot 2 was to find out if the functions of POSEIDON are sufficiently adaptable to the needs and abilities of persons with Down Syndrome. Therefore, we asked the Secondary Users if they were able to personalise the apps sufficiently to the abilities and needs of the person with DS. We wanted to know which functions they personalised for the person with Down Syndrome. Furthermore, which other functions should be personalised.

For the time being, only preliminary results are available, because the pilot still runs in some families. However, the participants seem to be pleased with personalisation and seem to think that POSEIDON is adoptable to meet the needs of persons with Down Syndrome. They also made suggestions for improvement. One example for improvement is the shopping assistance. They want to have the possibility to enlarge images of products bigger (the whole page). Another suggestion concerned the

calendar. They want the possibility to choose between a 12 and 24 hour clock and having icons for day or night.

8. POSEIDON pipeline and future prospects

For the final development of POSEIDON, the following personalisation features are being evaluated by DSAs in all participating countries during the last half year of the project, and implemented if the evaluation shows that these features are considered as helpful for the end users.

1. **Turning speech on/off – recorded messages or synthetic speech**. For persons with Down syndrome with low reading ability and/or some degree of visual impairment, spoken messages may indeed be of superior help, and also reassuring if these are recorded by carer(s) and thus play back a familiar, natural voice. In certain situations, this may be disturbing or even embarrassing, and it should be an option for the end user herself/himself to decide if s/he wants to enable/disable the speech. In other situations, it may be desirable to run on the speech, e.g. for safety in a navigation situation in order to look at the traffic instead of the screen. (Use of ear-phones will not be an option for all end users as they may prohibit the end user from hearing vital sounds from the environment, e.g. in traffic.)

   The design of this feature will be similar as the current navigation app's tracking choice:

   By whom: carer and end user

2. **Synthetic speech:** In order to provide the opportunity to listen to all texts in the apps, synthetic speech will be integrated with the apps. Suitable software packages are many[19]. Currently, synthetic speech is readily available in some smartphones and further development here may make use of separate software excessive. For the web applications in browsers on PCs, such software will probably be necessary.

   By whom: carer and end user

3. Depending on the reading ability and experienced educational approach, **different text alternatives** as combinations of capital letters and dashed words:

beautiful	BEAUTIFUL
beau-ti-ful	BEAU-TI-FUL

   NB. Enlargement of text (T → T) directly on the screen of the device is embedded in the smartphone's user interface, and is therefore defaulted as a sufficient solution.

   By whom: carer

4. **Text-free apps**: Some persons with Down syndrome cannot read. For them a text free version of POSEIDON will be provided (some symbols may be character-based such as weekdays or monetary units), and it can be optional to choose descriptive text to a symbol/icon.

   This option will require that the carers populate the apps with personalising symbols for example in the calendar and the check-lists, in addition to the "hard-wired" symbols in the apps. The POSEIDON symbol repository offers here a large number of suitable building blocks.

[19] http://elearningindustry.com/top-10-text-to-speech-tts-software-elearning

By whom: carer

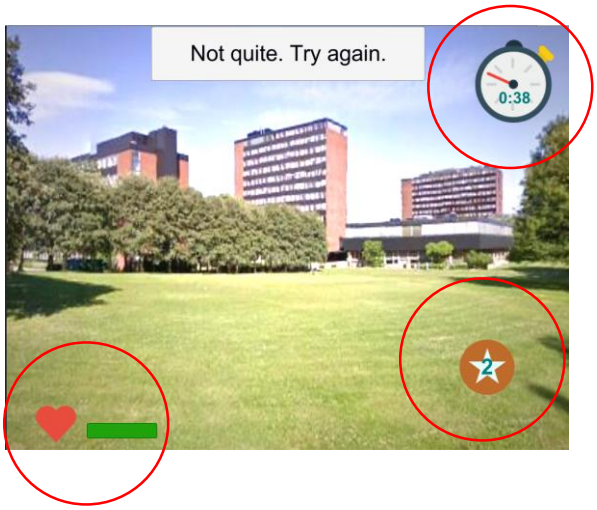
5. **"Persuasive gaming" levels** may include two approaches to motivate the end user to play and learn more in the POSEIDON Home Navigation Training app: indicating the time left and rewarding the result (e.g. a voice saying "Congratulations, you managed it!" or an animation of heart/fireworks on the screen, or both). Children/persons with Down syndrome may love to do tasks in a simplified way in a game as they often love television and computer games. This may increase the interest for this training task. Adequate personalisation will lead to more play and better navigation capabilities with the navigation app. Examples are "players" who enjoy the reward, but who cannot tackle the stress created by the clock ticking or who cannot read a clock (c), or a person who enjoys both (a).

Clock on	a	b
Clock off	c	d
	Rewarding feature on	Rewarding feature off

For additional personalisation, different types of clocks can be offered to the end user who cannot read a digital clock. Examples are the ones that have been developed by the Italian Down syndrome association. These were presented at the first POSEIDON seminar in Oslo by Anna Contardi[20]:

By whom: carer

In the pictures below, possible gamification aspects are shown (POSEIDON Home Navigation Training app):



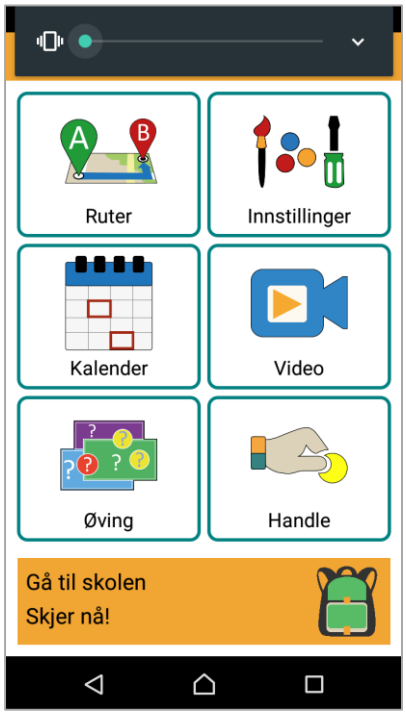
6. **POSEIDON apps on/off**: An opportunity to choose among useful apps will be implemented. This personalisation option will simplify the user interface for those end users who cannot make use of all POSEIDON apps.

By whom: carer

[20] Anna Contardi is a member of the POSEIDON Advisory Committee and Manager of the Italian Down syndrome association and general secretary of EDSA (European Down Syndrome Association).

7. **The POSEIDON symbol repository** will be extended according to end user needs exposed in the remaining user-centric activities. All symbols will also be presented in a downloadable catalogue for overview.

8. The POSEIDON mobile app's home has been extended with **new choices** with highly personalisable functionality: the shopping list, money handling exercise, and the video library. What are the most suitable functions to be shown on the home page *is still under evaluation (Pilot 2)*.



9. References to the Description of Work

In the POSEODON project's contract with the Commission (Description of Work – DoW), personalisation and context awareness ambitions of POSEIDON are presented as follows, including a short introductory commentary of how we treat the issue and where to find the elaboration[21]:

Down syndrome focus

- *[Scientific] Provide personalized solutions in such a way that maximizes people with Down's Syndrome's strengths and which allows adaptation to each individual (p. 3)*
- *For people with DS interfaces can be further personalized in a number of ways according to their needs and preferences (e.g., size of interaction areas) (p. 20)*
- *The general need for flexibility and support for different e-skills and abilities will be approached by enabling personalization of the user interface (p. 26)*
- *[Technological] Provide personalized solutions in such a way that maximizes people with Down's Syndrome's characteristics as a whole and which allows adaptation to each individual (p. 52)*
- *POSEIDON will provide intelligent, adaptive, and easy to personalize interfaces, specifically adapted for people with Down's Syndrome (p. 17, 30)*

[21] Substantial repetitions, other project's personalisation efforts and literature references in the DoW have been omitted.

- *Adaptive interfaces: POSEIDON will provide intelligent, adaptive, and easy to personalize interfaces, specifically designed for people with Down's Syndrome (p. 21)*
- *POSEIDON effectively provides an adaptive technology which can be personalized to meet the needs of a specific subset of the community. (p. 50)*

Commentary: The design of all personalisation aspects depart from specific needs of the end users with Down syndrome. In Chapter 2 and in the beginning of Chapter 3, implications of these to the personalisation of POSEIDON are explained.

Age groups

- *… across ages: it has to be personalized for children, teens, adults and elderly (p. 9)*

Commentary: The POSEIDON provides personalisation which is suitable and adaptable to all age groups. In particular, we have made a special effort avoiding childish expression. In addition, images, videos, speech comment, texts et, can be made by carers so that these fit the actual person and her/his age group and content requirements that exist.

Profiles

- *POSEIDON aims at using a certain set of information about the user - a restricted profile and information provided by the system itself to generate higher level services. This solution is less intrusive while still enabling a sophisticated level of personalization and adaptation (p. 14)*
- *A personal profile holding information about the modalities and functionalities best suited to the particular user's individual needs and preferences will be produced and applied when customizing/adapting the user interface. (p. 26)*

Commentary: This is implemented in the Smart Platform service. The user's account is there, and there, preferences can be saved for all POSEIDON applications. See Section 2.5 in the recently completed deliverable D5.4 v3 for a list of the properties that are stored there so far.

Standards

- *The project will aim at identifying: a) suitable standards to follow, and b) specific areas of standardisation that are under development for us to work with such as the IMS Accessibility project group focuses on adaptation or personalization of resources. (p. 59)*
- *A selection of these standards will be used to provide information on the design of personalised and personalisable interfaces for people with Downs Syndrome (p.59)*

Commentary: The project team has identified these standards are the most relevant ones: ISO/IEC 24751-1:2008 Information technology – Individualized adaptability and accessibility in e-learning, education and training – Part 1: Framework and reference model ISO/IEC 24751:2008 Part ISO/IEC 24751-2:2008 Information technology – Individualized adaptability and accessibility in e-learning, education and training – Part 2: "Access for all" personal needs and preferences for digital delivery ISO/IEC 24751-3:2008 Information technology – Individualized adaptability and accessibility in e-learning, education and training – Part 3: "Access for all" digital resource description. The finalised web and mobile applications will be subject to conformity check with standards during the last ½ year of the project.

For context awareness in connection with personalisation, the following ambitions are recorded in the DoW:

- *POSEIDON will provide an easy-to-use application making use of both web services and sensor data to provide a personalized, effective user experience (p. 13)*

- *Performance/research indicators: the project expects to obtain a context awareness layer which can facilitate developments for our primary/secondary users and can be personalized. (p. 16)*
- *As the system is supposed to serve the primary users (people with DS) but also other people who interact with them, for example family members, teachers and employers, the system will need different type of awareness for different users. An important part of this awareness is related to safety (p. 14)*
- *(Context-Awareness) will materialize the levels of consciousness and autonomous decision-making of the system in terms of understanding the situation the user is in and producing the best help available for that situation and communicating with the user in the best possible way in collaboration with the HCI side of the project. Contexts where safety may be compromised will be given priority all the time (p. 20)*
- *Persuasive and affective interfaces. The system will use context-awareness supported by a mobile platform to predict and detect possible needs and offer inclusive services which may be helpful in those situations (p. 53)*

Commentary: The context-awareness provides context reasoning, that uses three sources of data: sensors (on device), web services (weather), and external applications (Tellu Navigation). The reasoner allows for some rules to be personalised to allow the user to set particular parameters that suit their needs, for example what temperature they rate as cold. The system helps serves both the primary user and secondary user through its use of navigation assistance contexts. The primary user can be prompted if they need assistance from their carer, if the reasoner deduces this is the case. Safety is a prime aim of the context-awareness systems. Not only do we provide rules that can improve the safety of the user e.g. navigation assistance, we also are developing tools for the developer to verify their rules are correct. By verifying context rules before they are deployed in the field, a developer can be sure the rules will not contain adverse actions through context interactions (conflicting actions for example).