The Collective Experience of Empathic Data Systems

ICT-258749

Deliverable 8.1

CEEDs uses: use cases for different types of user and their needs

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Executive Summary

Deliverable 8.1 is the first of four scheduled deliverables for WP8. WP8 focuses on the end user and their requirements (including contexts of use) from CEEDs technology. Research with stakeholders and end users inform these activities.

The Stakeholder Advisory Group, set up in Year 1 and managed by WP8, is central to WP8's tasks and activities. It aims to complement the expertise of the consortium partners, to provide (support for) access to massive datasets for agreed use in the project, and to identify use and exploitation opportunities for the project outputs. Stakeholders include those internal and external to the project consortium. Some stakeholders were provisional members at the outset of the project and these have now been formally welcomed. Other relevant stakeholders (particularly from the marketing and advertising domains) have been recruited as new members this year.

The main aims of WP8 in the first year were to generate initial CEEDs use cases and scenarios. With a range of diverse applications planned for the project (from neuroscience and astrophysics, history and archaeology, through to retail/commerce based applications), it was essential to ensure congruence in the underlying potential user experiences.

To maintain consistency across applications, a unified high level conceptualisation of CEEDs uses was required and to this end, commonalities across application scenarios were sought. The process involved a consultation with stakeholders, and critical and creative thinking. These methods informed the development of a user interface taxonomy (with input-output pictorials to illustrate possible interactions) and culminated in a set of 'core features' (CFs). CFs are application-independent components of CEEDs experiences. This framework provides a guide/clarity on what application goals are considered in scope of the project.

The CFs comprise five interdependent components and two associated databases. Initial scenarios based on stakeholder inputs were developed and labelled as appropriate with the relevant CFs. Below the CFs are outlined along with an example from different applications:

- The raw stakeholder database **[CF-RDDB]** provides input to **[CF1]**, a filtered contextualised/multimodal perspective of the [CF-RDDB] that is independent of the CEEDs Sentient Agent (CSA).

  CF1 Application example: (History) A virtual 3D camp based on factual information about the Bergen Belsen site.

- Users respond to their experience of [CF1] and their raw implicit and explicit responses (e.g., heart rate, galvanic skin response) are collected and stored **[CF2]**.

  CF2 Application example: (Science) An expert user's gaze duration towards a particular area of abstractly presented neuroscience data is collected and stored.

- Raw user responses [CF2] are interpreted and stored **[CF3]** in terms of meaningful constructs such as 'interest', 'attention', and 'rule violation'.

  CF3 Application example: (Appliance) The B2B user's physiological reactions suggest that the user is not satisfied with the control panel on the dishwasher.

- The relationship between user responses (raw [CF2] and interpreted [CF3]) to CF1 is stored in the User Response Database **[CF-URDB]**.

- The display responds intelligently to user inputs based on a user model of a CEEDs Sentient Agent[1] (CSA)-dependent view (goal driven). This is real time artificial intelligence **[CF4]**.

  CF4 Application example: (Archaeology) Based on the way the user looks at an artefact, the CSA retrieves and presents to the user artefacts from a database with similar user scan paths.

- In **[CF5]**, users' responses and/or the data on which the CSA is making decisions can be displayed as an overlay to the output of [CF1] or [CF4]. This is a 'review' type component, exposing metadata.

  CF5 Application example: (Retail: Appliance) Design teams want to understand which features of a fridge to improve by reviewing a group of users' responses that have been interpreted as 'dissatisfied'

In Year 1, WP8 has been a collaborative activity involving many partners including internal and external stakeholders. In particular, it has been closely aligned with WP6 (Application Development) which has elaborated the scenarios to provide concrete, functional applications; and WP3 (CEEDs engine: perception, cognition and action) to ensure compatibility with the CEEDs system.

[1] The CEEDs Sentient Agent is an intentional, autonomous agent. A central characteristic of the CSA is that it is goal driven (see D3.1 for more information)

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Acronyms

CF	Core Feature
CSA	CEEDs Sentient Agent
CUPPS	CEEDs User Preference Profiles
DoW	Description of Work (Annex 1)
INCF	International Neuroinformatics Coordinating Facility
NDA	Non Disclosure Agreement
PCC	Project Coordination Committee
PMB	Project Management Board
PO	Project Officer
SAG	Stakeholder Advisory Group
SD	CEEDs Scientific Director
SSH	Secure Shell (for data transfer)
TD	CEEDs Technical Director

1 Introduction

1.1 Scope of report

This document represents the output of tasks and activities in WP8 ('Use cases and scenarios'). The main aims of WP8 are to ensure that the CEEDs applications are driven by user needs, not technology push; and to understand with the assistance of the Stakeholder Advisory Group (SAG):

- the characteristics of potential CEEDs applications users;
- what users require (user needs) from CEEDs; and
- in what contexts/how (develop examples of use).

D8.1 is based on work conducted in T8.1 (Scenario development and use cases). T8.1 is scheduled for completion at month 15. This deliverable will report work conducted from month 1 to 12 only.

GOLD is leading this WP and other partners who are named contributors to activities under this WP are UNIPD, UPF, ELECTROLUX, UH, UAU, UDP and BME. WP8 activities in Year 1 have interfaced with other WPs, in particular WP3 (CEEDS engine: perception, cognition and action) and WP6 (Application Development).

The activities conducted as part of T8.1 are to:

- develop the Stakeholder Advisory Group (SAG);
- develop and conduct primary qualitative end user research and desk research to:
    - identify (with input from SAG) target groups of potential CEEDs end users within each application domain;
    - understand the types of data collected by potential CEEDs end users; what questions they have about their data; how their current needs are met; the contexts in which their data are collected and analysed and the results used;
    - better understand potential primary and secondary CEEDs end users;
    - better understand the unmet needs of potential CEEDs users, and how they envisage meaning to be derived from applications of CEEDs technologies;
    - generate (draft) use cases and scenarios; and
- inform integration and application development (WP6)

This document details progress to date for activities in T8.1 from months 1 to 12, which have supported the development of a set of CEEDs core features (high level use cases). This has provided a common vision of in-scope application-specific use cases and scenarios for the project.

The report concludes with how the outputs of this year's work have informed the plan for work in the forthcoming year of the project.

1.1.1 Definitions

For the purpose of this document:

- *"Applications areas"* are the broad subject matters/domains for which CEEDs will broadly support through the development of applications, namely Archaeology, History, Science (Neuroscience/Astrophysics/Astronomy) and Retail/Commerce.

- *"Stakeholders"* are the organisations and people who represent the different application areas. They include those who are internal - our project partners (LU, ELECTROLUX, UoS) – and external to the project (e.g., Bergen Belsen, INCF). Stakeholders are 'high level' users/beneficiaries of the CEEDs applications.
- *"Implicit (user) responses"* in the context of this WP refer to covert, uncontrolled responses that are 'unconscious'. These could be physiological (e.g., ECG, respiration, EDR, EEG, EMG, pupil dilation)[2] or behavioural (e.g., blink rate, eye-tracking, reflexive postural and physical responses, vocal emotion).
- *"Explicit (user) responses"* in the context of this WP refer to overt, deliberate 'conscious' responses. These could include behavioural responses such as gesture, pointing, verbal responses/ speech, button pressing, manipulation of tangible representations and motion/ trajectory)
    - Nb. The formal characteristics of these types of implicit/explicit user responses will be described elsewhere as part of work conducted in WP1 (Theory of Human Unified Experience) and WP2 (CEEDs sensing system)[3]
- *"High level (Core) Use Cases/Core features" (CFs)* describe what can broadly be achieved with CEEDs independent of the application. In this document they represent a breakdown of the interrelated components of CEEDs uses (e.g., to collect, store and interpret a users' implicit and explicit signals).
    - The development of CFs has been informed by generating a user interface taxonomy comprising a series of 'input-output pictorials' which identify a number of dimensions or factors that may change from one user's CEEDs experience to another user's experience. The input-output pictorials include representations of the number of users in any session; the nature of the data displayed (raw or pre-tagged[4]), whether or not a users' implicit/explicit data are measured/monitored and whether or not there is any real time feedback.
- Finally, *"scenarios"* are short made-up stories that provide an illustrative example of why someone would want to use CEEDs and what happens to them (an outline of their experience) from the user perspective. These are very much anchored to the stakeholders' application-specific goals. In this document, initial scenarios for each application area have been generated by examining what stakeholders want to achieve by using CEEDs combined with what is possible with CEEDs (i.e., what is in scope, based on the CFs).

[2] Excludes biofeedback

[3] Partner UAU has been working on facial feature detection and extraction, and their sensing tools are currently capable of identifying gender and four broad classes of emotional states (happy, sad, surprised, angry) expressed with confidence levels in the range of 0-100. It can also support detection of multiple faces. In addition, their emotive speech recognition tools can recognise pre-trained classes of emotion (stress, happy and angry) based on ~1300 acoustic features. Partner UDP has made progress with their wearable physiological and gesture sensing, including a sensing 'glove' for hand interfaces (recognition of finger positions/gestures for grasp and pinch detection). Furthermore Partner EKUT has advanced in their work to implement brain signal measurements such as EEG systems that are appropriate to the CEEDs environment. In addition, they have considered the use of functional near-infrared spectroscopy (fNIRS) (as a more flexible and portable solution to MRI) which can be used as an index of active cortical areas. A real time version of this system has been recently developed by EKUT (see D2.1).

[4] For the purpose of this report, this process of storing explicit or implicit user data and annotating the stakeholder dataset or a similar dataset with this user response data is termed 'tagging'.

1.2 Use cases and Scenarios

'Use cases' have been used largely in software development research for several decades, and describe the way a system can be used by target end users; they describe the functional requirements of a system in terms of how the user achieves sub- and end-goals with the system (see References, Section 7 [1]). However, they do not describe how the *system* achieves these goals, or how the system will appear to the user.

Ivar Jacobson has been hailed as the inventor of 'use cases' and his IBM colleagues and others (including Kurt Bittner, Ian Spence, Gunnar Overgaard and Alistair Cockburn) have further developed these initial ideas. For instance, Cockburn formulated the Actors and Goals model based on Jacobson's ideas in 1994.

There are several components that are fleshed out in a use case. Templates for presenting use cases vary from researcher to researcher, depending on the complexity, goals and stage of the project. Initial use cases can be simple basic descriptions of the interactions that occur between the 'actors' involved (which can be people or computer systems) and the goals that are supported by the system. These can be developed over time into more detailed use cases that use formal templates to include additional information such as goal failures and extensions (i.e., potential alternative paths are specified where achieving the goal through the most direct route is thwarted by incomplete/incorrect preceding steps).

In developing an understanding of the CEEDs use cases and scenarios a series of activities were undertaken in T8.1. It was intentional and important to allow sufficient flexibility at this stage of the project with regard to the use cases and scenarios in order to incorporate partners' requirements and more detailed stakeholder requirements when primary research is conducted as part of the remaining months scheduled for T8.1 (months 13-15) and T8.2 (months 16-36).

The work conducted in Year 1 has led to the generation of a unified framework for CEEDs by developing a series of concrete features and simple example goals and scenarios to stimulate discussion about potential use cases and scenarios amongst stakeholders. This should particularly benefit those that are unfamiliar with and external to the CEEDs project who may have difficulty, in a short space of research time, to fully understand the CEEDs proposition.

The outputs of work reported in D8.1 aims to enable potential end users/stakeholders to understand how they might engage with CEEDs systems and this will support the research and communication process with end users/stakeholders (e.g., to focus research participants' attention on key goals that might be achieved by using the CEEDs system).

1.3 Workflow and focus

The work conducted in Year 1 for WP8 involved firstly gathering initial *user requirements* from stakeholders in each of the target application areas. The application areas were broad, covering subject areas from neuroscience through to retail/commercial applications. To ensure the technology requirements were well matched across these application areas, activity focused on developing a *user interface taxonomy* and through this a number of *core features*. The core features prescribe what is in scope for any application scenarios generated by stakeholders. Using the feedback from stakeholders on initial user requirements, a number of *initial scenarios* were generated in which the CEEDs core features involved were specified. In collaboration with WP6 the scenarios were further developed (see D6.1) (see Figure 1).

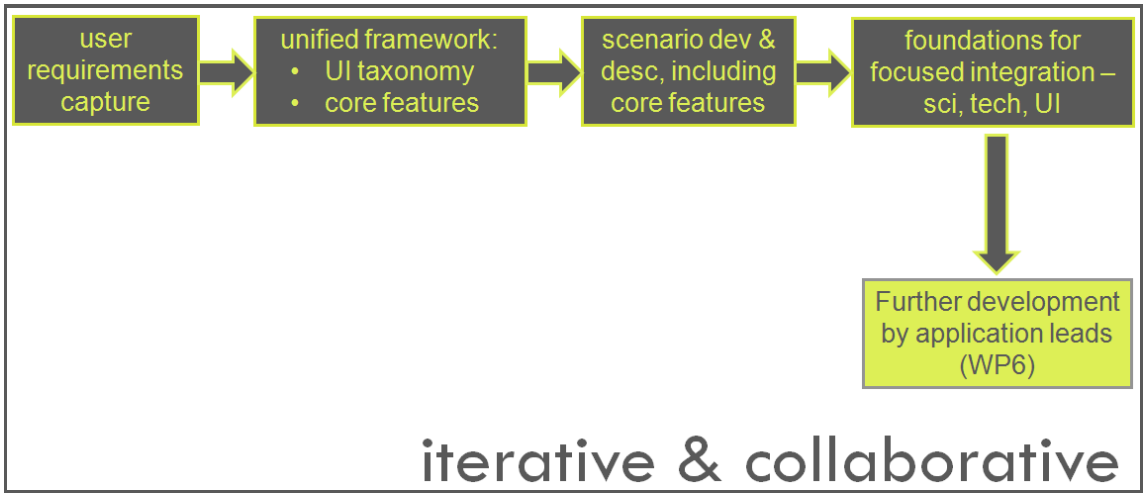

Fig. 1 - *WP8 Year 1 Workflow and Focus*

1.4 Summary of Year 1 achievements

To understand and develop user needs and requirements of CEEDs applications, the following activities have been conducted including:

- ✓ written and discussion based consultations with potential users/beneficiaries based on internal and external SAG members;
- ✓ close reference to the Description of Work;
- ✓ regular discussions with the Scientific and Technical Directors (UPF), interaction design partners (UH, UNIPD) and Application partners (WP6) regarding potential CEEDs functionalities and scope.

To ensure commonalities across different applications:

- ✓ a set of CEEDs core features developed.

To show how core features can apply to applications:

- ✓ illustrative scenarios for each application have been developed.

To understand the context in which CEEDs technology may operate:

- ✓ literature review of key trends has been conducted (see D9.1 for the output of this work).

To disseminate the CEEDs proposition:

- ✓ poster presented at Fet11 (Lessiter, J., Miotto, A., Freeman, J., & Verschure, P. CEEDs: Unleashing the Power of the Subconscious. (2011). *The European Future Technologies Conference and Exhibition, 4-6 May 2011, Budapest, Hungary*)
- ✓ 2-page abstract (of the same title as above) submitted for Fet[11]*essence* Proceedings (published by Elsevier).

1.5 Structure of report

In Section 2, the development of the ***Stakeholder Advisory Group*** is detailed including its purpose and stakeholder responsibilities. This is a central component of WP8 (and of T8.1)

as these (and other) stakeholders will be drawn on for their skills, advice, research participation and expertise throughout the lifespan of the project. The current members are listed and their input to Year 1 activities is specified. Associated administrative work with SAG members has been moved to the Annexes.

Section 3 describes the broad ***aims and objectives*** and questions to be explored that relate to WP8 activities in Year 1, and in Section 4, the ***methods*** used and ***process*** followed to explore these questions are outlined.

Section 5 details the ***results*** of the research process, first presenting the user requirements captured from the stakeholder consultation, then drawing on these outputs to inform the user interface taxonomy and then to formulating the application independent 'core features'. Draft activities of this process are consigned to the Annexes. The results chapter also provides illustrative draft scenarios which WP6 partners have further elaborated (see D6.1).

Finally in Section 6, ***WP8 plans for Year 2*** are outlined which involve concluding the activities of T8.1 and beginning the work of T8.2 (the activities for which are scheduled to extend to Year 3).

In the ***Annexes***, administrative work for managing the SAG along with draft outputs of work that have informed the critical and creative thinking presented in the main body of this deliverable are filed.

2 Stakeholder Advisory Group

The Stakeholder Advisory Group (SAG) is central to the activities of WP8. WP8 is responsible for establishing and managing the SAG, and engaging new stakeholders in the project throughout the project's life. This chapter outlines the purpose and responsibilities of the SAG; provides details of Stakeholder members and how they have been engaged in Year 1; specifies the inclusion criteria for new SAG members and notes planned changes to engaging stakeholders in CEEDs for Year 2 and beyond.

2.1 Purpose

The purpose of the SAG is to assist the PMB and the PCC in their decisions on the overall policy and long-term strategies of the project and especially with regard to the exploitation of its results. Most of the SAG members' organisations are not integrated into the project as contractors but are associated as an advisory body with the consortium because as an external advisory group the SAG can be extended as possible and desirable. Access will be kept open throughout the project life-cycle.

There are four main aims of SAG, which are outlined in the Description of Work:

- to complement the expertise of the Consortium partners in the focus (application) areas CEEDs will be addressing, to enable the project to better address user needs;
- to provide access to selected datasets for agreed use within the project;
- to provide support for accessing datasets and providing domain specific knowledge for CEEDs system development and testing;
- to identify exploitation and use opportunities related to the project's outputs.

2.2 Responsibilities

SAG invitees are informed of their expected responsibilities within the CEEDs project before they agreed to take on this role as SAG member. The responsibilities requested of SAG members are outlined below:

- Invited to participate in pre-review meetings (at least once a year) and will be asked to issue a report with their comments on the meeting. Comments will be reviewed by the PCC.
- SAG members may be called for specific advice and may attend PMB meetings upon request (and PCC meetings as required).
    - WP8 (T8.1, T8.2): SAG members will contribute to the user requirements capture and specification:
        - technical elaboration of use cases, scenarios and possible applications where users will encounter large volumes of data;
        - support contact and recruitment of potential end users who will be asked to participate in "creative lab sessions" to generate high level scenarios (ideas and suggestions on alternative futures; driving forces in the main fields covered by CEEDS).
    - WP8 (T8.3); SAG members will contribute to CEEDs consortium's understanding of the environment in which CEEDs is to operate including current standards, goals to be accomplished with the data sets, and characteristics of the data sets.

- Each SAG member will sign a Non-disclosure agreement, providing for confidentiality and effective cooperation and allowing them to deliberate freely.
- NOTE: The travel costs and participation fees for external members of the SAG will be reimbursed from the project budget, allocated initially to GOLD under management activities.

2.3 SAG members: inclusion criteria

Potential SAG members are identified as part of the activities in WP8 (T8.1) with support from other partners. Final decision on SAG membership is based on the stakeholders' seniority and complementary of competence, and membership is decided by the PCC in consultation with the EC Project Officer.

The DoW outlined the following specifications for identifying SAG members:

- To belong to one of the five application areas (each different application area must be covered by SAG);
- Direct or indirect access to large datasets;
- Target range of nationalities (from EC member countries), in order to ensure a wide applicability of the project results;
- Include representatives with a professional interest in better understanding large datasets (e.g., senior technical and marketing stakeholders).

Part of the activity in T8.1 is dedicated to understanding, across the five application areas, the commonalities in the datasets of these respective application domains; it is not the intention of CEEDs to produce five different display environments for each application area.

2.4 Members at project outset

2.4.1 Internal SAG members

Four CEEDS partners were automatically allocated to the SAG because of their ability to access/provide datasets for use in the CEEDs project and their specific expertise in an application area (see Table 1 below).

Tab. 1 - Internal SAG members and associated CEEDs application

Internal SAG member	Country	Principal Application
Leiden University	Netherlands	Archaeology
Electrolux	Italy	Commerce
Universitat Pompeu Fabra	Spain	History Neuroscience
Sackler Centre for Consciousness, University of Sussex	UK	Neuroscience

2.4.2 External SAG members

At project set-up, several external organisations working in the application areas of interest in CEEDs were invited to participate as external members of the SAG should the project obtain funding. Each had supplied a letter of intent to participate (see Annex I). Table 2 represents external SAG members with provisional membership at project outset.

Tab. 2 - Provisional external SAG members at project outset

External SAG member	Country	Principal Application
Laboratory for Engineering Man-Machine systems (LEMS), Brown University	USA	Archaeology (computer vision/information retrieval)
European Southern Hemisphere Observatory	Chile	Astronomy/Astrophysics
Centre for Research in Computing and the Arts (CRCA), University of California	USA	Commerce (scalable city virtual world)
Gedenkstätte Bergen Belsen	Germany	History (Topography of Bergen Belsen)
International Neuroinformatics Coordinating Facility	Sweden	Neuroscience (protein sequences, structure/function information)
Centre for Bioinformatics, Imperial University	UK	Neuroscience

2.5 Engaging new SAG members

SAG membership is open throughout the duration of the project. In Year 1, recruitment for potential SAG members has included:

- Advertising on the CEEDs website (with a link to SurveyMonkey for respondents to complete information about their CEEDs application of interest and what they can offer the project (e.g., database access);
- Requesting suggestions from the CEEDs project partners;
- Networking at events (e.g., FET11);
- Collaborations with relevant organisations as part of partners' day to day activities.

There have been four respondents to the SurveyMonkey feedback form of which only one has been considered for SAG membership (relevant to sensing, machine learning, systems application – see Table 3* below). Two respondents were PhD requests from non-EU students, and another respondent was untraceable). Several other relevant contacts have been made through GOLD's activities. Membership with the CEEDs SAG has been discussed with the PCC and PO. The list of new stakeholders and their areas of expertise is presented in Table 3 below.

Tab. 3 - New CEEDs Stakeholders

Potential/New SAG members	Country	Principal Application/Contribution/Role
*Prof. Dr. Paul Lukowicz, Universität Passau	Germany	Scientific advisory role (sensing, machine learning, systems applications etc) and input to exploitation; (coordinator of the FET Science of Socially Intelligent Systems funded SOCIONICAL and partner in FuturICT)
Nick North, Joint Managing Director, GfK NOP Media	UK	Use cases/scenarios/exploitation (Commerce: expertise in understanding and expanding clients' audiences; demonstrating value to advertisers; maximizing return on advertising investments; reinforcing leadership in consumer and business markets)
Chris Aubrey, Vice President Global Retail Marketing, Adidas	Germany	Use cases/scenarios/exploitation (Commerce: expertise in development of the store concepts, shop in shop concepts, presentation of product through visual merchandising and communication with the consumer through retail marketing and in-store multi-media
James Kydd, Director, Start Ventures	UK	Use cases/scenarios/exploitation (Commerce: expertise in branding, marketing and advertising)
Bob Udale, Planning Director, Start Judge Gill	UK	Use cases/scenarios/exploitation (Commerce: expertise in marketing and advertising)
Simon Sprince, Technology Development Consultant, Focus Innovation	UK	Use cases/scenarios/exploitation (Commerce: expertise in digital media and marketing, commercialisation of products and services, business models)
Les Binet, European Director, DDB (Creative Agency)	UK	Use cases/scenarios/exploitation (Commerce: expertise in marketing and advertising; background in A.I and computer modelling)

2.6 SAG involvement in Year 1

Stakeholders have:

- been formally welcomed to the CEEDs project;
- been matched on expertise to CEEDs Partners;
- contributed to the Consortium Meetings and Application meetings (internal SAG members only in Year 1); and
- been consulted on initial use cases for the application areas.

Stakeholders (internal and external) at project outset were contacted in December 2010 to formally welcome them to the CEEDs project (see Annex II for details). They were provided with details of WP8 partner contacts and asked to sign a two-way non-disclosure agreement (external SAG members only). This formal approach to membership is currently being reviewed for Year 2 to make the process easier and less formal (see 'WP8 plans for Year 2', Section 6.1.1). In practice some stakeholders (e.g., Bergen Belsen, INCF) prefer to have direct contact with partners with whom they had already developed a working relationship (e.g., UPF). This less formal style of interaction will continue in Year 2.

In Year 1 involvement from SAG will not extend to external members' participation in the pre-review meeting in November. Internal SAG members (e.g., UPF) or Partners with close stakeholder links (e.g., UNIPD/UH for Electrolux) will fulfil this role. All internal SAG members (see Table 1) are tightly integrated into the application development (WP6: see D6.1 for details).

It is expected that in Year 2, external SAG members will become more engaged with partners to whom they can offer support. Feedback from external SAG members has suggested that they can offer specialist advice and support in particular subject areas and WP8 aims to appropriately match the expertise of SAG members to that of partners. It is also more likely that because some external stakeholders expressed concern over their busy schedules with regard to attendance at pre-review meetings, that their involvement in this regard will be more ad-hoc, and physical attendance not necessarily required.

Stakeholders have been consulted formally and informally on initial use cases for the application areas (see 'Methods and Process' and 'Results', Sections 4.1 and 5.1 respectively). They will continue to be engaged in Year 2 for further input to the initial use cases and scenarios presented in this document (see 'WP8 plans for Year 2', Section 6.1.1).

3 Aims and objectives

In the Description of Work (DoW), it is proposed that CEEDs:

> *"will develop novel, integrated technologies to support human experience, analysis and understanding of very large datasets [...] will develop innovative tools to exploit theories showing that discovery is the identification of patterns in complex data sets by the implicit information processing capabilities of the human brain. Implicit human responses will be identified by the CEEDs system's analysis of its sensing systems, tuned to users' bio-signals and non-verbal behaviours. By associating these implicit responses with different features of massive datasets, the CEEDs system will guide users' discovery of patterns and meaning within the datasets." (DoW, p.3)*

Five CEEDs applications are described in the DoW and across these CEEDs broadly aims to support discovery, understanding and/or empathy in relation to large and complex datasets. Abduction (generating a feasible hypothesis) will be facilitated by deploying principles of phenomenal consciousness (GEPE model) and supporting the incubation stage of creativity (where the 'problem' is put aside and not consciously attended to).

Across the five application contexts described in the DoW, the role of CEEDs technology for users varies. For instance, the neuroscience and astrophysics scenario examples focus on CEEDs technology being used as a 'discovery' tool, and in the commercial scenario example, the role of CEEDs is to facilitate understanding of designers' experience maps of (e.g., interest in) products to support product design.

To ensure that the project does not develop markedly disparate applications, WP8 has focused effort this first year on identifying common underlying CEEDs features to support the selection and elaboration of application scenarios that are clearly in scope whilst ruling out others.

This work will also support further primary research with stakeholders to be conducted in WP8 in the next year. Refinement of the scope of CEEDs will ensure that stakeholders are provided with clear information about the central *functional affordances* of CEEDs technology on which they can brainstorm and elaborate the use cases and scenarios.

WP8 considered the following questions:

- What are the characteristics of the (raw) datasets that stakeholders intend to supply to the project?
- What are stakeholders' initial thoughts on CEEDs application scenarios presented in the DoW? *What are the commonalities across different application areas? How do these 'fit' with the CEEDs proposition – what is in scope?*
- How can we conceptualise CEEDs in a simple way? *What does CEEDs involve? What are the main features of any CEEDs application?*
- What do users respond to? *What is displayed? What are the data sources for display? For what purpose?*
- What data might be collected but not displayed? *For what purpose?*
- When is an application scenario CEEDs relevant? W*hen is it not CEEDs? What is 'in scope'?*

4 Methods and process

To address the questions posed by WP8 in the first year, *primary and desk research*, and *critical and creative thinking* were used. This involved questioning assumptions, identifying prerequisite conditions, identifying parameters of relevance and assessing their relative importance. The activities conducted in this regard were:

- stakeholder consultation on:
    - the application scenarios detailed in the DoW and summaries of the potential application related use cases, and
    - the properties of stakeholder datasets to be supplied to the project;
- development of a user interface taxonomy through:
    - consideration of a range of key variations in CEEDs experiences;
- specification of underlying, central affordances (processes/features) (CFs: core features/high level use cases).

To support a unified vision of CEEDs, outputs from this development process were regularly fed back to Partners via:

- Formal meetings (PCC and Consortium);
- Circulation of written update documents to wider and smaller groups (e.g., WP6 Application groups) of the Consortium; and
- Informal meetings (e.g., Skype calls to relevant Partners, one-to-one meetings to TD and SD).

4.1 Stakeholder Consultation

Contacts at organisations who had expressed interest in becoming a SAG member at project outset were contacted by post and email in early December 2010 (see 'SAG Welcome Pack' Annex II). Along with their welcome letter, NDA (where applicable), information about the aims of the SAG and their roles in the project, they were also asked to provide:

- Information about the characteristics of the dataset/s they were intending to provide to the project
    - *the goals were to provide this information to all Application developers; to plan for access/hosting if dataset was particularly large; to support integration activities; and to glean any relevant information to support the development of use cases).*
- Feedback about the initial aims of CEEDs for their specific application area
    - *the goal was to gather as many user requirements as possible which would provide enough scope for WP8 to refine and elaborate a smaller selection of requirements that are deemed in scope and can developed as prototypes.*

Replies were received by seven stakeholders:

- Gedenkstätte Bergen Belsen
- Imperial College
- University of California
- (Partner) Leiden University

- (Partner) Electrolux
- (Partner) University of Sussex
- (Partner) Universitat Pompeu Fabra

Some external stakeholders were followed-up by Partners familiar with them and (as noted in 'Stakeholder Advisory Group', Section 2) it is likely that their involvement with CEEDs is likely to continue via less formal links and processes. Other new stakeholders that were recruited by GOLD during Year 1 were also prompted for feedback on the use cases/scenarios during face to face meetings (see 'Results', Section 5.1).

4.2 User interface taxonomy

Critical and creative thinking and desk research (using as resources, the DoW and the results of the stakeholder consultation) were used to identify possible ways in which users' implicit and explicit responses may be used as inputs and outputs in any CEEDs application. To illustrate these possibilities with a range of key variations, a series of input-output pictorials were developed (see 'Results', Section 5.2.1 and 'Input-output pictorials' Annex IV for the development work).

This process highlighted a range of key parameters that are likely to vary from one CEEDs experience to another. These were integrated into an excel spreadsheet to indicate the flow of options in any CEEDs experience (see 'Results', Section 5.2.2).

4.3 Specification of CEEDs core features

Finally, further critical and creative thinking resulted in the specification of underlying processes/features of CEEDs: a series of statements about the core features of CEEDs. This was an iterative process whereby initial use cases/core features were refined following a face to face meeting (4th March 2011) with the Scientific Director and presentation at the 2nd Consortium Meeting (6th-7th April, 2011). The penultimate output of this activity was discussed at a face to face meeting with the Technical Director (TD) (with particular regard to WP3) in May 2011 to ensure consistency with the CEEDs system. This resulted in minor revisions to the statements with some additional explanation (see 'Results', Section 5.3 and 'Draft Core Use Cases' Annex V (a) and (b) for the development work).

5 Results:

5.1 Stakeholder consultation

5.1.1 Summary analysis of key findings

The Consultation requested that stakeholders provide information about any dataset(s) that they planned to share with the CEEDs project partners along with initial feedback on the application scenario/s (specific to their expertise/interest) as presented in the DoW. This was to capture initial user requirements of/perspectives on the CEEDs applications. The results indicated that:

CEEDs proposition is an unmet need and is highly desirable: Some stakeholders, particularly in the Retail (Commercial) domain from which a number of external stakeholders were also consulted, indicated that the ability to identify and use implicit as well as explicit user responses to data (e.g., in advertising and marketing contexts) is a highly desirable unmet need.

Contextualisation of data is required: The results suggested that many of the databases supplied by stakeholders would require some contextualisation (and perhaps less abstractive visualisations) to provide meaning to the data; particularly for end users with less expertise in the application (e.g., for general public applications that exploit CEEDs technology, such as retail consumers and historical archive spaces such as museums).

Information displayed to users can be influenced by different sources: Suggestions provided by stakeholders revealed that presentation of their (contextualised) raw data could be influenced by, or could be sensitive to, a number of sources such as real time user responses of which the user is aware/unaware, other users' responses and pre-defined target user 'states' (e.g., using subliminal/supraliminal cues).

Consistency across applications of CEEDs users: Across the application areas, there was evidence of consistency, for instance, with similar broad classes of CEEDs users/beneficiaries. Some stakeholder goals/requirements indicated a distinction between:

- (primary) CEEDs end users – users/interactors; and,
- (secondary) CEEDs beneficiaries – CEEDs system data owners.

Beneficiaries (owners) can also use the system as end users/interactors, but end users could not become owners.

(Primary) CEEDs end users are those who use and interact with the system. For instance, *customers* are supported in their product choices by CEEDs offering a personalised service based on their own (stored and/or real time) unconscious desires and preferences. As an alternative example, consider a team of neuroscientists attempting to validate/refute models to explain patterns of data. They are supported in this discovery process by CEEDs technology because it harnesses their unconscious responses to different visualisations of those models with the data. The neuroscientists can test these models for unconscious 'goodness of fit'. Primary CEEDs end users could be both expert/professional users as well as novices.

On the other hand, other stakeholder goals suggested that some CEEDs users could be more correctly classified as CEEDs beneficiaries as they are (secondary) CEEDs users of others' data. These are characterised as CEEDs system/database owners and can analyse end user responses to data in all sorts of ways. Beneficiaries could use CEEDs user data to optimise displays for different goals (e.g., learning, empathy, sales); predicting and influencing a users' behaviour by understanding their states/plans/intentions in a given context. For instance, design teams may be beneficiaries if they explore their customers' implicit

reactions to products to improve product design. Most users in this category were experts/professionals.

Consistency across potential CEEDs uses: Across the application areas, there was also some broad consistency in the goals that CEEDs technology could support. For instance, CEEDs supports insight and adaptability to users' responses to data which makes it a useful tool for the following interrelated uses:

- *discovering unknown relationships (e.g., between user responses and stakeholder data i.e., adding metadata to stakeholder databases);*
- *personalising experiences (e.g., refining choices)*
- *validating relationships (e.g., best fit);*
- *representing relationships (e.g., reviewing data)*
- *optimising experiences to a given construct (e.g., influencing others, learning sequences of actions, improving memorability of information, optimising enjoyment/presence)*

Information about specific stakeholder databases is presented in Annex III. Generic database information and stakeholder feedback on initial use cases and scenarios are presented below by application area.

5.1.2 Archaeology

Partner LU provided information about their dataset and feedback on the initial Archaeology scenarios.

LU reported that they were able to supply a large and highly-precise database relating to fieldwork at the ancient cities of Koroneia (Greece), Ostia (Italy), and heritage traditional villages and houses of Greece. They reported that already they have been pioneering various forms of 3-D townscape and monument recording and visualization (see Table 7, Annex III).

In terms of the Archaeological scenarios in the DoW, many of LU's requirements were location based.

In terms of target users, their goals broadly focused on CEEDs supporting specialists/experts in their (field)work and supporting interested novices (general public) in their understanding of the significance of archaeological discoveries.

With regard to potential CEEDs applications, the following broad goals were specified:

> **Goal 1:** *To speed up specialists' ability to identify commonalities in discoveries (pottery, mosaics, pieces of architecture) via matching, for instance through: pattern recognition/matching new finds with database of objects; in-situ (on site) ability to match; linking: place of finding; chronology, bibliography in which they are discussed*;
>
> **Goal 2:** *To provide to specialists, intelligence on how to correct the sampling procedure during fieldwork (based on quantity and association of previous finds) in case of under-representation of certain class of pottery e.g., where to dig the next trench;*
>
> **Goal 3:** *To improve specialists' tactile experiences of discoveries (rotation and manipulation) to: support closer contact (presence) and confidence in technology; provide an empathic experience;*
>
> **Goal 4:** *For supporting public understanding and education, for provision of a virtual museum supporting realism, mobility (e.g., iPad), engagement and empathy that is interactive audio/visual/text-based and supports meaning assigned to visualised data.*

5.1.3 History

External stakeholders Bergen Belsen and UPF were consulted.

UPF provided information about the dataset they were developing. They reported that information gathered from primary and secondary sources were being used to populate the spatial reconstruction with temporal information which would be tagged with factual information (see Table 8, Annex III).

The broad aim of this Historical CEEDs application was specified as:

> **Goal 1:** *To deliver a compelling, memorable, empathic and factual experience of historic events for visitors to the Bergen Belsen site. (This could include an experience in which the user is able to moderate their own emotion).*

As with the archaeology application, many of the requirements are location based. The goal of using CEEDs is primarily to support the public to better understand and remember the significance of Bergen Belsen.

They suggested reconstructing a simple virtual space along with:

- Interactive narrative structure (using visual/personal documents – e.g., capitalising on survivors' recollections), and
- Virtual emotive reconstructions (empathic representations)

Using, for instance:

- Expanding text-based narratives, and/or
- Emotion mapping

5.1.4 Retail

Partner Electrolux reported details of their database and supplied a wide range of user requirements.

Their database was reported to contain a large range of kitchen products (see Table 9, Annex III).

Electrolux's commercial requirements from CEEDs covered a range of environments (in retail, in design house, research units online, XIM) with benefits for a wide range of users (customers, product design teams, sales staff in business to business contexts). This also suggested a distinction between CEEDs end users (e.g., consumers) and CEEDs beneficiaries (e.g., secondary users of CEEDs data, e.g., using consumer data to inform product design).

> **Goal 1:** *To support customers in their independent, in-virtual-situ appliance selection by allowing them to explore virtual appliances (with 3D Kinect style interaction) in a contextualised naturalistic environment (virtual kitchen space);*
>
> **Goal 2:** *To provide training (for e.g., customers or sales staff) to use appliances (simple playback or interactive learning);*

> **Goal 3:** *To support designers speed up product development time by understanding customers' responses to appliances e.g., by exploring perceived aesthetics and usability indices[5];*
>
> **Goal 4:** *To support designers in their development of complex interactive navigation by understanding customers' responses to appliances e.g., force required for controls;*
>
> **Goal 5:** *To support sales teams in selling products to retailers (business to business) by using CEEDs e.g., to display the selection of products, and provide in-store training.*

Other commercially-oriented stakeholders, many in marketing and/or advertising, who were consulted in face to face contexts reported that the CEEDs proposition in a commercial environment would meet the needs of numerous industry professionals (advertising, PR, communications). They recognised the *'Paradox of Choice'* (e.g., see References, Section 7 [2]) whereby consumers today face an overwhelming volume of options from which to choose, which paradoxically reduces consumer satisfaction and impairs decision making. This in turn has implications for consumer protection for instance, how can consumers feel empowered to make the right choice for themselves? How do companies support a more tailored and less overwhelming consumer experience whilst ensuring consumers have given consent for their personal data to be used to support such automatic product selection tools? These topics as well as those in the related area of 'transparency' of information (with regard to, for instance, online behavioural advertising) have received considerable attention from regulatory bodies from different industries over the last decade (e.g., see References, Section 7 [3] [4]) and have implications for the implementation of CEEDs technology (see also D10.2 Project Ethical Guidelines).

Whilst some stakeholders already use interactive retail displays with basic tools integrated to understand characteristics of their consumers (e.g., Adidas's Adiverse Virtual footwear Wall is able to detect a user's gender – see D9.1), the use of implicit user responses, particularly to understand unconscious market needs, has not been implemented and is highly desirable.

Product and prototype user evaluations were also noted by these marketing/advertising stakeholders as uses for CEEDs technology, consistent with the results from Electrolux. Other issues raised by these stakeholders, suggested the following additional goals:

> **Goal 6:** *To better understand consumer needs based on consumer segmentations/user typologies derived from users' CEEDs User Preference Profiles (CUPPS) in order to best fit product displays to user preferences;*
>
> **Goal 7:** *To provide better targeting of stock in different outlets based on an understanding of the prevalence of user 'types';*
>
> **Goal 8:** *To understand, in real time, user responses to product for adaptive pricing (i.e., heat maps – strength of reaction);*
>
> **Goal 9:** *To uncover user state in relation to their context to identify moments in which users are most receptive to communications;*
>
> **Goal 10:** *To understand how to best trigger or manipulate emotional or rational journeys for consumers.*

One Commercial stakeholder also questioned what makes content (social objects) shareable.

[5] Nb. implicit responses may be less sensitive to product manipulations

5.1.5 Science (Astrophysics and Neuroscience)

The goals of exploring and discovering patterns in large datasets are the same in the application domains of Astrophysics and Neuroscience. For this reason, the two application areas are combined and termed 'Science'.

Partner UoS and UPF were consulted and replied with information about the neuroscience datasets; partner UoS provided tabulated information which is presented in Table 10, Annex III. Three datasets were described by UPF:

1. Neuronal: Multi-electrode recording (UoS), which is derived from activity in snail brains (for more information see Harris, C.A., Passaro, P.A. Kemenes, I., Kemenes, G., & O'Shea, M (2010) (see References, Section 7 [5]) (see Table 7 for further detail);
2. Connectome (UPF): Structural and functional connection matrices for the cerebral cortex - more recent work also includes subcortical regions. The array "CIJ_resampled..." contains the structural coupling coefficients ("anatomy"); and,
3. iqr (see References, Section 7 [6] for more information): Hierarchical; abstractions; dynamic properties (neuron and synapse update functions)

UPF provided additional information for reducing the datasets:

- Sorting the spiking activity of individual neurons from the 252 raw electrode channels;
- Series of spike time stamps, or the waveforms of the individual spikes for each neuron;
- Location where electrode they originated from;
- Max size: Number of recovered neurons (~5-30), for the number of spikes recovered for each (~1000-100000), and if spike waveforms are displayed, they have between 30-100 data points each.

CEEDs scenarios for this application could include:

> **Goal 1:** *To support experts in the discovery of new patterns in datasets, e.g., via implicit responses indicating rule violation;*
>
> **Goal 2:** *To support experts in testing alternative hypotheses/models through visualisation of the data in different ways e .g., to use information about the strength, direction and number of independent confirmations ("known-ness") of relationships within and between a large set of variables. This could include algorithms and equations (e.g., explore implicit zones of interest in astrophysics, neuroscience);*
>
> **Goal 3:** *To provide students/visitors in classrooms/museums with an educational/learning tool to support better understanding of the significance of brain structure and its relationship to function.*

5.2 User interface taxonomy

5.2.1 Input-output pictorials

To address the question of how CEEDs could be conceptualised in a simple way to support the specification of valid and in scope use cases and scenarios, a series of pictorials were constructed. These were used to illustrate the different ways that users' implicit and explicit responses *could* be used in CEEDs as inputs and outputs and to understand what would characterise a 'CEEDs experience'.

Three main components are relevant in the context of inputs and outputs in the CEEDs experience, namely the user, the CEEDs engine, and the content/data display. These components are linked by the presence of absence of explicit and implicit user response data.

For the purpose of this report, this process of storing explicit or implicit user data and annotating the stakeholder, or similar, dataset with this user response data is termed *'tagging'*.

In the example pictorials below, the 'user' is indicated by a circle on top of a triangle; the 'CEEDs engine' by a rectangle, labelled as such; and the 'content display' by a chunky arrow, also labelled. All three components are contained within a larger boxed space indicating the 'current session'. In some pictorials, a separate space is created to the left of the 'current session' to indicate the relevance of a previous session on the current session. Where this is shown, it indicates that data displayed in the current session have pre-tags based on the responses of users from previous sessions.

Colour is used to indicate whether implicit or explicit responses are involved or not. Blue (outline) and yellow (fill) are used to represent 'explicit' and 'implicit' responses, respectively. The colour is saturated/bright when it refers to the current session; the colour is desaturated/dull/faded when it relates to a previous session. Grey (outline) is used where neither explicit nor implicit responses are relevant.

In some pictorials where a current user is presented with pre-tagged stakeholder data (derived from a previous session) as well as real time tags based on the current users' responses, the colours are combined as overlapping layers (stripes).

The pictorials assume that any data displayed in CEEDs will have meaning and that 'raw data' (i.e., that provided by stakeholders before any users have experienced it with CEEDs) will be visualised (and potentially presented in other modalities) and 'produced' or contextualised before it is presented to a user.

This process generated a series of input-output pictorials that suggest that CEEDs could offer both passive (see Figure 2 for examples) and interactive (see Figure 3 for examples) experiences. The full set of pictorials is presented in Table 11, Annex IV.

5.2.1.1 Potential passive CEEDs experiences

Figure 2(a) indicates that the current user is presented with raw stakeholder data that has not been used (tagged) by the responses of any previous user. The user's implicit and explicit responses are not even being measured here so there cannot be any influence of user's responses on the data displayed. This illustration is akin to watching television and is unlikely to be considered a CEEDs experience.

Figure 2(b) illustrates an experience akin to 2(a) in that the user cannot influence the display in real time (no user feedback). However, it suggests that their (implicit/explicit) response data are being captured and tagged on to the raw stakeholder data. This tagged data could then be explored by the same/another user at a different session. An example of this type of set up would be circumstances where it is important to control presentation of (inert/moving)

stimuli so that multiple users' responses to standardised (identical) stimuli can be collected and later reviewed.

Figure 2(c) represents this type of 'review' scenario which is a consequence of the data collected, for instance, in Figure 2(b). Here, a previous user's data are 'overlaid', tagged or have influenced the way in which raw stakeholder data is presented. This is indicated by the presence of a previous user to the left of the current user in de-saturated yellow/blue which flows via the CEEDs engine and into the content display for the current user. As with 2(a) however, the current user's responses to those data is inconsequential as their responses are not being collected.

Finally, in Figure 2(d) the current user experiences 'tagged' stakeholder data (from a previous session of the same or another user's response data), akin to 2(c). Whilst the current user's responses are being collected and stored, they have no real time influence on the display. This could represent a current user's experience of data that has been optimised for a given construct (e.g., learning) based on a previous user's data and for which the beneficiary (e.g., an expert) is testing the effectiveness of this representation with the current user.

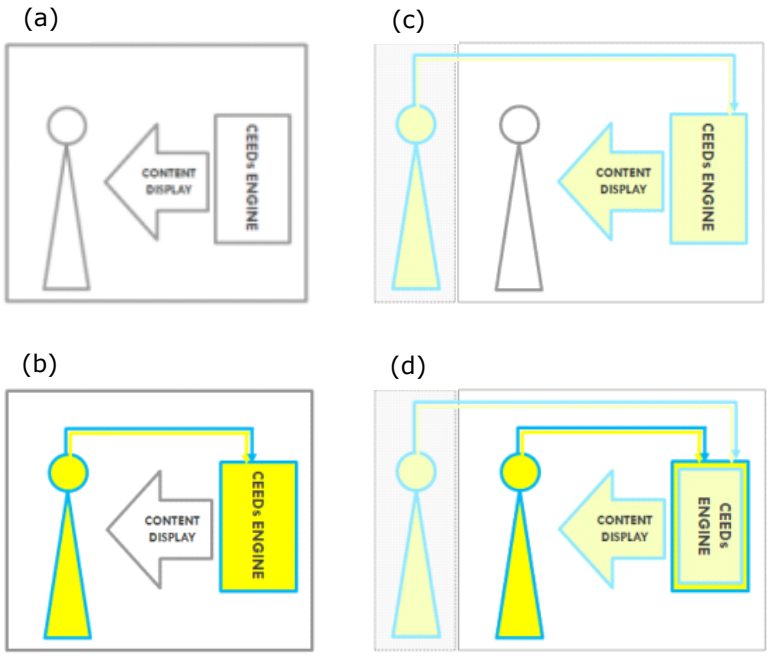

Fig. 2 - *Potential passive CEEDs experiences*

5.2.1.2 Potential interactive CEEDs experiences

Figure 3 shows a selection of the potential interactive input-output CEEDs experiences as indicated by the saturated yellow/blue colour arrows that flow from the user, via the CEEDs engine and back through the 'content display' arrow to the user.

In figure 3(a) the user explores the stakeholder data which is influenced in real time by the user's implicit and explicit responses. This relies on the CEEDs Sentient Agent (CSA) in the CEEDs engine which develops a user model based on user responses to data displayed and influences the display to support the goals of that experience (e.g., learning, maintain a particular level of arousal).

Figure 3(b) illustrates the same principle as that shown in 3(a) but this time, with multiple concurrent users. This raises issues about how the CEEDs engine will deal with data from

multiple simultaneous inputs (user responses). For instance, a teacher training their students in how to look for significant patterns in data may require that the CSA weights the group responses (and thus, the influence on the display) to that expert's response data.

Figures 3(c) and 3(d) respectively show how one or more user(s) is/are able to have real time influence over their experience of pre-tagged stakeholder data. This may be used to reinforce/strengthen associations between multiple serial/concurrent CEEDs users' responses and the representations in the stakeholder dataset.

Finally figure 3(e) highlights another potential use of CEEDs whereby two groups of (remotely located) users are simultaneously experiencing the same dataset. In this example, there is a group of data 'explorers' (end users) on the left and a group of 'evaluators' (beneficiaries) on the right. The explorers experience CEEDs in a manner similar to that specified in 3(b). However, in this instance, the group of evaluators have some explicit control over the explorers' experiences. An example might be that the evaluators are a product design team who have some explicit control over how the explorers are experiencing a product. For instance, they might (explicitly) command the system to direct the explorers' attention in real time to a new design feature to better understand how they respond to it.

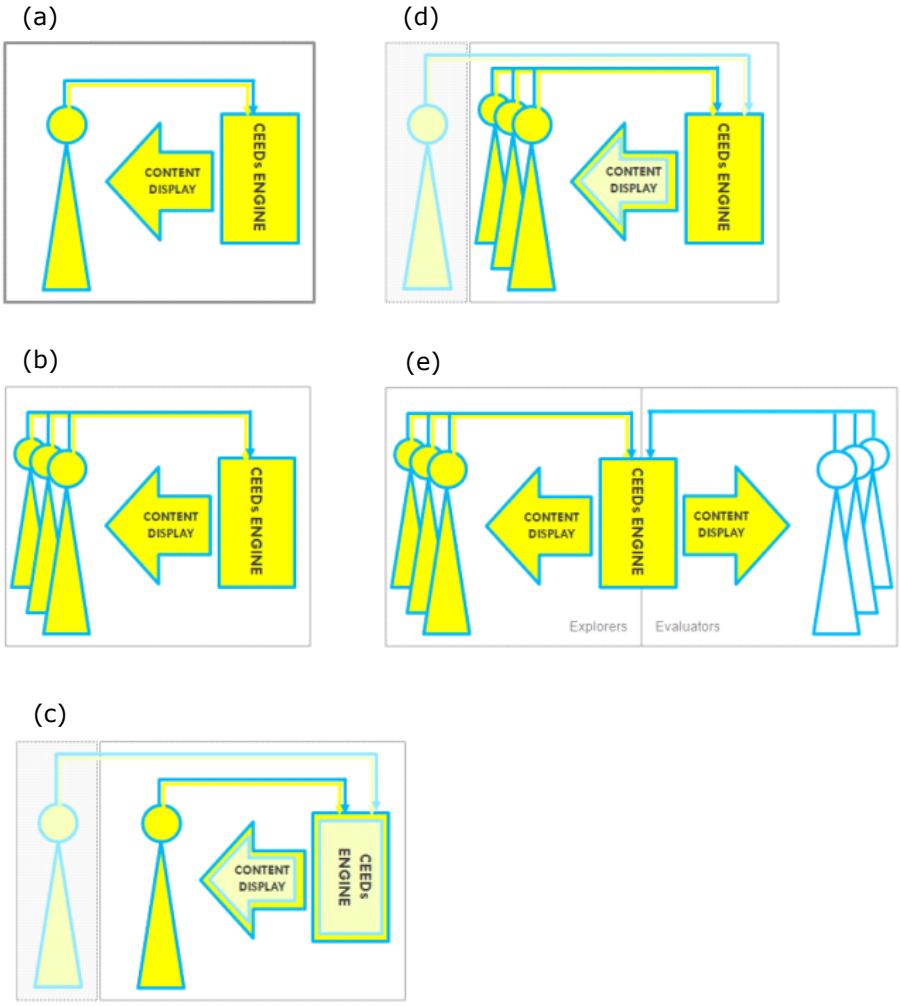

Fig. 3 - *Potential interactive CEEDs experiences*

5.2.2 Key variables in CEEDs

The process of generating input-output pictorials highlighted a number of implications and questions relating to variation in the range of potential CEEDs uses. These key and variable parameters are summarised in Figure 4.

5.2.2.1 Types/number of users

'Users' could be individuals or groups, and experts or novices of the dataset they are exploring

- *Q. How should CEEDs deal with input/output response data from members of groups? For instance, group members' implicit/explicit data could be averaged or weighted to members who are considered more 'expert' than others.*

For any stakeholder dataset, there may be a history of users who have previously influenced that data; it is important to distinguish previous users and current users.

- *Q. How many datasets are being used in CEEDs (raw data, user data)?*

5.2.2.2 Real time/non real time influence of user responses

Explicit and implicit user responses to whatever data is displayed may or may not influence the display in real time, depending on the user requirements for that CEEDs session.

- *Q. When might real time influence be required?*
    - *Real time influence can support intuitive interaction with the system through a series of pre-requisite rules that should be transparent to the user (e.g., pointing at an object might result in 'zoom in' to the object.) This is unlikely to require the CSA.*
    - *Real time influence can be used for the CSA to guide users' experience of the data (e.g., based on pre-tag thresholds or user thresholds of responding). This would require the CSA's involvement and is unlikely to be transparent to the user as it would make use of multiple sources of user response input (determined by work conducted in WP1 and WP2)[6]. For instance, how can we accurately derive a user's interest: what is the neurological and physiological basis of 'interest' that we can measure with the tools available in the project?*

If a current user's data are just recorded (but not used to influence the display), they should be accessible to the same or another user at a separate session, should they request it.

Whether or not tagging, based on current users' responses, has a real time impact on the display can have important experimental consequences.

[6] In Year 1, WP8 level descriptions of user implicit and/or explicit responses focuses crudely on patterns of responses that are associated with/indications of constructs such as interest, attention, engagement, rule violation (surprise), intensity of experience (arousal), emotional valence (positive/negative), quality and preference, and presence.

5.2.2.3 Data displayed

Thus, overall data displayed to the current user can originate from several sources:

- Raw, 'untagged', data (e.g., contextualised stakeholder data that has never previously been viewed by a user) – *passive experience*;
- Pre-tagged stakeholder data (i.e., tags created based on explicit and implicit user response data from a previous session) – *passive experience*;
- Tagged in real time (from the current user) which results in real time display modification – *interactive experience*; and
- Pre-tagged stakeholder data (derived from a previous session) with real time tags based on the current users' responses – *interactive experience*.

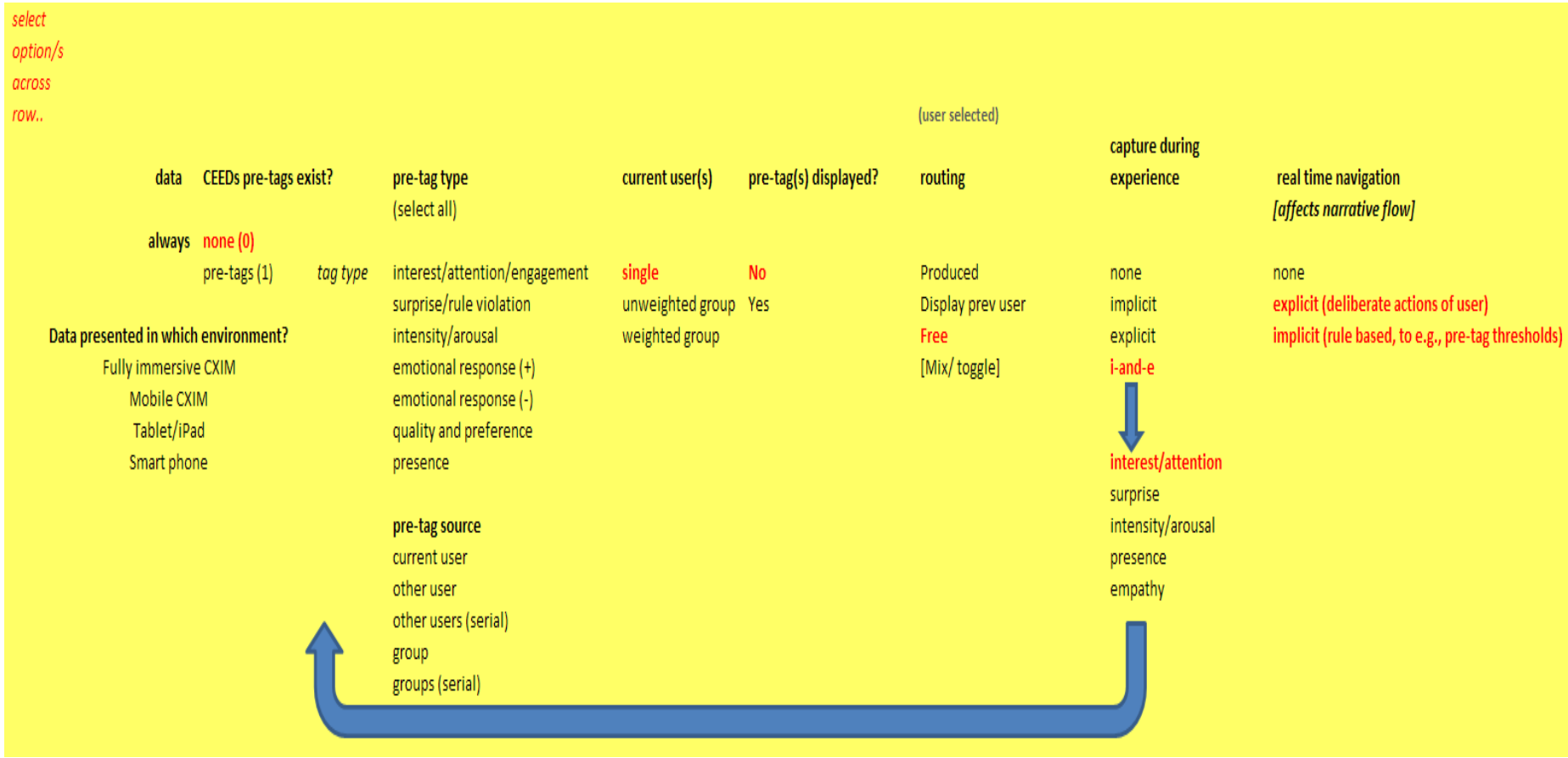

Fig. 4 - *Relevant (CEEDs user defined) variables for Use Cases*

5.3 Specification of CEEDs core features

To support identification of use cases, goals and scenarios that are not only possible but also in-scope for CEEDs, a framework of core features that apply across all applications was developed. This was an iterative process; the initial draft was presented as a set of use cases to the SD (at a face to face meeting, Barcelona) and then Consortium members (at the 2nd Consortium Meeting). It was then revised to better capture discrete components of any CEEDs experience and was verified for consistency with the technical components of CEEDs by the TD (meeting held at GOLD). The revised work was re-named as CEEDs core features.

The final version is presented here, and the development work is presented in Annex V (a) and (b).

One 'umbrella' core goal, five primary interdependent components and two associated databases were identified as core CEEDs features. This framework was developed to enable all partners to have a shared understanding of the commonalities across all CEEDs applications, and to support the development of in-scope application scenarios and goals.

At the top level, the overarching purpose of CEEDs can simply be stated as:

[CF0] to support discovery, understanding and empathy in relation to large and complex datasets, through:

a. abduction (generating a feasible hypothesis) which will be facilitated by deploying principles of phenomenal consciousness (GEPE model) and supporting the incubation stage of creativity (where the 'problem' is put aside and not consciously attended to).

This breaks down to five interdependent components and two associated databases, summarised in Table 4 below. Their relationships are illustrated in Figure 5.

Tab. 4 - CEEDs core features

Core Feature	Definition	Summary
CF-RDDB	Raw Data Database	Data input to CF1
CF1	The display of a CSA-independent filtered view, perspective or flow of CF-RDDB	Data representation (context/visualisation)
CF2	The collection and storage of users' (a) explicit and/or (b) implicit responses to a dataset	Data input (user response - raw)
CF3	The interpretation and storage of the output of CF2	Data input (interpretation of user response - semantic)
CF-URDB	User response database	Relational dataset (input to CF4)
CF4	The display based on a user model of a CSA-dependent view, perspective or flow of a raw dataset	Based on Real time A.I from CSA
CF5	The display of users' responses and/or the data on which the CSA is making decisions as an overlay to the output of CF1 or CF4	Review/ visualisation/multi-modal representation ("looking at the machinery")

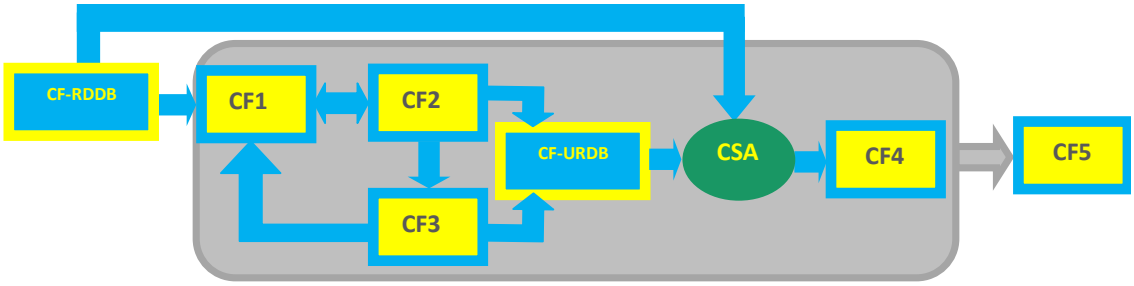

Fig. 5 - *Interdependencies and data flow between core features (arrows indicate input)*

These core features are described in detail below:

- ***[CF-RDDB] 'Raw Data Database'***

Exploring large datasets is fundamental to the primary objective of CEEDs. Any CEEDs experience requires an existing raw database from which data are represented (e.g., visualised) and displayed to the user. The 'raw data database' [CF-RDDB] for each application will be derived from stakeholder groups (including those internal to the consortium).

- ***[CF1] The display of a CSA-independent filtered view, perspective or flow of CF-RDDB***

CF1 defines the treatment of the CF-RDDB as it is displayed to users. It relates to the rules governing cue sequences including how the data is presented, the starting point and route taken. Importantly, CF1 is defined by its independence from the CEEDs Sentient Agent (CSA); how the data is displayed does not require a user model derived from the CSA. Thus, passive sequences of data (akin to a 'fly-through') can be determined by outcomes of non-CSA variables such as 'sort' or 'match' (e.g., typologies), a directorial/producer preference, or a random sequence, and the data can be contextualised using a developer-designed virtual reconstruction. Subliminal or supraliminal guidance through the data is possible if the director/producer specifies such influences in how the data is presented to users. Active interactions between the user and the data displayed would be possible based on (reactive) rules specifying interaction paradigms (e.g., hand flick gesture to browse through object sequences). The way in which the data are presented provides the problem/data space. Partners with key involvements in this core feature include TEES, UH and CERTH.

- ***[CF2] The collection and storage of users' (a) explicit and/or (b) implicit responses to a dataset***

In a CEEDs experience, users respond to datasets based on the output of CF1 or the output of CF4 (tagged dataset), and CF2 reflects the collection and storage of these responses. Raw user responses (e.g., GSR, ECG) are essential prerequisites for: (a) inferring how the user unconsciously interprets the data (i.e., CF3); (b) the CSA to build a user model (defined in CF4) and (c) user response 'overlays' (review) (defined in CF5). Partners with key involvements in this core feature include UDP and UAU and others involved in WP1 (Theory of human unified experience) and WP2 (CEEDS sensing system).

- ***[CF3] The interpretation and storage of the output of CF2***

Raw user responses (CF2) require interpretation in order to establish whether the display has provoked in the user the desired responses, which are variable across application scenarios/goals, and to understand what type of response the stimuli elicit (e.g., does the user's responses indicate implicit satisfaction?). In CF3, meaning is inferred through analysis of the pattern of user response data inputs from multiple sources (e.g., EEG, GSR). This information is used to drive CF4 and CF5. Partners with key involvements in this core feature include UAU and partners involved in WP1 (Theory of human unified experience).

- ***[CF-URDB (user response database)]***

The CF-URDB stores outputs of CF2 and CF3, and in relation to the raw data (CF-RDDB input to CF1), this information is input to CF4.

- ***[CF4] The display based on a user model of a CSA-dependent view, perspective or flow of a raw dataset;***

The autonomous CEEDs Sentient Agent (CSA) is a conscious, goal driven agent which can control the data displayed and guide data exploration (see D3.1 for more information). The CSA coordinates the interaction between the user and the problem/data space. It does this by constructing a user model based on the outputs of CF2 and CF3 and, together with its own interests and intentions, modifies the display to guide users in their data exploration. CF4 defines the presentation of this real time CSA-influenced dynamic perspective of the raw dataset. As with CF1, cue sequences are rule based but unlike CF1, in CF4 the rules are dependent on the CSA which may include subliminal and supraliminal influence to guide users through the data. This could be based on, for instance sort, match or typology functions (e.g., if the goal is to maintain a threshold level of interest or empathy). CF4 is analogous to car satnav systems by which a route is plotted and specified to the driver ("turn left") based on metadata of which the user is unaware (e.g., traffic congestion); that is, the metadata influences the presentation of raw data. This represents the CEEDs abduction tool. Partners with key involvement in this core feature include UPF and partners involved in WP3 (CEEDS engine: perception, cognition and action).

- ***[CF5] The display of users' responses and/or the data on which the CSA is making decisions as an overlay to the output of CF1 or CF4***

CF5 defines an alternative representation of the raw data (CF1) or tagged data (CF4) by overlaying the outputs of CF2, CF3 to allow the user to access an overview perspective. This could be used in contexts where a user wishes to see which user data (responses) have influenced the display, for instance, a professional examining the responses of a group of users, learning how experts classify stimuli, debugging, and general data exploration. In this sense, in contrast to CF4 in which metadata influences the display without the user being consciously aware of the relationships between their inputs and the output of the display, in CF, the metadata is displayed. Analogous to a car satnav system, CF5 is where the driver can see the traffic congestion data in addition to, or instead of, being provided with instructions based on those data.

To put these core features into context, Table 5 provides illustrative examples of how core features might apply to elements of the different overall goals supplied by CEEDs stakeholders.

Tab. 5 - Examples of types of core features for different parts of application goals

Core Feature	Examples within application area
1	(Appliance) A virtual showroom environment displaying examples of washing machines, and other electrical goods. (History) A virtual 3D camp based on factual information about the Bergen Belsen site.
2	(Science) An expert user's gaze duration towards a particular area of abstractly presented neuroscience data is collected and stored. (Archaeology) A user's comment on the place of finding of the sherd they are exploring is recorded and stored.
3	(Appliance) The B2B user's physiological reactions suggest that the user is not satisfied with the control panel on the dishwasher. (Science) The combination of the user's physiological reactions to an abstract representation of data suggests that it is inconsistent with other parts of the data
4	(History) The CSA guides the user to a less distressing experience on the camp because their physiological reactions suggest they are too highly and negatively aroused (Archaeology) Based on the way the user looks at an artefact, the CSA retrieves and presents to the user artefacts from a database with similar user scan paths
5	(Appliance) Design teams want to understand which features of a fridge to improve by reviewing a group of users' responses that have been interpreted as 'dissatisfied'

5.3.1 Summary of example stakeholder goals by core features

Within each application area there are specific initial goals (see Results, Section 5.1) that rely on combinations of these component core features.

Below in Table 6, a selection of example stakeholder goals across different application areas are presented in relation to the core features involved in delivering that CEEDs experience. Note that some application goals relate only to CF5; these entail access to previously stored user responses to a dataset (based on data overlaid on CF1 or CF4) and are thus also in-scope.

Tab. 6 - Core features addressed by different application goals

Application goal	CF1	CF2	CF3	CF4	CF5
ARCHAEOLOGY: To support experts' ability to assign pottery artefacts to satisfactory typologies *[single/multi user; single/multi-site?; portable CXIM; expert; real time and non-real time; data is virtual]*	✓	✓	✓	✓	
ARCHAEOLOGY: To provide a training tool for student archaeologists to learn how to assign pottery artefacts to satisfactory typologies *[single/multi user; single site; expert; non-real time; data is virtual]*					✓
APPLIANCE: To inform the design of optimised desirable white goods *[single/multi user; single/multi-site; portable CXIM; expert/novice; real time/non-real time; data is virtual]*	✓	✓	✓	✓	✓
HISTORY: To provide empathic and factual spatialised experiences of historic events from different viewpoints (e.g., survivor, victim, camp liberator, guard) to support awareness and understanding about the significance of Bergen Belsen *[single/multi user; single site; novice; real time/non-real time; data is real world]*	✓	✓	✓	✓	
HISTORY: To provide an empathic and factual spatialised experience of historic events in which the user can moderate their own emotion by selecting a guide path tagged for emotional intensity and valence *[single/multi user; single site; novice; real time/non-real time; data is real world]*	✓	✓	✓	✓	
SCIENCE: To support hypothesis generation (abduction) *[single/multi user; single/multi site; expert; real time/non-real time; data is virtual]*	✓	✓	✓	✓	✓

Teams for each application were established to develop a prototype application as part of WP6: Appliance[7], Archaeology, History, and Science.

[7] A prototype based on Electrolux's requirements in the 'retail' application area was renamed 'Appliance'.

In a collaborative process with the Application partners, WP6 and WP8 worked together to develop at least one scenario relating to an end goal. Each step in the process was described and linked to the CFs described here to highlight how that example was in scope for CEEDs.

For details of each current scenario planned for prototype, the reader is referred to D6.1. Below, two earlier draft examples (from the Retail and History application areas) are provided to show the development of the scenarios/CFs.

5.3.1.1 Retail: A CEEDs perspective on Appliance selection

(lead partner: UH *with CERTH, ELECTROLUX, TEES, UNIPD*)

Electrolux currently evaluate their product range with panels of end users via questionnaires which are susceptible to responder bias. To improve their product evaluations CEEDs has potential to offer a more valid product evaluation by measuring the implicit responses of their end users to their product range.

Goal: To inform the design of optimised desirable white goods by:

a. monitoring (and recording) implicit users' responses (as a group) [CF2] to representations of whole product images [CF1], specifically *where* users focus attention (gaze direction);
b. delineating products into parts (e.g., handle, display, buttons) that are considered 'satisfactory', 'unsatisfactory', or 'insignificant' on the basis of implicit user responses evaluated against (pre-determined) thresholds (level of satisfaction/positive-negative valence) [CF3];
c. replacing parts that are not considered (/tagged as) satisfactory with parts that *least* match that which were initially presented (using CERTH's content based search on part and the CSA) [CF4];
d. replacing parts that are considered (tagged) satisfactory with parts that *most* match that which were initially presented to identify whether higher satisfaction reactions can be elicited [CF4];
e. evaluating implicit responses to replacement parts in an iterative cycle [CF3, CF4] until all component product parts receive optimised satisfaction ratings with the evaluation group.
f. if none of the options for a particular product part reaches the satisfaction threshold, users can sketch their preference and a similarity search can be run [CERTH/ITI]
g. the recorded implicit/explicit responses of users (as individuals or groups) to the product range are accessed and reviewed by the product design team who are able to sort the results (e.g., by level of satisfaction per part/overall product) [CF5]

5.3.1.2 History: A CEEDs perspective on Bergen Belsen

Goal: To provide empathic and factual spatialised experiences of historic events from different viewpoints (e.g., survivor, victim, camp liberator, guard) to support awareness and understanding about the significance of Bergen Belsen, by:

a. recording recollections of a survivor whilst they walk through the camp, and storing this content alongside geospatial information relating to the location in which the recollections were generated [CF2];
b. analysing the speech data and interpreting (and storing) it for emotional valence and intensity [CF3] [nb. Speech data contains explicit content information (words) and implicit vocal cues relating to, for instance, pitch and tone, stability of voice etc.];
c. using historical records, to reconstruct experiences in the camp from others' viewpoints (victim, liberator, guard) [CF1];
d. reconstructing in 3D and rendering the environment [CF1];

e. enabling end users (visitors) to navigate through the site with a handheld device showing different (simple) reconstructions of the camp, accessing both (i) (explicit and implicit) information (recollections) from survivors to facilitate an empathic experience [CF4], and (ii) factual information to provide an informative experience [CF1]

Potential extensions to this application goal include:

a. allowing the user to moderate their own emotion by selecting a guide path tagged for emotional intensity and valence, by the user sorting the route according to a relevant construct (e.g., intensity of experience, positive or negative valence) [CF4]

5.4 Discussion of T8.1 results

The activities undertaken in Year 1 as part of WP8 has involved primary research and desk based research using critical and creative approaches to conceptualise a wide range of applications and stakeholder goals within a common framework. The CFs provide a useful component classification system through which to further develop the use cases and scenarios, and a simple vision for CEEDs with which to communicate and conduct research with stakeholders

Activity in WPs 1 and 3 will further refine the goal user state 'constructs' that CEEDs intends to support in different applications. That is, knowing *how* the raw physiological, gesture and brain data relate in a combinatorial way to meaningful constructs and desired (goal) states in different use cases and scenarios. Through further primary research with existing and potential stakeholders, WP8 will work to identify, for different applications, the types of explicit considerations and emotive and affective states that are associated with positive and negative experiences and outcomes of each scenario planned for development in WP6. In collaboration with these scientific workpackages, the feasibility of outputs derived from WP8 will be considered in the next few months (see 'WP8 plans for Year 2', Section 6).

6 WP8 plans for Year 2

6.1 WP8 tasks

In Year 2 (mo 13-24) of the project, there are two tasks. Outstanding activities to complete T8.1 (Scenario development and use cases; scheduled to run from Mo1-15) will be conducted between months 13-15, and work will begin on T8.2 (Specifications and use case updates; scheduled for months 16-36).

Activities for the remainder of T8.1 will focus on further end user research, capitalising on discussions with existing stakeholders, and specifying a range of higher level scenarios including applications, tools and services enabled by CEEDs technology.

Task 8.2 (mo 16-36) involves continued collaboration with stakeholders and WP6 (Application Development), and also with WP7 (Experience assessment and human factors). WP7 will comprise small scale end user evaluations of initial CEEDs application components. Using an iterative collaborative approach to understand stakeholder and end user reactions to CEEDs applications and experiences, in Year 2 WP8 will update the use case and scenarios work developed in Year 1.

More detail on the aims and scope of the activities planned for Year 2 (/3 where T8.2 applies) is presented below.

6.2 WP8 activities

6.2.1 Stakeholder Advisory Group

Streamlined and less formal engagement process: As noted earlier in this document (see Stakeholder Advisory Group, Section 2.1), a formal process of SAG membership was developed in Year 1 which will be revisited and revised to better meet stakeholder needs. A more streamlined and less formal engagement process (to simplify stakeholder roles) will be developed and deployed in Year 2.

Engagement with new Stakeholders will continue: The aim of the SAG is to complement the skills of the consortium, provide or identify access to relevant massive databases, and to support identification of potential exploitation of CEEDs technology in as wide a range of potential contexts as possible. This means that there is not a fixed number of SAG members. However, with budget restrictions, the stakeholder requirements (e.g., attendance at, at least one meeting per year) will not uniformly apply across all stakeholders and a more ad-hoc (input as required) approach is likely to be adopted.

Supporting stakeholder/partner interaction: In the first year of the CEEDs project, progress has been made on consolidating and formalising the initial ideas for CEEDs applications, to support a unified vision of CEEDs throughout the consortium and for communicating with others, outside of the consortium. Input from internal stakeholders has been essential in this first year to support identification of how user/beneficiary goals might be met by CEEDs technology. As the project is maturing, partners may require and benefit from more concrete information relating to external stakeholders' particular experiences, knowledge/expertise and skills in any of the application domains. Progress in Year 1 has facilitated communication with external stakeholders in Year 2 by having a concrete framework of in-scope goals, and simple example scenarios with which to prompt relevant discussion and debate with and amongst stakeholders. New methods of better supporting this new type of external stakeholder/partner interaction that facilitates efficient, effective and mutually agreeable relationships will be considered.

The stakeholders will be asked to participate in informal discussions and formal research as appropriate to the work of T8.1 and T8.2 (see below).

6.2.2 Updates of use cases and scenarios

To further specify use cases and scenarios, the functional affordances for different types of user/beneficiaries will be explored within each application. Higher level elaborations and lower level abstractions of scenarios from the user/beneficiary point of view will be generated, for instance:

(a) abstractions of the scenario steps for applications in WP6 will enable definition of potential CEEDs user actions across application area; and

(b) qualitative (and possibly quantitative) research with end users/beneficiaries of different applications to explore experiences of prototype applications and to brainstorm on possible CEEDs futures. Participants are anticipated to include stakeholders (from SAG) and end users of prototypes recruited for experiments in WP7. There are a number of potential method(s) to gather user requirements and perspectives, such as focus groups, creative workshops, interviews, and brief post-experience questionnaires. The method chosen for different user/beneficiary groups will be influenced by the specific aims, the context in which the data are gathered (e.g., lab based experiment in WP7 vs. external stakeholder meeting in an office environment) and pragmatics (e.g., stakeholder or participant availability).

Primary research (b) will consider research questions concerning:

- different types of end users;
- explicit considerations and emotive and affective states of end users that are associated with positive and negative experiences and outcomes of each scenario (to support identification of target end user goal states);
- applications, tools and services enabled by CEEDs technology and current/future unmet end user needs in this regard;
- motivations to engage with CEEDs (purpose and context) including explicit considerations such as whether the user/beneficiary requires support from CEEDs for leisure/entertainment, knowledge/information/education, discovery/professional ('novel insights'), personalisation/search type purposes;
- for different application contexts, how end users/beneficiaries rank order the importance of generated functional affordances, and why;
- end user attitudes and responses to the notion of CUPPs (personalised data storage of responses to displayed stimuli for use by users in other contexts). For easy to understand anchors/prompts for users, similarities can be drawn with attitudes towards store cards, and online behavioural advertising; and
- end user concerns with CEEDs uses: understanding user attitudes towards the appropriateness of wearables in different contexts; understanding how to best balance concerns with benefits of CEEDs, for instance what are acceptable parameters to users? User consents and controls: how to manage user control over their CEEDs experience particularly experiences with real time implicit/explicit response capture.

The scope of these activities will also be balanced with the application level requirements and constraints: WP8 tasks can explore a wide range of user attitudes, experiences and ideas for CEEDs use case and scenario futures, but the scope may change during the year through collaborative discussions with internal partners regarding any technical constraints or limitations.

7 References

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[2] http://www.ted.com/talks/barry_schwartz_on_the_paradox_of_choice.html

[3] European Advertising Standards Alliance (EASA) (13 April, 2011). EASA Best Practice Recommendation on Online Behavioural Advertising. http://www.epceurope.org/presscentre/archive/easa_bpr_oba_12_april_2011.pdf

[4] IAB Europe (14 April, 2011). European Self Regulation for Online Behavioural Advertising: Transparency and Control for Consumers. http://www.iabeurope.eu/media/51094/iab%20europe%20self%20regulation%20for%20online%20behavioural%20advertising%20140411%20f.pdf

[5] Harris, C.A., Passaro, P.A. Kemenes, I., Kemenes, G., & O'Shea, M (2010). Sensory driven multi-neuronal activity and associative learning monitored in an intact CNS on a multielectrode array. *J. Neurosci Methods (2010), 186 (2):171-178.*

[6] < http://iqr.sourceforge.net >

Annex I: Stakeholder Letters of Intent

(a) International Neuroinformatics Coordinating Facility (INCF)

October 26, 2009

Professor Paul Verchure
Lab of Synthetic Perceptive, Emotive and Cognitive Systems
ICREA-Universitat Pompeu Fabra
Barcelona

Letter of support for CEEDS

I have had the opportunity to read the CEEDS application. The intention is to develop an integrated theoretical framework by analyzing real and virtual sources for an understanding of online perception when considering large volumes of data. Our brain relies on implicit forms of information processing as it generates the stream of consciousness and guides our actions in the real world. Many steps in the process of discovery rely on implicit factors rather than explicit considerations. CEEDS will address this problem by investigating the creation of a mixed reality implicit presence that will boost the human creative process.

The International Neuroinformatic Coordinating Facility (INCF) with its secretariat in Stockholm finds this project to be of great interest and intends to validate the CEEDS engine in the exploration of the high dimensional data set that describes the mammalian brain. In particular the users of CEEDS will be able to explore the multidimensional description of anatomical properties of the brain through the meta-database that has been constructed through the merger of several dedicated databases. INCF will be happy to provide extensive support of CEEDS with regard to the databases and other facilities that are being developed by INCF.

Sincerely,

Sten Grillner
Executive Director of INCF
Professor

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INCF Secretariat
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(b) Gedenkstätte Bergen-Belsen

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Gedenkstätte Bergen-Belsen

Gedenkstätte Bergen-Belsen
29303 Lohheide, Anne-Frank-Platz

Dr Jonathan Freeman
Senior Lecturer, Department of
Psychology
Goldsmiths, University of London
New Cross,
London, SE14 6NW, UK

Bei Antwort bitte angeben
Ihr Zeichen
Ihre Nachricht vom
Mein Zeichen
Bearbeitet von Bernd Horstmann
Meine E-Mail bernd.horstmann@stiftung-ng.de
Durchwahl-Nr 05051 - 4759 - 255
Lohheide, den 22.10.2009

Subject: Letter of Support for FP7-Cooperation-ICT-5th Call proposal CEEDS (the Collective Experience of Empathic Data Systems)

To whom it may concern,

On behalf of the Foundation for Memorials in Lower Saxony/Memorial Bergen-Belsen, Germany, I would like to confirm our interest in being a member of the Stakeholder Advisory Group for the

"the Collective Experience of Empathic Data Systems (CEEDS)"

the proposal to be presented in response to the EU FP7-Cooperation-ICT 5th Call Objective ICT 2009.8.4. Human-Computer Confluence: Call-Identifier: FP7-ICT-2009-5.

The CEEDS consortium will develop and deploy new methods to experience and analyze complex massive data sets by combining advanced mixed reality, pervasive computing, ambient intelligence and interface technologies with a theory driven approach towards shaping human unified implicit and explicit experience through new forms of perception and action.

As a member of the Stakeholder Advisory Group we would like to participate in the following activities:

- provide access to selected datasets [topography of Bergen-Belsen] for agreed use within the project,
- provide support for accessing datasets and providing domain specific knowledge for CEEDS system development and testing
- provide specific advice and attend specific project meetings relevant to our interest

Vorsitzende des Stiftungsrates
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Geschäftsführer
PD Dr. Habbo Knoch

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In return, we understand that the costs incurred by providing data to CEEDS will be reimbursed by the project.

Sincerely,

PD Dr. Habbo Knoch
CEO Foundation for Memorials in Lower Saxony

Contact details:
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(c) Laboratory For Engineering Man/Machine Systems (LEMS), Brown University

BROWN

October 29, 2009

Dr Jonathan Freeman
Senior Lecturer, Department of Psychology
Goldsmiths, University of London
New Cross,
London, SE14 6NW, UK

Subject: Letter of Support for FP7-Cooperation-ICT-5th Call proposal CEEDS (the Collective Experience of Empathic Data Systems)

To whom it may concern,

On behalf of the Laboratory for Engineering Man/Machine Systems (LEMS) at Brown University, I would like to confirm our interest in being a member of the Stakeholder Advisory Group for the

"the Collective Experience of Empathic Data Systems (CEEDS)"

the proposal to be presented in response to the EU FP7-Cooperation-ICT 5th Call Objective ICT 2009.8.4. Human-Computer Confluence: Call-Identifier: FP7-ICT-2009-5.

The CEEDS consortium will develop and deploy new methods to experience and analyze complex massive data sets by combining advanced mixed reality, pervasive computing, ambient intelligence and interface technologies with a theory driven approach towards shaping human unified implicit and explicit experience through new forms of perception and action.

As a member of the Stakeholder Advisory Group we would like to participate in the following activities:

- provide access to selected datasets [2D shapes, images, 3D meshes] for agreed use within the project,
- provide support for accessing datasets and providing domain specific knowledge for CEEDS system development and testing,
- provide specific advice and attend specific project meetings relevant to our interest

In return, we understand that the costs incurred by providing data to CEEDS will be reimbursed by the project.

Sincerely,

Benjamin Kimia
Professor of Engineering
Associate Director,
Laboratory for Engineering Man/Machine Systems
Brown University, Box D
182 Hope Street,
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Brown University Providence, RI 02912

(d) Center for Research in Computing and the Arts (CRCA), University of California

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Oct. 21 2009

Dr Jonathan Freeman
Senior Lecturer, Department of Psychology
Goldsmiths, University of London
New Cross,
London, SE14 6NW, UK

Subject: Letter of Support for FP7-Cooperation-ICT-5th Call proposal CEEDS (the Collective Experience of Empathic Data Systems)

To whom it may concern,

On behalf of the Center for Research in Computing and the Arts at the University of California San Diego, USA, I would like to confirm our interest in being a member of the Stakeholder Advisory Group for the

"the Collective Experience of Empathic Data Systems (CEEDS)"

the proposal to be presented in response to the EU FP7-Cooperation-ICT 5th Call Objective ICT 2009.8.4. Human-Computer Confluence: Call-Identifier: FP7-ICT-2009-5.

The CEEDS consortium will develop and deploy new methods to experience and analyze complex massive data sets by combining advanced mixed reality, pervasive computing, ambient intelligence and interface technologies with a theory driven approach towards shaping human unified implicit and explicit experience through new forms of perception and action.

As a member of the Stakeholder Advisory Group we would like to participate in the following activities:

- provide access to selected datasets from the Scalable City virtual world project for agreed use within the project,
- provide support for accessing datasets and providing domain specific knowledge for CEEDS system development and testing.
- provide specific advice and attend specific project meetings relevant to our interest

In return, we understand that the costs incurred by providing data to CEEDS will be reimbursed by the project.

Sincerely,

Sheldon Brown
Director, Center for Research in Computing and the Arts
Professor of Visual Arts
Site Director for the Center for Hybrid Multicore Productivity Research

(e) European Southern Observatory

European Southern Observatory
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Date 24th October 26, 2009

Dr. Jonathan Freeman
Senior Lecturer, Department of Psychology
Goldsmiths, University of London
New Cross,
London, SE14 6NW, UK

Subject: Letter of Support for FP7-Cooperation-ICT-5th Call proposal CEEDS (the Collective Experience of Empathic Data Systems)

To whom it may concern,
I would like to confirm our interest in being a member of the Stakeholder Advisory Group for the
"the Collective Experience of Empathic Data Systems (CEEDS)"
proposal to be presented in response to the EU FP7-Cooperation-ICT 5th Call Objective ICT 2009.8.4. Human-Computer Confluence: Call-Identifier: FP7-ICT-2009-5.

The CEEDS consortium will develop and deploy new methods to experience and analyze complex massive data sets by combining advanced mixed reality, pervasive computing, ambient intelligence and interface technologies with a theory driven approach towards shaping human unified implicit and explicit experience through new forms of perception and action.

As a member of the Stakeholder Advisory Group I would like to participate in the following activities:

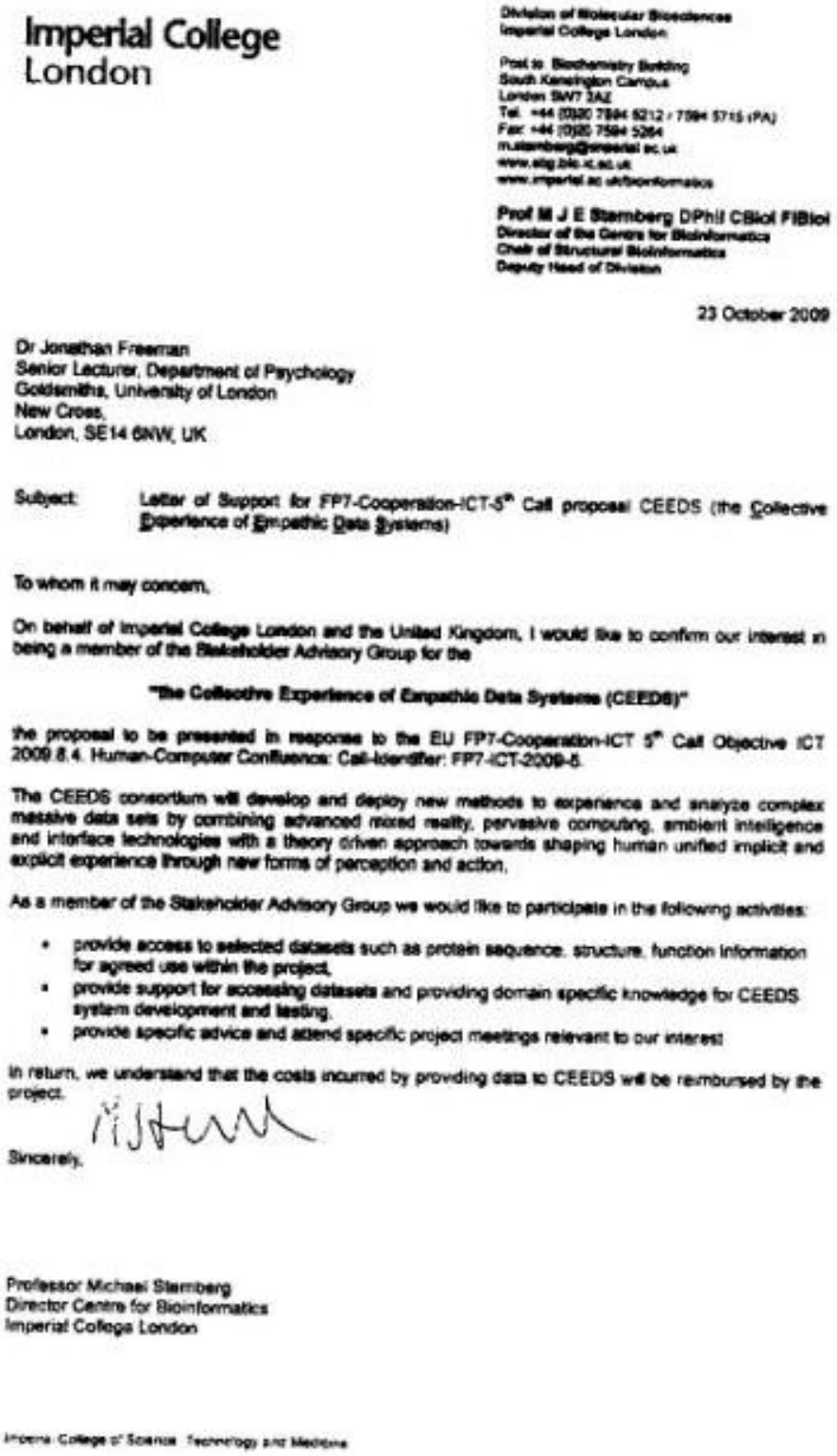
- Provide access to selected datasets (such as ESO C-081.F-0017B and EVN-GP028) for agreed use within the project,
- Provide support forcdomain specific knowledge for CEEDS system development and testing.
- Provide technical and scientific advice and attend specific project meetings relevant to our interest

In return, I understand that the costs incurred by providing data to CEEDS will be reimbursed by the project.

Sincerely,

Dr. Rodrigo Parra
Astronomer
Atacama Pathfinder Experiment (APEX)

(f) Division of Molecular Biosciences, Imperial College, London



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23 October 2009

Dr Jonathan Freeman
Senior Lecturer, Department of Psychology
Goldsmiths, University of London
New Cross,
London, SE14 6NW, UK

Subject: Letter of Support for FP7-Cooperation-ICT-5th Call proposal CEEDS (the Collective Experience of Empathic Data Systems)

To whom it may concern,

On behalf of Imperial College London and the United Kingdom, I would like to confirm our interest in being a member of the Stakeholder Advisory Group for the

"the Collective Experience of Empathic Data Systems (CEEDS)"

the proposal to be presented in response to the EU FP7-Cooperation-ICT 5th Call Objective ICT 2009.8.4: Human-Computer Confluence: Call-Identifier: FP7-ICT-2009-5.

The CEEDS consortium will develop and deploy new methods to experience and analyze complex massive data sets by combining advanced mixed reality, pervasive computing, ambient intelligence and interface technologies with a theory driven approach towards shaping human unified implicit and explicit experience through new forms of perception and action.

As a member of the Stakeholder Advisory Group we would like to participate in the following activities:

- provide access to selected datasets such as protein sequence, structure, function information for agreed use within the project,
- provide support for accessing datasets and providing domain specific knowledge for CEEDS system development and testing,
- provide specific advice and attend specific project meetings relevant to our interest

In return, we understand that the costs incurred by providing data to CEEDS will be reimbursed by the project.

Sincerely,

Professor Michael Sternberg
Director Centre for Bioinformatics
Imperial College London

Imperial College of Science, Technology and Medicine

Annex II: SAG Welcome Pack

(a) Cover letter

<date>

<Addressee>
<Address 1>
<Address 2>
<Address 3>
<Address 4>
<Address 5>

Dear <addressee>,

Re: Welcome to FP7 ICT-258749 CEEDs Stakeholder Advisory Group

Thank you for your Letter of Support to Dr Jonathan Freeman/Dr. Paul Verschure, Coordinator/ Scientific Director of the CEEDs project, in which you confirmed your organisation's interest in being a member of the Stakeholder Advisory Group (SAG) for the project entitled, "the Collective Experience of Empathic Data Systems (CEEDs)". We would like to take this opportunity to welcome you to the CEEDs project.

I, Dr Jane Lessiter, from the Department of Psychology at Goldsmiths, University of London, am leading Work Package 8 of the project, which is responsible for setting up the SAG. Our team's contact details are provided should you need to speak to us about any SAG related business (see 'Information for SAG Members', attached).

The CEEDs project's activities commenced in September 2010, and we are now writing to you as a SAG member to outline the role of SAG members (see 'Information for SAG Members'), and to request from you:

(a) information by email (to J.Lessiter@gold.ac.uk) about the following:

a. your views on the aims of CEEDs for your application area (see 'Use Cases/Applications (Taken from : Annex 1: Description of Work)' document attached). In the Project Proposal to the Commission, potential use cases for each application area were outlined. Please feedback on the relevance of these use cases based on your expertise in this area and your suggestions for any other goals that you could envisage being met by CEEDs.

b. using the template provided (see 'Information about your Dataset/s' attached), a description of the dataset/s that you are able to supply to the CEEDs consortium. This will enable us to better understand across the application areas, the diversity, as well as the commonalities, in the datasets we plan to use in CEEDs.

c. a named contact from your organisation (which could be yourself) who has technical expertise and could liaise with our technical partners to arrange the practicalities around the CEEDs project accessing your data (please provide details on the 'Information about your Dataset/s' sheet, attached).

(b) a completed copy of the 'Non-Disclosure Agreement' (attached)

Please sign, date and return to us in the pre-paid envelope provided and email a scanned copy of the enclosed Non-Disclosure Agreement. This will enable us to register you as an Official SAG Member. With your permission, we will then publish your organisation's details on the CEEDs website (http://CEEDs-project.eu/) and you will be free to contact any of the other SAG members. If you have any queries about any of the above, please do not hesitate to contact me, or any of the Goldsmiths team.

We look forward to hearing from you.

With very best wishes,

Dr. Jane Lessiter

Enc.:

(b) Information for SAG members

INFORMATION FOR SAG MEMBERS

Aims of SAG:

The SAG will be called to assist the Project Management Board (PMB) and the Project Coordination Committee (PCC) in their decisions on the overall policy and long-term strategies of the project and especially with regard to the exploitation of its results. The SAG members' organisations are not integrated into the project as contractors but are associated as an advisory body with the consortium because as an external advisory group the SAG can be extended as possible and desirable. Access to the SAG will be kept open throughout the project life-cycle. As indicated in our initial correspondence with you, the four main aims of the SAG are to:

- complement the expertise of the Consortium participants in the focus areas CEEDs will be addressing, to enable the project to better address user needs;
- provide access to selected datasets for agreed use within the project;
- provide support for accessing datasets and providing domain specific knowledge for CEEDs system development and testing;
- identify exploitation and use opportunities related to the project's outputs.

SAG Member Roles:

To ensure successful collaboration between SAG members and the CEEDs Consortium to meet the project objectives, we kindly ask that SAG members engage with the following activities:

- You are invited to participate in pre-review meetings (at least once a year) and will be asked to issue a short report with comments on the meeting. Comments will be reviewed by the PCC.
- SAG members may be called for specific advice and may attend PMB meetings upon request (and PCC meetings as required)
- Advice is sought from SAG member with regard to activities within Work Package 8 (WP8), "Use Cases and Scenarios", particularly "user requirements capture and specification". For WP8, the CEEDs consortium would appreciate input from SAG members in:
    - Task 8.1: support contact and recruitment of potential end users who will be asked to participate in "creative lab sessions" to generate high level scenarios (ideas and suggestions on alternative futures, driving forces in the main fields covered by CEEDs)
    - T8.3: contribute to the CEEDs consortium's understanding of the environment in which CEEDs is to operate including, current standards, goals to be accomplished with the data sets, and characteristics of the data sets.
- Each SAG member will sign a Non-Disclosure Agreement (attached), providing for confidentiality and effective cooperation to allow SAG members to deliberate freely.
- NOTE: Travel costs and participation fees for members of the SAG will be reimbursed from the project budget.

CEEDs Partner Contacts:

Dr Jane Lessiter	Mr. Andrea Miotto	Dr Jonathan Freeman
CEEDs WP8 Leader	CEEDs WP8/WP10	CEEDs Project Coordinator
+44 (0) 20 7717 2201	+44 (0) 20 7078 5409	+44 (0) 20 7919 7884
J.Lessiter@gold.ac.uk	A.Miotto@gold.ac.uk	J.Freeman@gold.ac.uk

Psychology Department, Goldsmiths, University of London, London SE14 6NW

(c) Materials for SAG consultation on Application scenarios (part 1 of 3) *cont...*

Use cases/Applications (Taken from: Annex 1: Description of Work)

['evaluation' sent to all]

[only the application area specific to addressee will be included in correspondence]

Evaluation

CEEDs will validate its approach at both scientific and technological levels through a number of use cases and user driven scenarios. These scenarios are related to different types of data and users including: complex high-dimensional scientific data stemming from astrophysics, archaeology and neuroscience; social/historical data for mixed user groups and application oriented scenarios for industrial use. With respect to high dimensional data a number of problems are apparent. Here "high-dimensional" may first of all refer to many degrees of freedom, leading to sampling problems of the "curse of dimensionality" type and having the consequence of under sampling. Secondly, it may indicate the need for high dimensional models (e.g. embedding or correlation dimension) or model classes (e.g. Vapnik-Chervonenkis dimension). In this sense, "complexity" may mean the presence of significant high order or long range correlations that on one hand are difficult to detect and on the other hand need to be incorporated in and reflected by any good model. Complex systems are ones where model compression is possible, in contrast to purely stochastic ones, but difficult to achieve, in contrast to simple systems.

Users will interact with the data using the CEEDs synthetic reality system or the CEEDs eXperience Induction Machine (CXIM). The exploration of the data is conceptualized asan interactive narrative of varying forms, where the user's implicit and explicit (re)actions to the data, based on her conscious and unconscious experiences, will be modulating the data representation provided by CEEDs engine. The interactive narrative can range from representational elements that are analogue to the phenomena that are described by the data to highly abstract non-representation forms. The overall user experience then will be a common product between the initial data representations suggested by the CEEDs engine and the changes made interactively due to user's implicit and explicit cues and the (re)actions of the CEEDs sentient agent.

For the scientific domains existing data sets provided by pertinent members of the respective expert communities will be used stemming from astronomy, archaeology and neuroscience. For the area of history CEEDs will cater towards both expert and novice users in understanding the holocaust. CEEDs will also explore a commercial scenario will be explored. The CEEDs system will be benchmarked by comparing the efficiency and quality of discovery of groups of users that use standard methods and those that use CEEDs. In addition, the specific aspects of implicit/explicit processing and action incorporated in the CEEDs sentient agent and the tools for discovery CEEDs provides will be separately addressed through a number of experimental studies with human subjects.

Archaeology:

Imagine the archaeologist confronted with typical fieldwork data: some millions of broken pieces of pottery that can be recovered from an ancient city, or the hundreds of fragmentary traces of the walls of houses, temples and fortifications visible on the surface of an abandoned Classical town, or finally the complex construction of a ruined 19th century house with its internal furnishings left inside or restorable from interviews and archive records. How are these residues of pre-Modern and ancient cultures integrated into an understanding of their patterns of organization and interaction? Indeed also archaeology is facing an immense data overload that is hampering its enormous potential to contribute to the understanding of long-term social and socioecological dynamics. A fundamental challenge for archaeology is to enable scientifically meaningful integration and use of the expanding corpus of systematically collected archaeological data. Currently this is not the case and solutions beyond standard technological solutions are needed (Kintigh, 2006).

CEEDs will provide the archaeologist in the field with 3D reconstruction tools that automatically project all properties of the 3 dimensional objects combined encountered in the field with its associated geo-data into a a synthetic reality representation. In the field the archaeologist can access this information directly by wearing a head mounted augmented reality display. For more detailed analysis and the generation of

(c) Materials for SAG consultation on Application scenarios (part 2 of 3) *cont...*

hypotheses to deploy when exploring and understanding new areas of ancient towns or new instances of ruined heritage pre-modern village-homes, the archaeologist together with his colleagues will enter a portable field version of the eXperience Induction Machine (XIM). Using a range of explicit and implicit interfaces the archaeologists can interact with their data choosing different modes of representations including advanced data and signal processing techniques, musical (from sonification to complex synthetic musical compositions), representational (using objects and avatars) and non representational visualizations (colours and textures) and sonification. Virtual objects scanned in the field can be manipulated and combined in different configurations in a virtual space. In this way a cycle of discovery and hypotheses generation and testing can be generated that can range from explicit analytical to the implicit and dream-like. Hitherto, Virtual-Reality visualizations in Archaeology have tended to recreate past lifestyles digitally along the lines of computer-gaming, to make them come alive (Renfrew, 1997). What is needed and offered by this collaborative project is to merge the very large body of real data from surviving material culture brought to light by archaeologists, with sophisticated virtual „completions" for that data, creating hybrid total structures which can be experienced in visual, aural ways and through active real-world navigation through ancient townscapes and ruined houses, as discussed in S. Campana and M. Forte (Campana & Forte, 2006). These 'complete' experiences will be the basis for an unprecedented new depth of analysis of how ancient cities 'worked' for their inhabitants and how pre-modern houses functioned as 'machines for living'. The aim will be to enhance presentations of heritage sites and monuments for the public as well as enrich the archaeologist's and historian's tools for investigating and interpreting them. CEEDs partner LU has a considerable and highly-precise database relating to its fieldwork at the ancient cities of Koroneia (Greece), Ostia (Italy), and heritage traditional villages and houses of Greece. It has already been pioneering various forms of 3-D townscape and monument recording and visualization (Bintliff & Slapsak, 2009, 2010).

History:

The holocaust has been a singular historical event that is of great importance to be conserved and presented to future generations. However, the presentation of this event faces a number of problems both due to its psychological and moral significance and its highly heterogeneous and complex data set. In addition, in this case the users will be members of the general population, whose members are not trained in methods of history and archival research. Hence, this poses a new challenge for the CEEDs system in that it is to be used by both specialized and non-specialized users. In collaboration with the Gedenkstätte Bergen Belsen (see letter of support in Appendix) and building on the framework developed for archaeology, CEEDs will develop an application that will optimize the acquisition, storage and presentation of data that represents key aspects of the holocaust including its archaeological, social, cultural, psychological, medical aspects. The objective here is to find an interactive narrative structure that allows users to understand the importance of the holocaust, to identify with its victims and to assign meaning with respect to their own existence.

Astronomy:

Astronomy has seen revolutionary growth in the tools available to measure the properties of the universe. However, it is recognized that the quantity and complexity of the data exceeds our current abilities of processing. For instance, the, so called, Large Synoptic Survey Telescope (www.lsst.org) will generate several petabytes of new image data per year, while the, so called, Square Kilometer Array (SKA; www.skatelescope.org) will produce about 200 Gbytes of raw data per second that will require petaflops (or possibly exaflops) of processing to produce detailed radio maps of the sky [Gorton et al. Data-Intensive Computing in the 21st Century. COMPUTER-IEEE COMPUTER SOCIETY- (2008)] (Gorton, et al., 2008). Hence, new approaches must be explored.

CEEDs addresses this challenge by collaborating with the European Southern Hemisphere Observatory (see letter of support in Appendix). Starting point is the volumetric rendering of the raw data by the rendering instance. The CEEDs engine will receive explicit and implicit user data, which indicates interesting/uninteresting/surprising configurations in the data. This behavioural data is used on the one hand to mine the astronomical data for comparable configurations, and on the other hand to control the

(c) Materials for SAG consultation on Application scenarios (part 3 of 3)

location of the user(s) inside the volumetric rendering. A multi-user version of this scenario would be that one user is connected to sensors, while a second user is presented the collected data dependent on the states of the first user. Alternatively the behaviour of multiple users is combined and they collectively control the data presentation.

Neuroscience:

In 2009 the centenary of the publication of the first structural map of the cerebral cortex by Brodmann is celebrated (Annese, 2009; Brodmann, 1909). Since Brodmann's publication many new dimensions have been added to this map including genetic and molecular markers, detailed morphological properties of neurons, physiological properties and interconnectivity. As a result neuroscience is moving from the hypothesis testing mode to an exploration mode of genetics and systems biology (Geschwind & Konopka, 2009). This development illustrates the specific problems faced in analyzing data from neuroscience. Data is not only complex but also defined at multiple levels of organization such as morphological, genetic, molecular, physiological, behavioural, etc (Eckersley, et al., 2003). The data deluge in neuroscience has given rise to the institution of an international coordination facility for the storage and exchange of neuroscientific data (INCF, Stockholm) (Bjaalie & Grillner, 2007). In collaboration with the INCF, CEEDs will validate the CEEDs engine in the exploration of the high dimensional data set that describes the mammalian brain. In particular, the users of CEEDs will in this case explore the multi-dimensional description of anatomical properties of the brain by navigating through a meta-database that has been constructed out of the merging of a number of dedicated anatomical databases. The objective of this interactive exploration is to find inconsistencies in the mapping between different representations and to gain a better insight in the details of neuronal connectivity and their associated morphological features.

A second neuroscience based scenario developed by the partners of CEEDs (University Of Sussex and Universitat Pompeu Fabra) will deploy the CXIM to interactively generate and process physiological data. In addition to the explosion of structural data also the availability of means to obtain physiological data has rapidly progressed including fMRI, M/EEG, and multielectrode arrays (MEA). What is currently most needed are new ways to dissect large data volumes in terms of task-relevant patterns. CEEDs will provide exactly this capability. On onehand the CEEDs engine will be interfaced to MEA systems (available in the labs of UOS and UPF) in order for the users of CEEDs to perform collaborative and distributed experiments. The data obtained will be projected into CXIM following a number of representational modes and the users will interactively decide which subset of probes to sample data from.

Commercial scenarios:

CEEDs develop commercial scenarios for designers and for consumers. For the former we address the issue of collective design. A group of industrial product designers are observing a virtual product in a collaborative mixed reality space. The CEEDs system will build the "interest/experience" map of the car based on the data from the designers. This interest map will be based on both explicit and implicit cues from the users (e.g. eye-tracking data and associated arousal level). For example, the map can highlight the parts of common liking or disliking thus facilitating further discussion. The designers can further examine the details of high common interest at the next stage of their collaborative work. In the consumer oriented commercial scenario the objective is to use the CEEDs technologies to allow users to construct a CEEDs Universal Personal Preference (CUPP) file. This file contains the explicit and implicit preferences of users with respect to their interests and behaviours. The content of the CUPP file is generated while the user visits one of the mobile CXIM sites that will be installed by vendors. Users can, upon their agreement, make their CUPP file available through their mobile phones/PDAs and received a service more tailored to their history and interests.

(d) Stakeholder dataset information capture sheet

Information about your dataset/s

Please complete one copy of this information sheet per dataset that you plan to share with the CEEDs project partners and return to J.Lessiter@gold.ac.uk.

Who owns the data contained in this dataset?	
What is the size of the file for this dataset?	
Approximately how many variables are contained in this dataset?	
Approximately how many cases are contained in the dataset (min-max if different across variables)?	
How could we access your dataset - could you host it, and provide us with access support?	
Please provide an outline the types of data contained in this dataset (e.g., temporal, spatial, average velocity etc.)	
Contact at your organisation with technical expertise (name/email)	
Any other comments about this dataset	

(e) Two-way non disclosure agreement (part 1 of 5)

CONFIDENTIALITY AGREEMENT

For the multilateral exchange of information between the the CEEDs consortium (represented by Goldsmiths, University of London) and <SAG member, please specify> for the EC funded project: Collective Experience of Empathic Data Systems (CEEDs)

Between the undersigned:

Goldsmiths, University of London, an academic establishment duly organized and existing under the laws of England and having offices at the Department of Psychology, Goldsmiths, University of London, New Cross, London, SE14 6NW, UK, represented by **Dr. Jonathan Freeman,** acting in his capacity of CEEDs Project Coordinator,

hereinafter called "**GOLD**", acting on its own behalf and on behalf of the companies and establishments involved in the **CEEDs project consortium and related companies**, as further set forth below,

and

<*SAG member details* - please complete>, a company duly organized and existing under the laws of <country> and having offices at <address>, represented by <name>, acting in his/her capacity of <role>

hereinafter called "<please specify>", acting on its own behalf.

Whereas the Parties, as defined above have each developed or acquired certain confidential, substantial and identified Information, as defined below, concerning the Subject Matter, also as defined below;

Whereas the Parties as of the effective date of this agreement desire to communicate in their discretion to each-other part or all of such Information, subject to confidentiality and the other terms and conditions of this agreement,

1 NDA: CEEDS-SAGmember 21/09/11

(e) Two-way non disclosure agreement (part 2 of 5)

NOW, THEREFORE, it is agreed as follows:

ARTICLE 1 - DEFINITIONS

For the purpose of the remainder of this agreement, the following words, used with a capital first letter, shall mean:

1.1. "Subject Matter": Technical, business or other information regarding a project ("CEEDs") funded under the framework of the 7th Framework Programme of the European Union under the 5th Call launched by the European Commission (FP7-ICT-258749).

1.2. "Confidential Information": any information in any form (including but not limited to know-how, models, samples, or in oral, written, electromagnetic, or other form), concerning the organization, business or finances of the disclosing party or of any third party, including but not limited to information with respect to trade secrets, inventions, products, designs, methods, know-how, systems, processes, software programs, works of authorship, pricing and terms of licenses, results of demonstrations of products, financial records and data, projects, plans and proposals disclosed to the receiving party by the disclosing party.

ARTICLE 2 - PURPOSE

The purpose of this agreement is to set forth the terms and conditions under which each Party in its discretion shall communicate Information to the other Party(ies), and keep confidential and subject to limited use Information received from the other Party(ies).

ARTICLE 3 - METHOD OF DISCLOSURE

Confidential Information disclosed in written or other tangible form shall be prominently marked or stamped as "Confidential Information" or the like at the time of disclosure; Information disclosed orally or visually shall be clearly identified as confidential at the time of disclosure and a summary of such Information prominently so marked in writing or stamped and submitted to the other(s) Party(ies) within thirty (30) days thereafter.

ARTICLE 4 - CONFIDENTIALITY AND LIMITED USE

4.1. Each Party shall (i) keep confidential all Confidential Information disclosed to it by the other(s) Party(ies), (ii) use such Confidential Information solely for non commercial, in-house evaluation, and (iii) make such Confidential Information available only to those of its employees who need to know the Confidential Information in connection with such evaluation; and then, only to the extent of such need to know, for the effective performance of their duties as related to the Subject Matter, and provided that they are contractually bound to protect the Confidential Information of the disclosing party.

5 NDA: CEEDS-SAGmembers 21/09/11

(e) Two-way non disclosure agreement (part 3 of 5)

4.2. The foregoing obligations of confidentiality and limited use shall not apply to Confidential Information which:

(i) was known to receiving Party(ies) prior to the date it was received from the disclosing Party provided that the receiving Party(ies) can clearly demonstrate, with written evidence, that such is the case;

(ii) is or later becomes publicly known or available without breach of this agreement, and without any act or omission by receiving Party(ies);

(iii) is lawfully obtained by receiving Party(ies) from a third party not under obligation of confidentiality, directly or indirectly, to the disclosing Party with respect to such information provided that the receiving Party(ies) can clearly demonstrate, with written evidence, that such is the case;

(iv) is disclosed pursuant to a judicial order, a lawful requirement of governmental agency; or by operation of law, but then only to the extent so ordered; If the receiving party is required to disclose any Confidential Information through judicial or governmental order, the receiving party shall promptly notify the disclosing party and take reasonable steps to cooperate with the disclosing party in contesting or limiting such order or in protecting the disclosing party's rights prior to disclosure; or

(v) is disclosed by either party to any new collaborators, participants or partners. Any such new participants shall sign a non-disclosure agreement similar to this non-disclosure agreement.

4.3 Confidential Information may not be reproduced, except as required for the limited purpose specified above, i.e. – the Subject Matter. Upon demand by the disclosing party at any time, the receiving party agrees (a) immediately to cease using Confidential Information and (b) promptly to return or destroy, at the disclosing party's option, all materials that contain, disclose or embody Confidential Information. The receiving party shall not cause or permit reverse engineering of any software programs or recompilation or disassembly of any software programs which are part of the Confidential Information received by it under this Agreement.

4.4 The receiving party agrees not to remove any proprietary rights or confidential legends from, and upon the disclosing party's reasonable request shall add such legends to, materials containing, disclosing or embodying Confidential Information.

ARTICLE 5 - PROPRIETARY RIGHTS

Confidential Information shall remain the exclusive property of the disclosing Part(ies). Disclosure of Confidential Information pursuant to this Agreement in no case shall be construed as granting to the Receiving party, expressly or implicitly,

(e) Two-way non disclosure agreement (part 4 of 5)

any license, proprietary right, title or interest whatsoever with respect to the Confidential Information, prior or subsequent to this Agreement, except the license for limited use as set forth in article 4.1, above.

ARTICLE 6 - TERM AND TERMINATION

This agreement shall be deemed effective as of January 1st, 2011 and shall remain effective for a period of five (5) years thereafter. Restrictions with respect to the use and disclosure of the Confidential Information shall remain in force for three (3) years after termination or expiration of this agreement.

ARTICLE 7 - MISCELLANEOUS

7.1. The present agreement is binding on the Parties, their successors and assigns.

7.2. This agreement cancels and supersedes all previous proposals, representations, understandings, and negotiations, either written or oral, between the Parties hereto or their representatives on the Subject matter, and constitute the entire agreement between the Parties on the Subject Matter. This agreement or any provision thereof may be amended or modified only with the mutual consent of the Parties hereto as set forth in a written instrument, signed by a duly authorized representative of each Party, and expressly stating the Party's intent to amend or modify this agreement.

7.3 Confidential Information is preliminary and incomplete and relates to products under development. NO WARRANTIES ARE MADE BY THE DISCLOSING PARTY. CONFIDENTIAL INFORMATION IS PROVIDED "AS IS". THE DISCLOSING PARTY ACCEPTS NO RESPONSIBILITY FOR ANY EXPENSES, LOSSES, OR ACTIONS INCURRED OR UNDERTAKEN BY THE RECEIVING PARTY AS A RESULT OF ITS USE OF CONFIDENTIAL INFORMATION.

7.4 Each provision of this Agreement shall be treated as a separate and independent clause, and the enforceability of any one clause shall in no way impair the enforceability of any other clauses herein. Moreover, if one or more of the provisions herein contained shall for any reason be held excessively broad so as to be unenforceable at law, the appropriate judicial body shall construe such provision by limiting or reducing it or them, so as to be enforceable to the maximum extent compatible with the applicable law as it shall then appear.

7.5 Any waiver by the disclosing party of a breach of any provision of this Agreement by the receiving party shall not operate or be construed as a waiver of any subsequent breach of such provision or any other provision hereof.

7.6 This agreement shall be construed according to the substantive laws of England.

7.7 This Agreement may be executed in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

(e) Two-way non disclosure agreement (part 5 of 5)

Executed in 2 originals, one being returned to each Party.

Name: Jonathan Freeman for and on behalf of Goldsmiths University of London and the CEEDs consortium and related companies

Signature _____Dated:_____

Name <please specify> for and on behalf of <company/establishment, please specify>

Signature _____Dated:_____

Annex III: Stakeholder databases

Tab. 7 - Dataset properties: Archaeology (LU)

Characteristics	16 variables * 30,000 cases Variables: qualitative (pottery shape, fabric), temporal (chronology of pot shapes) and spatial (distribution on site)
Size	~20Mb
Format	Access
Hosting	Happy to circulate to partners
Dataset contact	Chiara Picolli (c.b.m.picolli@arch.leidenuniv.nl)

Tab. 8 - Database properties: History/Bergen Belsen (constructed by UPF)

Characteristics	[In development] Topographical maps (sources used: brochure The Topography of Bergen-Belsen with six maps; large pdf file Quellen zu Topografie Bergen-Belsens 1938-1945 from 2008) and factual information derived from around 3000 textual documents about Bergen-Belsens provided by the Yad Vashem archive.
Size	Not specified
Format	Not specified
Hosting	@ UPF[8]
Dataset contact	Paul Verschure (paul.verschure@upf.edu)

[8] UPF (SPECS) REQUESTED THIS IMPORTANT NOTE: This use case is touching upon a very sensitive period of our recent history. Hence, it should be treated with utmost care and as separate from all other scenarios, i.e. it is not a playground for our different hypotheses on interaction, narrative, adaptation etc. Nothing can be made public about our activities with respect to this use case until full agreement with the Memorial Site Bergen Belsen (MSBB) on content and implementation has been achieved. Communication lead is with MSBB. All contacts with CEEDS and MSBB will run via SPECS to assure efficiency. CEEDS partners should only contribute to this use case when they fully agree with and underwrite this agreement.

Tab. 9 - Dataset properties: Retail/Commerce (Electrolux)

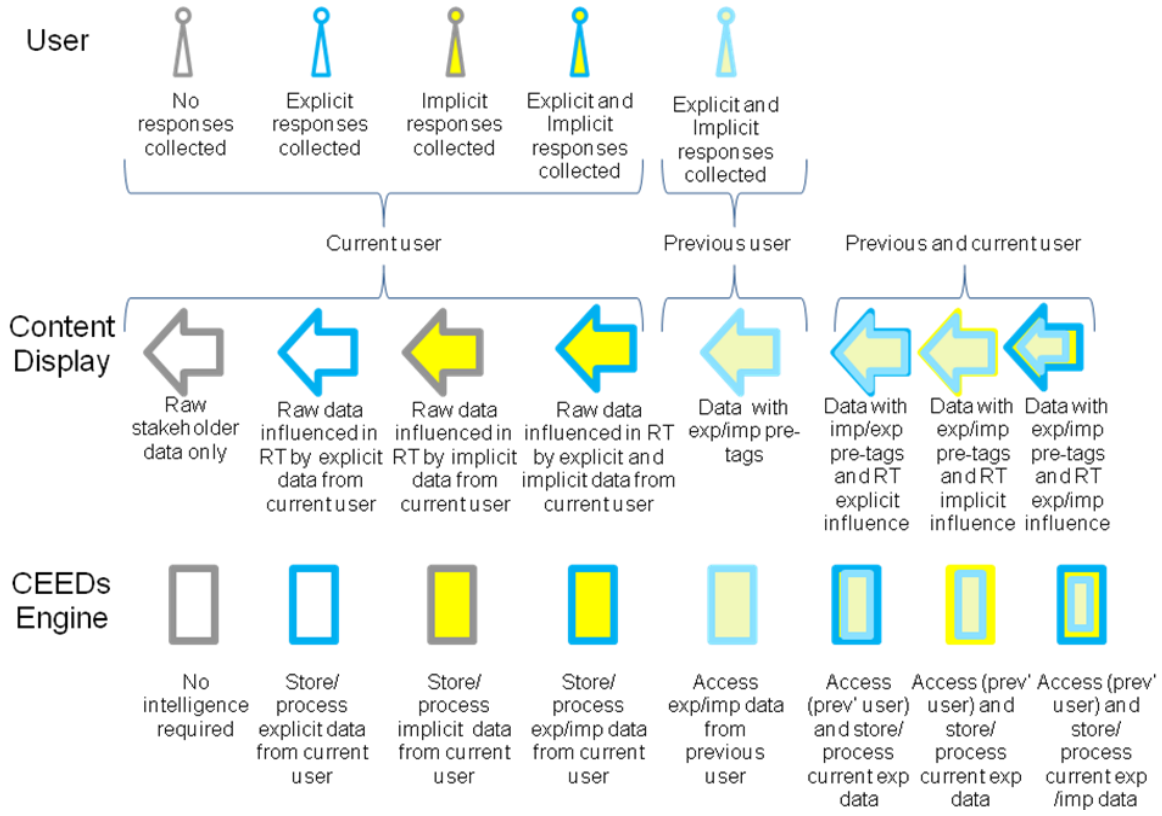
Characteristics	Domestic appliances CAD virtual models (e.g., dishwashers, Ovens, refrigerators, hobs, hoods). Over 100 high resolution (used for marketing content creation) and over 500 low resolution (used for kitchen planning software) models. Database is expected to increase in the future as new product ranges are launched in the market.
Size	~5Gb (~50Mb/model for high resolution models, ~2Mb/model for low resolution models)
Format	Models are available in well known design formats: •DWG(3D), MAX, MB and 3DS formats for low resolution models; •MB, MAX, FBX and CSB (Cosmo Binary - RTT proprietary) formats for high resolution models. License for software – models can be visualised by any device with a suitable graphics card
Hosting	At present, models are stored in a database used for marketing purposes. In the future, models will be integrated in Electrolux's new PLMS (product lifecycle management system) together with Catia 3D files, bills of materials, etc.
Dataset contact	Daniele Zanella (daniele.zanella@electrolux.it)

Tab. 10 - Dataset properties: Neuroscience (UoS)

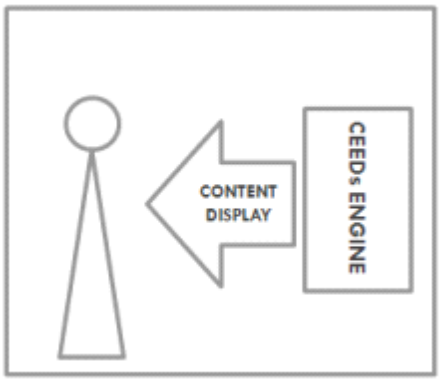
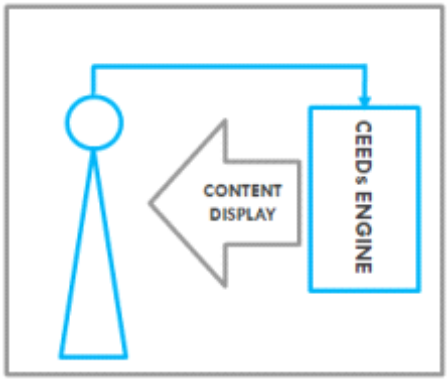
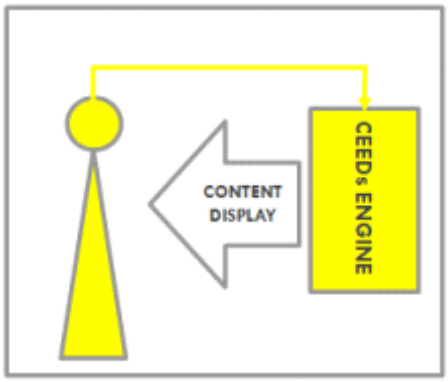
Characteristics	252 variables; *n* cases uncertain (several datasets represent different recording sessions; max data set likely to be ~ 252 x 36M datapoints) Spike train time series (generally point processes) over multiple (252) electrodes under different experimental conditions Data comes from multi-electrode array recordings obtained from a semi-intact preparation of the acquatic pond snail, lymnaea stagnalis. The data in raw form are continuous time traces at high sampling rate (e.g., 10KHz, range of ~ +/-1mV) in processed form, they represent point process spike trains either from spatially localised neurons or on electrodes. 2D (x,y) physical position on the recording array.
Size	Up to 30Gb
Format	Not specified
Hosting	UoS aim to host and provide access via SSH
Dataset contact	Peter Passaro (p.a.passaro@sussex.ac.uk)

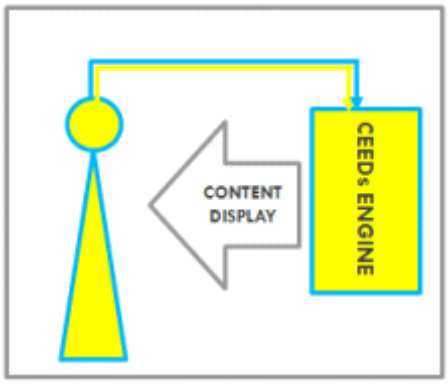
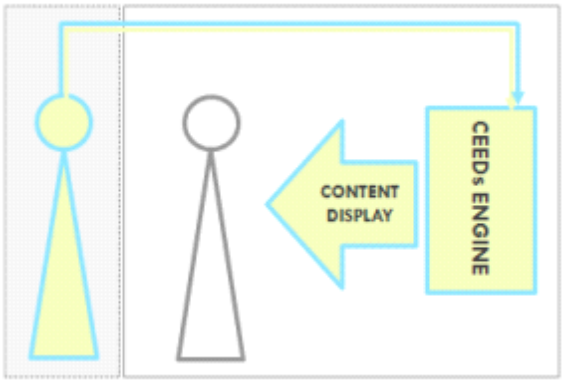
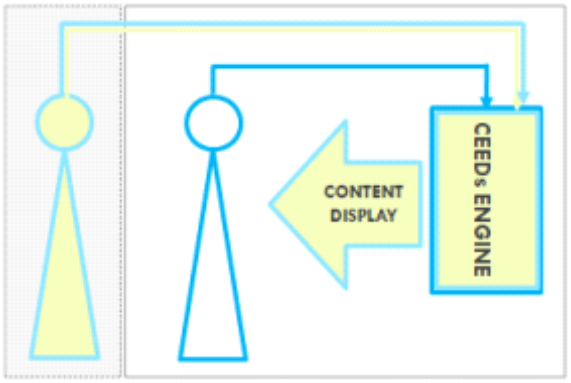
Annex IV: Input-output pictorials

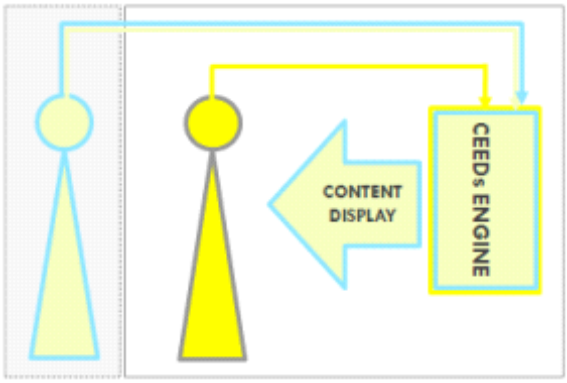
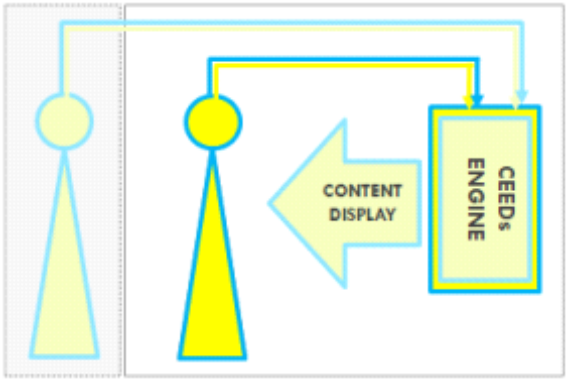
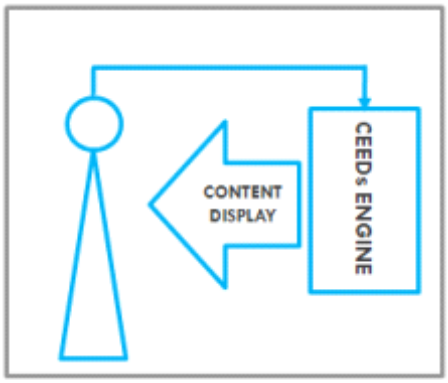
Key to input-output pictorials

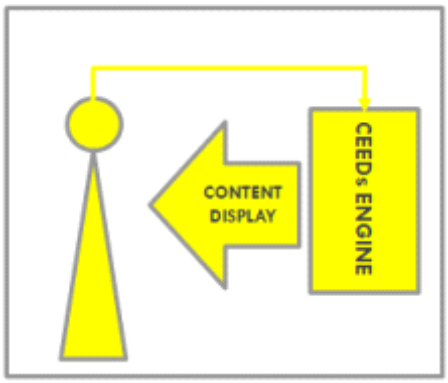
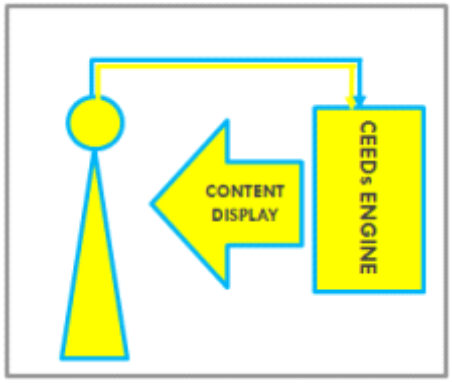
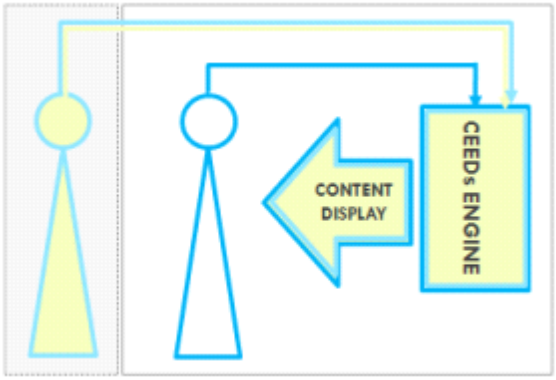


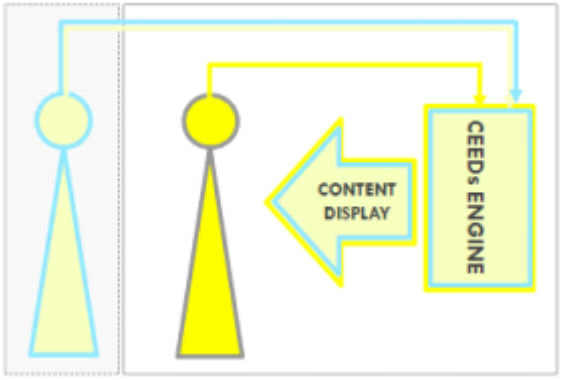
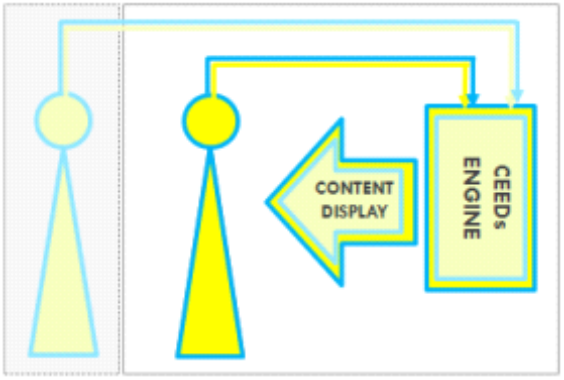
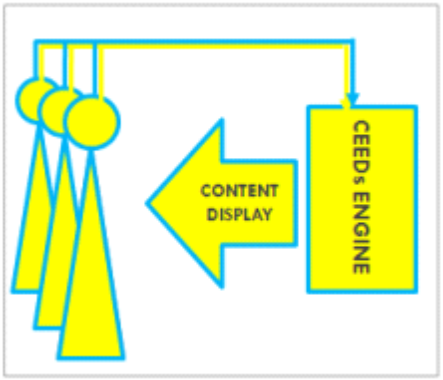
Tab. 11 - Characteristics of input-output pictorials

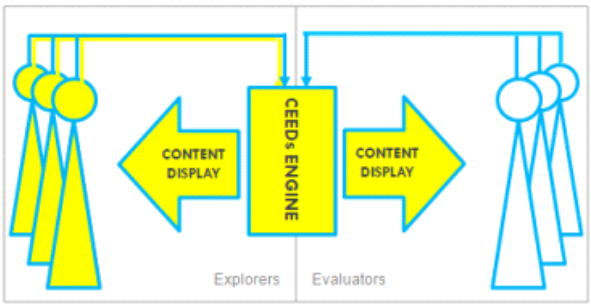
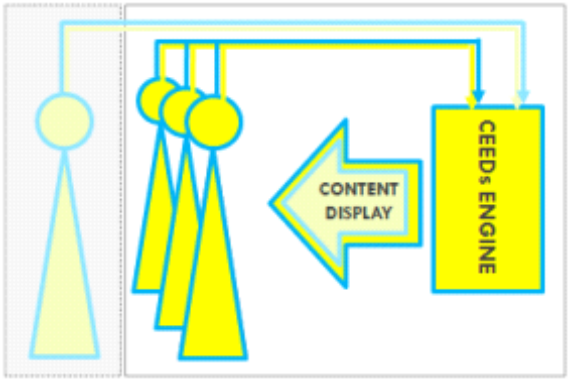
#	Pictorial	Description
io1		*Most simple use (passive viewing)* • **Data displayed:** Raw data with no pre-tags displayed (i.e., influence of previous user('s') explicit/implicit reactions on content display are not shown) • **Storage of user data ('Tags'):** No current user responses are stored • **Real time user influence:** No real time influence of current user data on content display
io2		*Simple use (passive viewing)* • **Data displayed:** Raw data with no pre-tags displayed (i.e., influence of previous user('s') explicit/implicit reactions on content display are not shown) • **Storage of user data ('Tags'):** Current user's explicit responses are stored. Stored information from current session may be presented at another session to the same/other user(s) • **Real time user influence:** No real time influence of current user data on content display
io3		*Simple use (passive viewing)* • **Data displayed:** Raw data with no pre-tags displayed (i.e., influence of previous user('s') explicit/implicit reactions on content display are not shown) • **Storage of user data ('Tags'):** Current user's implicit responses are stored. Stored information from current session may be presented at another session to the same/other user(s) • **Real time user influence:** No real time influence of current user data on content display

io4		*Simple use (passive viewing)* • **Data displayed:** Raw data with no pre-tags displayed (i.e., influence of previous user('s') explicit/implicit reactions on content display are not shown) • **Storage of user data ('Tags'):** Current user's explicit and implicit responses are stored. Stored information from current session may be presented at another session to the same/other user(s) • **Real time user influence:** No real time influence of current user data on content display
io5		*Simple use (passive viewing)* • **Data displayed:** Pre-tagged data displayed (i.e., influence of previous user('s') explicit/implicit reactions on content display are shown) Note: this could be the current user's data from a previous session • **Storage of user data ('Tags'):** No current user responses are stored • **Real time user influence:** No real time influence of current user data on content display
io6		*Simple use (passive viewing)* • **Data displayed:** Pre-tagged data displayed (i.e., influence of previous user('s') explicit/implicit reactions on content display are shown) Note: this could be the current user's data from a previous session • **Storage of user data ('Tags'):** Current user's explicit responses are stored. Stored information from current session may be presented at another session to the same/other user(s) • **Real time user influence:** No real time influence of current user data on content display

io7		*Simple use (passive viewing)* • **Data displayed:** Pre-tagged data displayed (i.e., influence of previous user('s') explicit/implicit reactions on content display are shown) Note: this could be the current user's data from a previous session • **Storage of user data ('Tags'):** Current user's implicit responses are stored. Stored information from current session may be presented at another session to the same/other user(s) • **Real time user influence:** No real time influence of current user data on content display
io8		*Simple use (passive viewing)* • **Data displayed:** Pre-tagged data displayed (i.e., influence of previous user('s') explicit/implicit reactions on content display are shown) Note: this could be the current user's data from a previous session • **Storage of user data ('Tags'):** Current user's explicit and implicit responses are stored. Stored information from current session may be presented at another session to the same/other user(s) • **Real time user influence:** No real time influence of current user data on content display
io9		*Interactive use* • **Data displayed:** Raw data with no pre-tags displayed (i.e., influence of previous user('s') explicit/implicit reactions on content display are not shown) • **Storage of user data ('Tags'):** Current user's explicit responses are stored. Stored information from current session may be presented at another session to the same/other user(s) • **Real time user influence:** Real time influence of current user's explicit data on content display

io10		*Interactive use* • **Data displayed:** Raw data with no pre-tags displayed (i.e., influence of previous user('s') explicit/implicit reactions on content display are not shown) • **Storage of user data ('Tags'):** Current user's implicit responses are stored. Stored information from current session may be presented at another session to the same/other user(s) • **Real time user influence:** Real time influence of current user's implicit data on content display
io11		*Interactive use* • **Data displayed:** Raw data with no pre-tags displayed (i.e., influence of previous user('s') explicit/implicit reactions on content display are not shown) • **Storage of user data ('Tags'):** Current user's explicit and implicit responses are stored. Stored information from current session may be presented at another session to the same/other user(s) • **Real time user influence:** Real time influence of current user's explicit and implicit data on content display
io12		*Interactive use* • **Data displayed:** Pre-tagged data displayed (i.e., influence of previous user('s') explicit/implicit reactions on content display are shown) Note: this could be the current user's data from a previous session • **Storage of user data ('Tags'):** Current user's explicit responses are stored. Stored information from current session may be presented at another session to the same/other user(s) • **Real time user influence:** Real time influence of current user's explicit data on content display

io13		*Interactive use* • **Data displayed:** Pre-tagged data displayed (i.e., influence of previous user('s') explicit/implicit reactions on content display are shown) Note: this could be the current user's data from a previous session • **Storage of user data ('Tags'):** Current user's implicit responses are stored. Stored information from current session may be presented at another session to the same/other user(s) • **Real time user influence:** Real time influence of current user's implicit data on content display
io14		*Interactive use* • **Data displayed:** Pre-tagged data displayed (i.e., influence of previous user('s') explicit/implicit reactions on content display are shown) Note: this could be the current user's data from a previous session • **Storage of user data ('Tags'):** Current user's implicit responses are stored. Stored information from current session may be presented at another session to the same/other user(s) • **Real time user influence:** Real time influence of current user's explicit and implicit data on content display
io15		*Interactive use* • **Data displayed:** Raw data with no pre-tags displayed (i.e., influence of previous user('s') explicit/implicit reactions on content display are not shown) • **Storage of user data ('Tags'):** Current group's implicit and explicit responses are stored. Stored information from current session may be presented at another session to the same/other user(s) • **Real time user influence:** Real time influence of current group's explicit and implicit data on content display (e.g., averaging; weighting by significance of group members)

io15 v2		*Interactive use (potential extension of io15)* • **Context:** Two groups of users (explorers and evaluators) interact remotely with the same dataset: evaluators observe in real time how the explorers react to the data; evaluators' explicit responses are weighted in their favour giving them more control over the display through their explicit reactions (e.g., if they want the explorers to spend more time examining something in the dataset, they will give an explicit indication to re-shift the information on display). CEEDs considers members from both groups as part of one group (only the applied weighting/roles vary). • **Data displayed:** Raw data with no pre-tags displayed (i.e., influence of previous user('s') explicit/implicit reactions on content display are not shown) • **Storage of user data ('Tags'):** Current group's implicit and explicit responses are stored. Stored information from current session may be presented at another session to the same/other user(s) • **Real time user influence:** Real time influence of current group's explicit and implicit data on content display (e.g., averaging; weighting by significance of group members)
io16		*Interactive use* • **Data displayed:** Pre-tagged data displayed (i.e., influence of previous user('s') explicit/implicit reactions on content display are shown) Note: this could be the current user's data from a previous session • **Storage of user data ('Tags'):** Current group's implicit and explicit responses are stored. Stored information from current session may be presented at another session to the same/other user(s) • **Real time user influence:** Real time influence of current group's

		explicit and implicit data on content display (e.g., averaging; weighting by significance of group members)

Annex V: Draft work towards core use cases/core features

(a) Initial draft; content discussed with SD (4th March 2011) and presented at 2nd Consortium Meeting (6/7 April 2011)

The draft core (high level) use cases, which will be elaborated in Year 2, are as follows:

Core Use Case 1: To display data with a structured narrative.

Core Use Case 2: To collect, interpret and store users' implicit and/or explicit responses to tag components of the stimuli.

Core Use Case 3: To feedback* to users in real time their implicit and/or explicit responses in relation to stimuli.

Core Use Case 4: To display in real time other users' implicit and explicit responses in relation to stimuli.

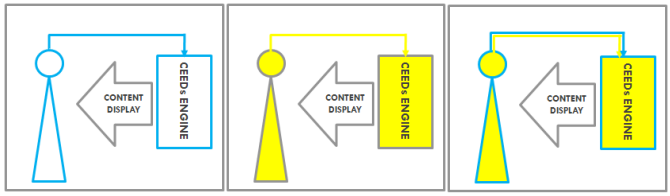
Core Use Case 5: To display, but not in real time, users' implicit and explicit responses to stimuli

Each of these use cases is described below and illustrative simple (statement) scenarios are presented based on the stakeholder goals provided or alternative goals generated by GOLD.

*Note: feedback relates to the interaction paradigms (UH activity) implemented in the context of the narrative structure (TEESIDE activity), and can be interpreted in a number of ways. For instance, feedback can be made apparent to the user by exaggerating features of the display so that it draws attention to their real time responses (highlight zones of interest); it can be intuitive, natural and realistic (user orientation and gaze to guide focus on the display); or cues and prompts can be used to modify the presentation so that it enhances, reduces or maintains any particular user response index (the user need not be explicitly aware of those changes). Responsibility for drafting these interaction paradigms is not a central focus of WP8, and relates to the work by Partner UH (nb. Giulio Jacucci at UH has been following GOLD's development of these Use Cases, along with partners UNIPD and UPF).

Core Use Case 1: To display data with a structured narrative	
Relevant Pictorials	(all pictorials)
Description	All CEEDs presentations will involve a display of data likely contextualised, or provided with some form of narrative. The narrative structure and impact (e.g., emotive significance) can be enhanced through the other use cases described above (by exploring other users' responses to data and continually updating the dataset with tags for new users' responses). This use case can represent the first time view of any presentation, the final view of any presentation, or indeed, any presentation in the process of being optimised by criteria that are relevant to the goal (e.g., to inform, to induce a particular emotion etc.)
Relevant scenarios	**Scenario 1: To provide a simple use guide to customers about white goods (NOT FULL CEEDs USE/DOES NOT REQUIRE CSA) and support understanding of products** Felix, the buyer from a national retailer, is choosing the kitchen appliances to be in the new Spring range in their stores. He visits various manufacturers and is looking for some key features including

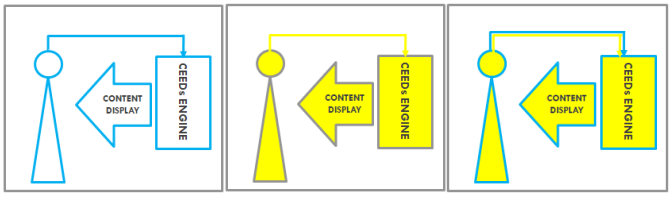
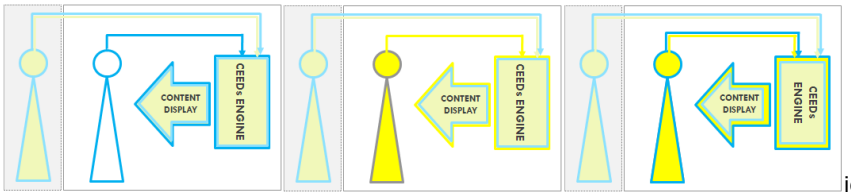
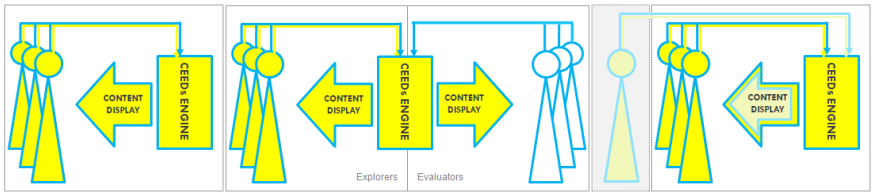
	low energy use, usability and quiet performance. He is impressed by Electrolux's sales pitch. He experiences an informative fly through of a virtual range of their latest dishwashers with virtual plates and pans. He watches as the 'film' shows him why it's imperative to load the dishwasher in a particular way and what happens when a user does not follow the instruction manual. It's easier to understand now why the manufacturer instructs the consumer to use the product in a particular way, and Felix feels more able to explain this now to his sales staff for their sales pitches. ***Alternatively users could be retail sales staff (training) and customers (learning how to use)*** **Scenario 2: To provide a multimodal representation of known relationships between variables (hypotheses) to enable reflection on validity of hypotheses or as a tool to explain/demonstrate an hypothesis**

Core Use Case 2: To collect, interpret and store users' implicit and explicit responses to tag components of the stimuli	
Relevant Pictorials	 io2-io4
Description	In most scenarios CEEDs will require users to don wearable technology for collecting implicit and explicit user responses to the representations displayed. This occurs irrespective of whether or not the responses are being represented in real time to the user, or to observers to the users' experience, or neither. This use case refers to all activities where the environment requires tagging either because it renders the presentation more realistic (e.g., real time navigation), or to draw users attention to their responses which are less amenable to conscious awareness, or because the information is being stored for the next user. The (re)presentation to which users are responding could be un-tagged (i.e., raw with no previous users' data having impact on the display) or it could already be tagged (i.e., modified by previous users' feedback).
Relevant scenarios	**Scenario 1a: To set up CUPPs** Every time John explores product choices in retail contexts using CEEDs, his data is stored onto a card that he can use elsewhere to support his selection of other products (CUPP)… **Scenario 2: To conduct intra-person reliability checks of variation in CUPPs relating to external parameters such as time of day, year, which may be used to infer trends in likely preferences (e.g., fashion trends).** **Scenario 3: To develop an enhanced meaningful, informative and emotive story (non-real time) about Bergen Belsen (see also**

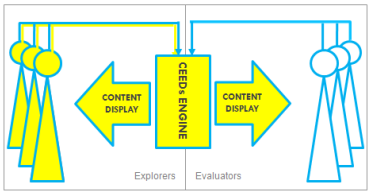
	UC5 for output example of this scenario; and important note (see footnote [7] on p62 of this D8.1) [UPF text] The holocaust has been a singular historical event that is of great importance to be conserved and presented to future generations. However, the presentation of this event faces a number of problems both due to its psychological and moral significance and its highly heterogeneous and complex data set. In addition, in this case the users will be members of the general population, whose members are not trained in methods of history and archival research. In the context of the CEEDS project (WP 6), we will design an application for the optimization, acquisition, storage and presentation of data that represents key aspects of the holocaust. Our purpose is to develop an enhanced meaningful, informative and emotive story (non-real time) about Bergen Belsen. To support public awareness and understanding of the significance of Bergen Belsen, a virtual reconstruction of the space will be created. We aim to develop a mobile application through the use of a handheld device in order to enhance the user's experience while visiting the Bergen-Belsen memorial site. This application will adopt several technologies such as GPS assisted navigation, geolocation and 3D reconstruction and rendering of the original site to present to the user the available data: • The spatialized memory of a survivor: in this case we ask a survivor (for instance Simone Weill) to recount their memories while they walk through the camp. Visitors can now follow in the footsteps of that person and be exposed to that persons experience and memory. • The spatialized memory of a victim: in this case we follow one inmate in detail, for instance Anne Frank, and use the historical record to reconstruct their period in the camp and provide it with contextual information. • The spatialized memory about a liberator of the camp: in this case we follow one liberator in detail, for instance BBC's Richard Dimbleby or the army photographers who went through the camp, and use the historical record to reconstruct their period in the camp and provide it with contextual information. • The spatialized memory of a guard: in this case we follow one guard in detail, for instance Josep Kramer, and use the historical record to reconstruct their period in the camp and provide it with contextual information. The output of this development process is illustrated with scenarios in UC5. **Scenario 4: iqr, a multi-level neuronal simulation environment** [UPF text] Our ability to extract data from natural and artificial phenomena in different scientific disciplines by far exceeds our ability to understand it. Due to the lack of tools to effectively extract, analyze and understand massive amounts of data, the data is frequently left unexplored.

	Hence, a key challenge of modern science is how we can advance our comprehension of the data that we extract from the systems under investigation. The rational we follow is that computer-supported, interactive, representations of abstract data allow to amplify our cognition by forming associative elements into new combinations that meet specific requirements and/or are useful . Grounded in this concept, multi-modal representation techniques can play a key role in helping to discover patterns and meaning within complex data-sets. Neuroscience is one of the scientific fields that contributes most to the generation of the extensive amount of data produced by multi-electrode recordings and magnetic resonance imaging. Within neuroscience one large set of data stems from the analysis of the connectivity of the brain. This "connectome data" is composed of hundreds of thousands of neurons and their connections and is virtually impossible to understand without the aid of models and data analysis techniques. iqr is a multi-level neuronal simulation environment which allows to design complex neuronal models graphically, and to visualize and analyze their properties on-line. The architecture of iqr is modular, providing the possibility to write new neuron and synapse types, as well as custom interfaces to other hardware systems. iqr can be connected to both sensors and effectors, and can simulate large neuronal systems of over 500000 elements (neurons and synapses). The code of iqr is publicly accessible under the GNU General Public License (GPL), and the software runs on the Linux, Apple's Mac OS X and Microsoft Windows platform . iqr provides a 2D graphical interface to design and manipulate the neuronal model. While the simulation is running, the user can visualize internal states and change the parameters of system elements. Neuronal models in iqr are organized at three different levels: The top (or system) level comprises an arbitrary number of processes, and connections. • The second level consists of processes which in turn contain an arbitrary number of groups. The process level allows to structure the model into logical units, and to interface groups to external devices. • At the third level are the groups that are an aggregation of neurons of identical type. Connections are used to send information from neurons of one group to neuron of another group, and are made up of synapses of identical types. • Functional as it might be, the two-dimensional representation of a neuronal system that is effectively organized in three dimensions, can present a limitation to the understanding of the system the user is dealing with.

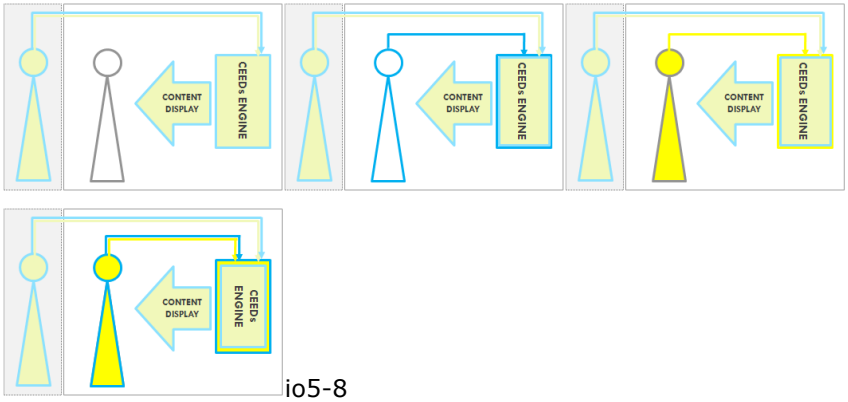
Core Use Case 3: To feedback <u>to users</u> in <u>real time</u> their implicit and/or explicit responses in relation to stimuli

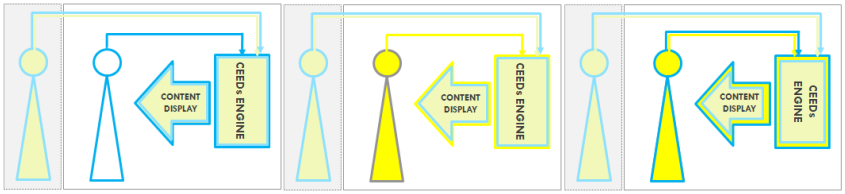
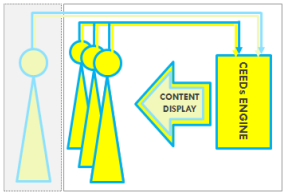
Dependent on	UC2
Relevant Pictorials	 io9-11  io12-14  io15, 15v2 and 16
Description	Many CEEDs scenarios will require real time feedback to the user. For explicit, navigation related features, real time feedback theoretically enhances presence (action-response loops). For implicit indices, it could make interaction more intuitive, and could also serve to draw the users' attention to components of the display which have triggered a 'significant' subconscious response. What is considered 'significant' enough to warrant altering the display is to be defined in other WPs (WP1, 2?). This use case does not specify the representation to which they are responding. The database on which the representation the users' responses are based could be untagged (no pre-tags from any previous user) or could already be tagged based on at least one previous user's responses.
Relevant scenarios	**?Scenario 1: RETAIL (ELUX) To support customers' product selection** Mary and John have been living in their new home for six months now. They have decided to get a new kitchen and that they may as well buy 'all new' and replace the dishwasher left by the previous owner. They've always preferred to use the shortest wash cycles on dishwashers because of their concerns about energy efficiency. On the dishwasher they have, the longer, though probably more efficient, wash always takes over two hours! They've found the cleaning to be inadequate and find that their cutlery is always left dirty. John has a day off work today and decides to have a look for dishwashers at their local retail park. He explains his situation to the sales advisor who recommends the new service to help customers choose. In real time, he is made aware of his own subconscious reactions to the product – the feedback shows him that he shows an aesthetic preference for one product over the

	others. This information is used to help him decide which of three products that he's is interested in that he will purchase. **Scenario 2: To provide an interactive use guide to customers about white goods (NOT FULL CEEDs USE) and support understanding of products** Felix, the buyer from a national retailer, is choosing the kitchen appliances to be in the new Spring range in their stores. He visits various manufacturers and is looking for some key features including low energy use, usability and quiet performance. He is impressed by Electrolux's sales pitch. He is able load up a virtual version of a range of their latest dishwashers with virtual plates and pans. He initiates the virtual wash cycle by pressing the virtual button, and if he chooses, he is then able to enter into the virtual product. He can see where the water comes from and how it is dispersed, how much is used… He can leave that product and try another one … *Alternatively users could be retail sales staff (training) and customers (learning how to use)* **Scenario 4: To layer new variables on top on of existing known relationships (UC5) – for hypothesis testing/exploration** **Scenario 5: To use information about the strength, direction and number of independent confirmations ("known-ness") of relationships within and between a large set of variables. This could include algorithms and equations (e.g., astrophysics, neuroscience)** User measure include identification of zones of interest

***Core Use Case 4: To display to observers in <u>real time other users'</u> implicit and explicit responses in relation to stimuli [UC3, to a 3rd party] (*extension of UC3)**	
Relevant Pictorials	 Note: single user pictorial as per the above is also relevant and possible Note: alternative image is possible whereby observers only observe (as oppose to observe and influence, as per the pictorial above)
Description	For some purposes, CEEDs can be used to show to an observer or group of observers, the real time responses to a (re)presentation of a CEEDs user or group of users. Real time observation may be useful for remotely located research teams. Real time observers may or may not be able to have control over the (re)presentation experienced by the 'users'.

Relevant scenarios	**Scenario 1: RETAIL (ELUX) To speed up product development time** As part of product testing the new protocol indicates that CEEDs can be used to support designers' understanding of their customers' preferences. In the research sessions, customers are located in one space within the design house and interactively explore the range of products. A design team in a second room is looking at the same display. They can see what the customers are looking at, how long they inspect areas, where they point, and where something looks odd or inconsistent with expectations. When appropriate, the design team can control what products they view and can manipulate the objects represented which is displayed in real time to both groups of users. This is enabled because the design team's explicit responses are weighted more heavily than the consumers with regard to how to process explicit reactions. **Scenario 2: To test ergonomic design** In developing new controls for their washing machines, the manufacturer is aware of some customer feedback from call centres that the dial to select the cycle could be improved. A sample of 10 research participants take turns using a virtual version of the control. The design team vary the force required to turn the control in real time and observe how this affects users' responses. **Scenario 3. To enable real time remote tactile interaction with an object** Tom, an archaeologist on a dig, wears CEEDs gloves. Back at the lab, Paul dons the master CEEDs gloves to control Tom's hands and receives real time visual and tactile information about the object(s) which Tom is manipulating under Paul's control. This supports a sense of object presence for Paul and increases his connection with the field site (empathic experience). Alternatively, Tom is in full control but Paul provides verbal guidance to Tom.

Core Use Case 5: To display, but <u>not in real time</u>, users' implicit and explicit responses to stimuli	
Relevant Pictorials	 io5-8

	Note the pictorials below show how a previous users'/group's responses are represented to the 'current' user (as part of the basic/default presentation), even though, in these contexts the current users' responses are also being used to manipulate the display in real time.  io12-14  io16
Description	CEEDs allows users to store their implicit and explicit responses to a (re)presentation. In some contexts, after the data collection session, users may wish to view their own, and/or other people's responses to compare and contrast and identify similarities in responding.
Relevant scenarios	**Scenario 1: RETAIL (ELUX) To support customers' product selection** John had a CEEDs experience on his day off from work to help him work out which dishwasher to choose. His wife, Mary, comes to the same store a week later to see John's responses to the dishwashers and to compare them with her own. She'd like them to come to an agreement on which product to buy based on averaging their responses so that they're both somewhat happy with their purchase decision… **Scenario 2. (ARCH) to support interpretation of implicit/explicit user responses (e.g., scan path across a scene) to identify potential topographical structures/layouts/groupings in a 3D space** Chiara uploads scans of new objects with geotags in the field in Greece. John in CXIM views visualisation of current site status; CEEDs extrapolates his eyes' scan to the right, suggesting a structural continuation of one area to another. Based on a search for similar structures in other databases, CEEDs highlights potentially fruitful areas on site to dig next. **Scenario 3. HISTORY (BB) To provide an enhanced meaningful, informative and emotive story about Bergen Belsen to members of the public (see also UC2 for development of this; see important note on p.12)** [UPF: PV/UB/AB text] EXPERIENTIAL: While moving through the camp site the visitor can on the basis of the various reconstructions of the camp (related to its different stages of development) access

	information in the form of interviews with survivors who recount events and experiences as they relate to locations. These stories are not focused on "facts" but on experience. FACTUAL: In this case the user can access factual information on locations. Such as "A block could house X inmates", etc. In this case we combine interviews with factual information such as building designs, archive records, etc. A typical trajectory could be: 1) the sequence of positions visited when an inmate entered the camp; 2) the daily routine of inmates; 3) the daily routine of the guards; 4) The holocaust has been a singular historical event that is of great importance to be conserved and presented to future generations. However, the presentation of this event faces a number of problems both due to its psychological and moral significance and its highly heterogeneous and complex data set. In addition, in this case the users will be members of the general population, whose members are not trained in methods of history and archival research. 5) In the context of the CEEDS project (WP 6), we will design (see UC2) an application for the optimization, acquisition, storage and presentation of data that represents key aspects of the holocaust. the camp's liberation; 6) the camp's evacuation; 7) the camp's destruction; 8) the different subdivisions of the camp.

Peripheral Use Case 1: To sort, match, or group objects by their properties	
Relevant Pictorials	(none)
Relevant scenarios	**Scenario 1. To speed up ability to identify commonalities in discoveries (pottery, mosaics, pieces of architecture)** Sue is on an archaeological dig. She's found a new artefact and needs to know more information. She scans the artefact using a handheld scanner and sends the image and GPS information to her colleague, Deborah, in the lab. Deborah is using CEEDs to remotely support Sue's work. When Deborah receives the file, she loads the information into CEEDs. CEEDs searches the database which includes information about the place of finding and chronology of previously found artefacts along with a bibliography in which they're discussed.

(b) Revised draft (selected ppt slides); content discussed with TD (26-27th May 2011)

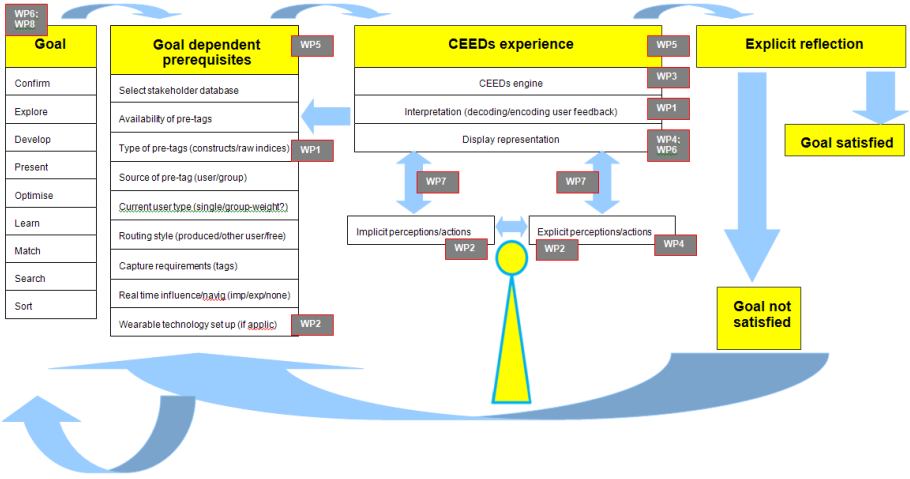
The Collective Experience of Empathic Data Systems

Meeting with Ulysses (UPF) 26-27 May 2011

Use cases and scenarios

Jane Lessiter, Jonathan Freeman & Andrea Miotto (GOLD)
Psychology Department,
Goldsmiths, University of London

A unified vision…



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Overview

- In delineating the use cases that are not only possible but also in-scope for CEEDs, use cases are presented at different levels
- Primary use of CEEDs
- System level (component) use cases – what does CEEDs do?
- Application level scenarios
  - Archaeology
  - Electrolux
  - History
  - (Neuroscience/Astrophysics)

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Primary use of CEEDs

- ***[UC0] to support discovery, understanding and empathy in relation to large and complex datasets, through:***

a. abduction (generating a feasible hypothesis) which will be facilitated by deploying principles of phenomenal consciousness (GEPE model) and supporting the incubation stage of creativity (where the 'problem' is put aside and not consciously attended to).

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Component use cases

- *[UC1] To display a CSA-independent view, perspective or flow of a focal/raw dataset;*
  - *[based on: (a) other variables e.g., sort, match, typology, reconstruction; or (b) directorial/ producer preference, or (c) random]*
  - *Subliminal or supraliminal influence/guide users' experience of the display (CUES are rule based independent of CSA)*
- *[UC2] To collect and store users' (a) explicit and/or (b) implicit responses to a dataset that is based on the output of UC1 [focal/raw] or UC4 [tagged];*
- *[UC3] To interpret and store users' (a) explicit and/or (b) implicit responses to a dataset that is based on the output of UC1 [focal/raw] or UC4 [tagged];*
- *[UC4] To display a CSA-dependent view, perspective or flow of a focal/raw dataset;*
  - *[based on outputs of UC2, UC3 on which sort, match, typology functions could be applied] (empathy, understanding)*
  - *METADATA INFLUENCES presentation of raw data.*
  - *Subliminal or supraliminal influence/guide users' experience of the display (CUES are rule based dependent of CSA)*
- *[UC5] To represent as an overlay users' responses to a CSA dependent or independent view or perspective of a focal/raw dataset on the dataset [i.e., UC1 or UC4] or a*
  - *[based on outputs of UC2, UC3] (overview, planning, professional, deliberate)*
  - *DISPLAYS METADATA*

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