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RECOGNITION considers embedding self-awareness in ICT systems using inspiration from psychology. This will be based on the cognitive processes that the human species exhibits for self-awareness, seeking to exploit the fact that humans are ultimately the fundamental basis for high performance autonomic processes. This is due to the cognitive ability of the brain to efficiently assert relevance (or irrelevance), extract knowledge and take appropriate decisions, when faced with partial information and disparate stimuli. Using the psychological and cognitive sciences as concrete inspiration, our approach is to develop functional models of the core cognitive processes that allow humans to assert relevance and achieve knowledge from information. This involves mechanisms such as inference, belief, similarity and trust. These will be translated to the ICT domain by development of flexible RECOGNITION algorithms that can be imbedded in ICT on a flexible basis for self-awareness.

We will demonstrate this new paradigm for Internet content. The future Internet will see ever-increasing amounts of content that needs to be effectively managed and acquired, often from portable devices and in diverse spatial and social situations. The massive scale of content will swamp the user with information, impeding effective management and relevant acquisition by the user. By exploiting the self-awareness capability we will enable the users, content and network to cope effectively in a scalable manner, thus making unprecedented amounts of relevant content available and unleashing new classes of applications that extract maximum utility from content.

Summary Description of the Project Objectives

The RECOGNITION project has two core objectives:

- To **identify and engage** a robust psychological basis for self-awareness in ICT. *This will involve engaging cognitive-based processes from the human brain that enable*

understanding, inference and relevance to be established while suppressing irrelevant information in the context of massive scale and heterogeneity.

- To **exploit the psychological basis for self-awareness in a content centric Internet**. *This will involve engaging the spatial dimension, interactions and intelligent processes that reflect cognitive behavioural heuristics to provide content and knowledge flow to other participants and network components.*

To fulfil these objectives the RECOGNITION project seeks to:

- **Determine the psychological basis** for understanding, belief, inference and relevance.
- Translate this psychological basis into **principles expressed in quantitative terms**.
- Develop these quantitative principles as **dynamic protocols and algorithms** for components in a content-centric Internet.
- **Engage self-awareness of relationships, mobility, interactions and knowledge flows** between devices, content and network components.
- **Facilitate learning and predictive ability** at the level of multiple network components to enable enhanced intelligence with reduced overheads for the user and network.
- **Enable relevant content acquisition** with validated robust and resilient behaviour based on trust and security.
- **Demonstrate the concepts** through rigorous analysis and simulation

The four components of the project that show the approach adopted in the project are given in Figure 1.

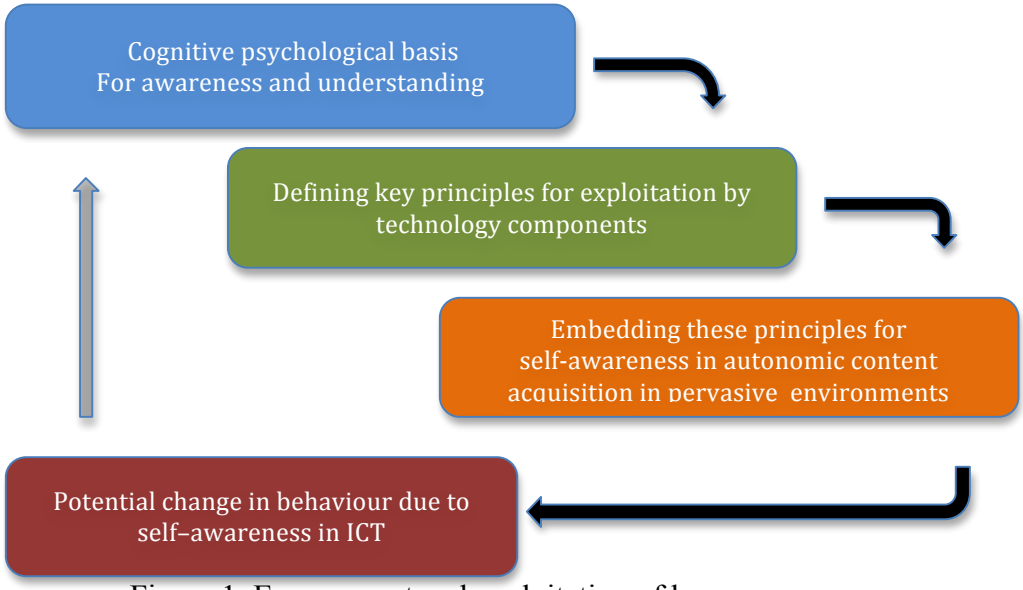

Figure 1. Engagement and exploitation of human awareness

The RECOGNITION project first examines the key cognitive behaviours that allow the human brain to establish relevance. These are to be selected and translated into design principles. This leads to fundamental open research issues in a range of key areas, which are developed in their own right and subsequently integrated. This will enable an architecture to be developed that can be engaged with flexibility for the ICT domain in different "node" components and for different applications. The four components in our methodology can be summarised as:

- **Phase1: Identification** of models of humans' cognitive processes and their

exploitation to derive baseline functions for self-awareness in ICT systems (WP1);

- **Phase2: Translation** of concepts to a flexible architecture, oriented towards content management in the perspective of a future content-centric Internet (WP2);
- **Phase3: Development** of enabling protocols and algorithms with the architecture for content-centric applications (WP3);
- **Phase4: Demonstration and validation** of the concepts (WP4)

Main Results achieved

The main contributions of the RECOGNITION project achieved during the first year focus on the fulfilment of the first phase, related to the identification of those aspects from psychology that can be directly mapped to the development of the ICT components. These are to be used as a basis for the definition and deign of the self-* architecture constituting the core of the second phase and work package of the project. To develop and extend this thinking we have organized two workshops to educate the consortium in cross discipline issues and concepts. This has led to detailed analysis of potential cognitive concepts (D1.2) and the development of a preliminary architecture and scenarios for RECOGNITION nodes (D2.1).

Relevant aspects of cognitive psychology

Through systematic analysis from the cognitive science literature the project has identified of a pool of prominent cognitive areas potentially relevant for self-awareness in the context of ICT systems. We have identified five broad areas based on: the modelling of human reasoning and decision making processes; the social aspect and representation of ourselves in relation to other individuals; an area related to personality psychology and its influence on people information behaviours; the perception of external context and spatial/temporal influence; and finally a group of related areas including concepts from neurophysiology and cognitive applications in the field of human computer interaction. For each of these areas we have identified a number of relevant concepts and the transfer of these concepts to the ICT domain has been assessed. Furthermore, from our assessment of the literature a broad tri-partite classification has been established. This has led to a tri-partite model for cognition that is indexed by multiple dimensions (reaction time, cognitive cost, flexibility). This is shown in Figure 2. More details on this are provided in Deliverable D1.2.

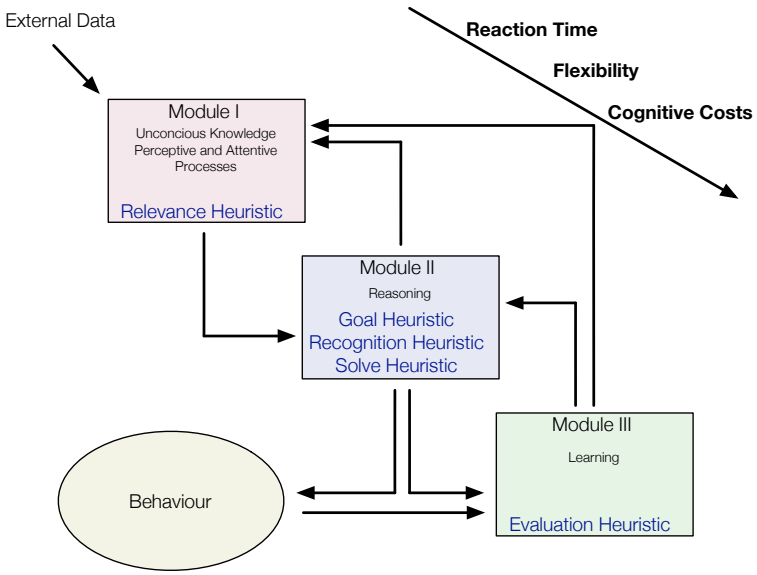

Figure 2: The tri-partite classification model for cognition.

Definition of key scenarios, fundamental requirements and preliminary architecture of the RECOGNITION project

The further main result in year 1 has been the preliminary development of a framework for ICT. This has involved development of preliminary architecture based on the tri-partite model for so-called RECOGNITION self-* nodes. This maps the general components that will be used and tailored for self-awareness in a range of different scenarios. From the general architecture algorithms and protocols can be developed based on the underlying cognitive literature. This will mainly take place in WP3. The scenarios developed for the project concern three main areas: content consumption, content dissemination and content management. The relationship between these scenarios is shown below.

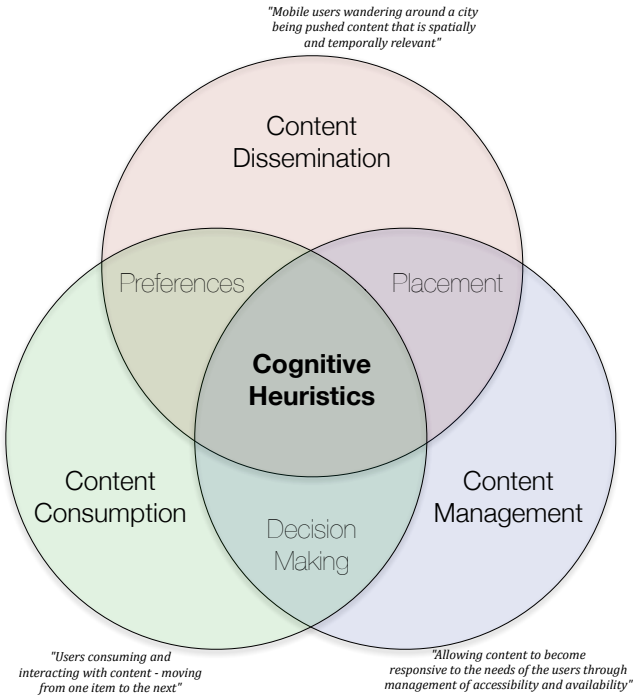

Figure 3: An overview of the scenarios being developed.

The scenarios address different types of Internet content, the mixing of the physical and virtual worlds and the "long-tail" issue of real-time content relevance including the spatial dimension. The diversity of scenario allows the trialling of RECOGNITION nodes in a variety of situations.

Expected Results and Their Impact

We expect to show how the general RECOGNITION node approach can be used to provide content-centric awareness in a range of scenarios. The methodologies that we adopt include simulation as well as interaction with users. We envisage being able to engage with users through prototypes and some experimentation. In the latter case this will be publically available and online, leading to potential concepts applied to specific scenarios that can be made available for demonstration and trials. This will provide a real insight into how ICT system operation and human behaviour can be more closely integrated to provide content for the user.

End of Summary