

ADAPT

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Artificial Development Approach to Presence Technologies

Deliverable Item 1.2

Dissemination and Use Plan

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Table of Contents

1. Ov	verview of Expected Results	3
2. De	escription of Dissemination Plan	5
2.1.	Workshops and conferences	5
2.2.	Publications	5
2.3.	Web Presence	6
2.4.	Clustering and Standardization	6
3. Description of the Use Plan		7
3.1.	An intentionality based approach to robotics	7
3.2.	An intentionality based approach to developmental psychology	. 7

Overview of Expected Results

As part of the IST-FET proactive initiative on presence research, ADAPT will disseminate and use new knowledge and results as widely as possible. In particular we will contribute to the understanding of the basic processes underlying the integration of sensory modalities.

In this document we describe the mechanisms we will adopt to ensure that the outcomes of the project are best exposed to academia and industry and we outline possible paths towards their exploitation. Four aspects will be relevant to the dissemination of the knowledge acquired during the project:

- the integration of separate sensory modalities in a epigenetic inspired robotic setups;
- the modality of sensory integration in humans;

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- the relevance of morphology on the integration of sensory modalities;
- the nature of Presence based on a sensori-motor inspired theory of intentionality.

Each partner will have the responsibility to contribute to the aspects that more closely match its own expertise and the content of related workpackages.

The dissemination of these results will be performed by exploiting many different channels and activities. In particular, given the broad range of possible interests to the aforementioned aspects we plan to submit papers to several journals in the field of Cognitive Science, Developmental Psychology, Philosophy of Mind, Epigenetic Robotics, and Autonomous Systems. Also, we will participate to the most important international conferences in order to attract the attention of the scientific community on these topics.

We provide in §2 a list of journals to which we are currently submitting or to which we will submit in the course of the three years of the project. The work presented to these journals is supported by the ADAPT project.

In order to begin disseminating the result of ADAPT a series of workshops and/or meetings will be organized by the partners on topics related to the goal of producing an integrated feeling of being there (Presence). Although they would not be organized on a regular basis the plan is to have a few of them scheduled during the three years of the project.

A first example is the Fourth International Workshop on Epigenetic Robotics that will be held in Genoa on August 2004. This conference, thanks also to the contribution of ADAPT, will address a number of issues related to sensory motor integration and embodiment in robotics and developmental psychology. For more information see: <u>http://www.epigenetic-robotics.org</u>. The conference will offer an important occasion for the dissemination of the partial result of ADAPT as well as an occasion to get feedback and comments on the approach.

In the course of the project and in the time immediately following it, we plan to contribute to at least a book on the topic of intentionality/presence. Of course, more contributions are expected as the experimental part of the project develops.

Finally, although our project has been proposed mainly as a scientific project aiming at acquiring fundamental result on the topic of intentionality and the sense of being there, we hope to utilize the results in robotic prototypes and applications. It is not easy to estimate completely the potential relevance of a better understanding of the processes that allows producing an integrated representation of the external world. Robots endowing this capability may achieve a definitive advantage in real world applications if compared to traditional ones. Therefore a potential but very attractive channel of dissemination of our results might be represented by the potential "joint venture" between academia and industry on designing and implementing robots with the developed technology.

2. Description of Dissemination Plan

By dissemination, we mean making the results of this project visible to the widest audience possible. This will be achieved by the following means: i) publishing and presenting results within the scientific community, ii) making results publicly available through a web site, iii) designing and implementing artifacts usable as cognitive science tools; iv) proposing an interdisciplinary foundational theory of phenomenal experience.

2.1. Workshops and conferences

As part of the ADAPT project dissemination policy, the three partners will participate to International and European workshops and conferences on Presence related topics. In particular they will be present in conferences in the field of epigenetic robotics, consciousness, biologically inspired robotics, and developmental psychology. Also, the activity of ADAPT will be presented at conferences not traditionally related to Presence research: e.g. robotics or developmental psychology.

Due to the past experience in the field of epigenetic robotics one of the three partners, the LIRA-Lab (partner DIST), will organize the fourth international workshop on epigenetic robotics where some of the aspects of the project will be discussed. Appropriate advertisement of the event is planned as soon as the call for paper is issued. The workshop among other things will be focused on strengthening the collaboration and convergence between developmental psychology and robotics.

2.2. Publications

We intend to disseminate the findings of the project in several conferences and journals. Their number is increased by the fact that the potential scope of ADAPT is very large: from developmental psychology to epigenetic robotics, from developmental robotics to philosophy of mind.

In the past, the three partners have published many articles, papers and books on the same aspects that are now central to ADAPT. We anticipate that cooperation, made possible by the project, will allow reaching a wider audience and foster the interdisciplinarity of the approach.

The list of journal where we plan to submit papers is the following:

- Robotics and autonomous systems
- Mind and Machines
- Axiomathes
- Neural networks
- Behavioural Brain Science
- Journal of Integrative Neuroscience
- Developmental Science
- Cognitive Development
- Advances in Psychology Research
- Adaptive Behavior
- Neural Computation
- Neural Networks

2.3. Web Presence

Due to the importance given to the dissemination of the outcomes from the ADAPT project a website will be created. The general guideline followed during the design and implementation of this website has been simplicity. By simplicity we mean that we tried to avoid all unnecessary aesthetical add-ons. We tried to concentrate on the availability of the information.

A preliminary and in progress web site can be found at

http://www.liralab.it/ADAPT

The ADAPT website is designed with four main goals in mind: i) to present the state of the art of the ongoing activity inside the ADAPT project; ii) to make results publicly available to those doing research in biologically inspired robotics, epigenetic robotics, developmental psychology, philosophy of mind; iii) to promote discussion on the most critical part of the project; iv) to offer an area of comparison with other projects.

Future additions will include results and the description of what has been achieved by the project together to the state of advancement within the planned activity.

2.4. Clustering and Standardization

Related projects relevant to the ADAPT project include Mirror from the EU Neuroinformatics for "living" artifacts projects and other EU projects:

MIRROR http://<u>www.lira.dist.unige.it/mirror</u> investigates mirror neurons in monkeys and humans. It aims at understanding sensori-motor control with a focus on visual gesture recognition and generation of such gestures by a robot.

In terms of the research aims, we feel ADAPT close to the TOUCH-HAPSYS project. Aspects of the perception of objects and multisensory integration will be investigated in TOUCH-HAPSYS that could easily complement the developmental findings expected from ADAPT. Although no formal steps have been undertaken yet, we see a possible line for collaboration and clustering here. Perhaps a joint-workshop could be organized later on in the project. See also: <u>http://www.touch-hapsys.org/</u>

Although most of the projects in the Presence initiative deal with aspects of Presence which are not directly linked to the approach of ADAPT, we believe that the ADAPT project aims at foundational issue that are potentially relevant for all the projects inside the initiative. By developing an artifact mimicking the process of developing new integrated representations, it is possible to gain a better insight of similar processes in humans. ADAPT findings could therefore be used to consolidate the procedure and technique developed by other partners. In order to do this a theoretical debate on the nature of the feeling of being there has to be promoted. It is expected that the definition of a commonly accepted frame of reference for the phenomenal aspects of experience will lead to a consolidation of different Presence techniques over the next few years. Issues like the difference between information and meaning, phenomenal experience and feeling of being there will be clarified. Such consolidation emerging from cooperation will be very useful for the community as a whole.

Given the foundational approach of the ADAPT project, the use plan cannot be very specific. On the other hand the possible exploitation of ADAPT findings is large. There are three levels of deployment: i) the implementation of a Presence based technology in robots could have a wide market; ii) the exploitation of a theory for phenomenal experience in the field of psychology and virtual reality devices; iii) the exploitation of artifacts to better understand human development.

3.1. An intentionality based approach to robotics

Traditional approach to robotics and artificial intelligence almost failed to cope with the complexity of real world. Similarly, it has been hitherto difficult to provide a detailed and completely satisfactory description of what is the feeling of being there, elsewhere defined as Presence. In practice, the two problems could be related and the solution could lie in understanding how to endow robots with the capability of developing true integrated representations of the external world.

Therefore the design and implementation of robots with the capability of developing true integrated representations from several sensory modalities could be seen as an efficient way to reduce the complexity of the external world. These Presence-oriented robots will be able to deal with everyday objects and situation in a much more efficient way.

There are potentially many uses that can be made of the findings of ADAPT to create robots that develop integrated representations and achieve a "feeling" of Presence. As a result they might be able to control their behavior in highly unpredictable and dynamic environments. These robots are innovative compared with the current state of the art in robotics. Presence oriented robots may provide a better foundation for a general use of a robot control architecture than the current specialized implementations.

The Presence-oriented architecture will be especially successful for entertainment robots (as the recent Sony AIBO or the Honda ASIMO). These robots would likely deal with the unpredictable environment of their users' homes in a more efficient way thanks to their integrated representations. Further, since they have to achieve a sense of presence they will behave in a more human-like way with the result of a better integration with humans.

3.2. An intentionality based approach to developmental psychology

Newborns are equipped to interact actively with the physical and social world: they are not solely stimulus respondent but also stimulus expectant. This distinction highlights the selective exploration of stimuli which characterizes newborn activity. Newborns prefer moving over static stimuli, novel over familiar stimuli, human over non-human stimuli. They detect face versus non-face stimuli, biological versus non biological movements. These capacities guide their perception and their early coupling between perception and action. The coupling however is not formed at random. Rather it is based on another of the neonate's capacities: the capacity to detect and expect contingency.

A first way to organize the world, for very young infants, is to start establishing relationships between events, i.e. to detect and expect contingency. This capacity is

effective immediately at birth and even before birth. Numerous conditioning studies have demonstrated this point. Furthermore, Watson (1972), among others, has shown that 2-month-olds seek for perfect contingent relations between their activity and external stimulus, but that after around 3 months they switch to high but imperfect response-stimulus contingency. He argues further (Watson, 1994) that the initial search for perfect contingency serves to identify the range of self-generated stimuli, and it is followed by a bias to explore the external world and build representations primarily on the basis of exteroceptive stimuli rather than on internal, proprioceptive cues. This provides an interesting model to hypothesize a first priority for intersensory integration between proprioception and vision in the very first weeks of life.

A more sophisticated extension of this capacity is to detect and expect social contingency. It is more sophisticated since it requires being able to establish relationships between your own and another's (dynamic) behavior. From a standpoint of developmental psychology, experiencing our own agency and others' agency is a sine qua non condition of what differentiates self and other objects, from which emerges a sense of 'being there'. By agency, we mean after Russell (1996), the ability to alter at will one's perceptual inputs, motorically or attentionnally. How could perception lead to a sense of being there if we do not produce action coupled with perception, goal-directed action coupled with attention?

What the study of developmental psychopathology teaches us, compared to typical development, is the strong evidence that the development of self and other's agency is embedded in contingent social interactions: if these are lacking, the building of body awareness, the sharing of actions and intentions is not guaranteed. In this way, the idea of a sense of being there has its home in the context of communication.

Infants do not have to exercise a network of concepts (i.e. possess the concept of agency) to experience their agency (and the reverse is true, see schizophrenic patients who possess the concept but do not experience action-based responsibility for what they perceive). What is at stake is "ownership" (Russell, 1996). While acting, we take experience to be our own and take ourselves to be responsible for what we experience, to be subject of a first-person point of view. It takes around one year to a child to start being aware of the other as subject also of a first-person point of view. Imitation offers a unique opportunity to experience the distinction between two kinds of stimuli: those which are self-generated and those which are generated by the external world, to observe our intentions acted through the behavior of another and to adopt a third-person perspective. Knowing what our action is to experiencing agency and from experiencing agency to represent intentionality there is a continuous path in the typically developing infant.

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