ADAPT

IST–2001-37173

Artificial Development Approach to Presence Technologies

Deliverable Item 1.7
Management Report 3

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Partners Contributed: ALL

Short Description:
Contributors:

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This document describes the project advancement six months before the end of the project.

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Summary

1 Executive summary

Adapt deals with a very basic question about the sense of presence: that is, how do we represent our world and, in particular, how do we represent our world of objects? It does so by incorporating findings and experimenting of different disciplines ranging from philosophy of mind to robotics.

Adapt technical work is divided into four workpackages. Progress is reported for this period in three of them, namely on the investigation of morphology (WP3), the experiment on developmental psychology (WP4), and the development of the robot architecture (mainly WP5). According to the plan, WP2 is "dormant" for this period it is concerned with the validation of the theory put forward in D2.1 by employing the results of the experiments developed during the whole duration of the project.

In the following, we will briefly describe the experiments with robots, those on the study of morphology, and finally the advancement on the experiments on developmental psychology.

During the reporting period the Adapt team also contributed to the exhibition of the Presence booth at CeBit2005 (March 2005) with posters and videos of the latest experiments. Some of the hardware being developed by one of the partners was also exhibited.

2 Work progress overview

2.1 Specific objectives for the reporting period

Most of the effort for the reporting period has been devoted to the advancement of the experiments that were already planned as described for example in D1.6. We still have one delayed deliverable (D5.4). Retrospectively, it is fair to say that D5.4 was allocated incorrectly as an intermediate result and, it is actually a conclusive aspect of the project rather than an intermediate one. It deals with the emergence of multisensory representations which is one of our objectives.

In summary, our goals for the past six months were:

- Continue experimentation according to the planned activity;
- Initial conceptual work on the link between the results and the theory;
- No new experiments were planned.

Apart from the delayed deliverable, we believe the actual activity is very close to the planned one.

No formal Adapt meeting was organized during the reporting period but the collaboration continued through several bilateral meetings and email exchange. Meetings between the UNIZH and UGDIST happened particularly often because of other formalized projects and conferences. The same is true for meeting with CNRS and UNIZH or CNRS and UGDIST. Exchange of data for the preparation of some of the experiment was realized by electronic means.

2.2 Overview of the progress

W**orkpackage 2**, as we mentioned earlier, this workpackage is sort of dormant and will be restarted from this moment on to try to capitalize on the behavioral and robotics experiment in drawing the conclusions from our research activity. That is, we will try to understand how much of our experimental work may contribute to validating the "theory of intentionality" proposed in D2.1 and the realization of a common vocabulary and understanding between psychology and computer sciences.

Workpackage 3 is also completed now and we are in the process of preparing a conclusive report: that is D3.3. A set of publications mainly by University of Zurich demonstrates our activity in this direction. Although not completely clear from the reporting structure, similar experiments are also planned and will be included in the reporting of workpackage 5.

In between workpackage 3 and 5, we have completed the implementation of the robot architecture for reaching and grasping. Also in this case several papers are testimony of this activity. The Babybot at the University of Genoa can now reliably (to a certain extent) locate objects in its workspace and grasp them. We believe this is a state-of-the-art robotic system incorporating several different behavioral modules in a coherent whole together with learning abilities. The reporting of the robot behavioral experiments is the goal of workpackage 4.

Workpackage 4 is devoted to the study of the developmental time course underlying the acquisition of the multimodal representation of objects. A full report of this activity, just concluded, is available in D4.3. The report contains results that we believe are important for presence research beyond the immediate needs of Adapt. In practice, they range from the investigation of the development of the interaction with objects to the development of the interaction with other people (social interaction). These results may be clearly of use, for instance, in focusing the implementation of VR systems toward cues that are important cues for conveying the feeling of "being present", or for engaging the users in social interaction within or mediated by VR systems (for example augmented reality).

Workpackage 5 is devoted to the realization of the architecture for the robotic implementation of the developmental model. Aspects of the architecture are described in D3.1, D3.2, and D5.1. D5.2 and D5.3 present the details of the implementation and the initial experiments of learning multi-modal features. Also D4.4, not yet finished, will contain results of these experiments, for the parts relevant to developmental psychology.

2.3 Deliverables

Deliverables status and reached milestones are detailed below.

Number	Title	Type	Due month	Expected
D1.1	Project presentation	Docs + web site	3	N.A.
D1.2	Dissemination and use plan	Document	6	12
D1.3	Management report #1	Document	6	6 (rev1)

				12 (rev2)
D1.4	Periodic progress report Y1	Document	12	12
D1.5	Management report #2	Document	18	20
D1.6	Periodic progress report Y2	Document	24	25
D1.7	Management report #3			
D2.1	A tentative theory of intentionality and the sense of being there	Document	7	12
D3.1	Definition and implementation of a human-like robotic setup	Document	12	12
D3.2	Hardware and software in place to run experiments on changing morphologies (e.g. changing resolution and motor precision)	Prototype	15	20
D3.3	A set of formal methods for the analysis of the interplay of morphology, materials, and control	Document	30	32
D4.1	Definition of experimental paradigm	Document	12	13
D4.2	Definition and implementation of setup for the investigation on child development	Prototype	12	13
D4.3	Results of behavioral experiments with babies	Document	30	30
D4.4	Results of behavioral experiments with robots	Document	30	32
D5.1	System's architecture specifications and design	Document	6	14
D5.2	Basic unit design and implementation	Prototype	9	14
D5.3	Initial implementation of the integration model	Prototype	12	20
D5.4	Initial experiments with multiple sensory modalities integrations (DELAYED)	Document	18	27-28
Additional document	Plan of experiments	Document	-	N.A.

Submitted [yellow]. This document [cyan]. To be delivered [white].
The deliverable marked in white are now available from the Adapt website contextually with this report. D5.4. see notes below.

2.4 Comparison between planned and actual work

The work performed in good agreement with the technical annex. We are now in the process of finalizing workpackage 3 and 4. There still work to be done on the experiments with the

developing sensory representation (unsupervised discovery of features) according to the architecture developed within workpackage 5. Workpackage 2 will be also completed starting from now on by considering the experimental results obtained so far in integrating new data. This activity will be carried out until the end of the project.
A special mention deserves D5.4 since it has been delayed. In the original proposal, we expected this report to contain a first hint of the multimodal discovery of features in the robotic setup. Clearly, preparing the robot for experimenting with multimodal integration took longer than expected but also the development of multimodal integration is the last aspect we wanted to consider in Adapt and could not be developed as planned. We have already considered unimodal feature analysis (see D5.3), but the extension to multimodal (amodal) feature analysis has been started only now around month 30. We expect thus to deliver D5.4 together with D5.5 at the conclusion of the project.

2.5 Milestones

Number	Title	Delivery date (month)
M1	Tentative Theory formulation	7
M2	Validated theory and common vocabulary	36
M3	Different robotic setups to test the effect of morphology	12
M4	Formal analyses and first setup of conclusions	30
M5	Final evaluation of morphology changing experiments	30
M6	Human like robotic setup	15
M7	Experimental setup and paradigm	12
M8	Result of behavioral experiments	30
M9	Modeling of coherent representations	33
M10	Basic units design and implementation	12
M11	Multi sensory modalities integrations	21
M12	Artificial intentional architecture	33

[yellow] reached.

2.6 State of the art update

What is becoming clear to the community is that manipulation is becoming the “hot topic” of robotic research. For example, Brooks (personal communication) is developing new robotic hardware for manipulation (see for example: http://people.csail.mit.edu/etorresj/robot-obrero/ and http://people.csail.mit.edu/edsinger/domo.htm). Still, tactile technology is lagging behind.

We expect this to be a topic of further research that can really bring to exciting new development in the near future. We are glad to see that indeed several EU projects were already at the forefront of this new trend in robotics research.

2.7 Planned work and status of experiments

Current status of the project:

WP2: the workpackage is re-activated now. Conclusion of the experiments and contribution to the validation of the "theory of intentionality" will be described in D2.2 and D2.3.

WP3: the workpackage is completed now. The results will be described in D3.3.

WP4: the developmental psychology experiments have been completed (see D4.3).
WP4: the part of the robotic experiments pertaining to WP4 will be completed soon and described in D4.4.

WP5: work in progress.

2.8 Future work

The future experimental activity for the remainder of the third year will mainly see the completion the ongoing experiments of WP5. In particular, we would like to complete the tests of the unsupervised learning model on the robotic setup. Several conclusive activities will be also performed including the preparation for the final review meeting.

2.8.1 Contribution of experiments to the validation of the theory of intentionality

In the last six months we will analyze the results of the Adapt developmental psychology experiments and try to single out the contribution to the validation of the theory presented in D2.1. Also, we will report on our experience on merging psychology and computer science and in establishing a common vocabulary or sharing results.

2.8.2 Experiment on the discovery of multisensory features

A set of experiments will focus on the acquisition of multi-modal features. This will fully test our unsupervised model of the extraction of features from unlabeled data sets described in D5.1. The goal of the experiments is to verify that interaction with the world can guide the development of a coherent representation that supports this interaction.

3 Project management and coordination

The major part of the management effort in Adapt has been directed to the harmonization of the different experimental plans coming from such a diverse range of disciplines. This has been

carried out mostly by email and through telephone calls. Collaboration at this point is also carried out by exchange of data from the robotic platform for example for off-line analysis.

4 Cost breakdown

Participant Code	One person-month corresponds to N hours
C1 – DIST	141
P2 – UNIZH	179
P3 – CNRS	135
P4 –UPMC	

Work-Package ID	Title		Reporting period
WP1	Project management		1.10.2004 – 31.03.2005
Participant Code	Spent (person-months)	Planned (person-months) Total	Start date / End date Month 1 / Month 36
C1 – DIST	0.3	3	
P2 – UNIZH[1]	0.9	1(1)	
P3/P4 – CNRS/ UPMC	0.2	1.2	

Work-Package ID	Title		Reporting period
WP 2	Theory of intentionality and the sense of being-there		1.10.2004 – 31.03.2005
Participants Code	Spent (person-months)	Planned (person-months) Total	Start date / End date Month 1 / Month 36
C1 – DIST	2	12	
P2 – UNIZH[1]	0	10(5)	
P3/P4 – CNRS/ UPMC	0.2	4	

Work-Package ID	Title		Reporting period
WP 3	Embodiment and body morphology		1.10.2004 – 31.03.2005
Participants Code	Spent (person-months)	Planned (person-months) Total	Start date / End date Month 1 / Month 30
C1 – DIST	2	12	
P2 – UNIZH[1]	6	24(10)	
P3/P4 – CNRS/ UPMC	3.5	12	

Work-Package ID	Title		Reporting period
WP 4	Development of Coherent Representations		1.10.2004 – 31.03.2005
Participants Code	Spent (person-months)	Planned (person-months) Total	Start date / End date Month 1 / Month 31
C1 – DIST	3	14	
P2 – UNIZH[1]	5	25(10)	
P3/P4 – CNRS/ UPMC	5	26	

Work-Package ID	Title		Reporting period
WP5	System's architecture		1.10.2004 – 31.03.2005
Participants Code	Spent (person-months)	Planned (person-months) Total	Start date / End date Month 1 / Month 33
C1 – DIST	2	12	
P2 – UNIZH[1]	1.8	12(3)	
P3/P4 – CNRS/ UPMC	0.5	4	

The number between brackets report the persons/month spent by permanent staff at UNIZH and not charged to the project.

Title				Reporting period		
Cumulative effort				1.10.2004 – 31.03.2005		
Participants Code	SPENT HOURS	Spent (person-months)	Planned hours 3nd year	Planned person-months 3nd year	Planned hours (TOTAL)	Planned person-months (TOTAL)
C1 – DIST	1452.3	10.3	2496	17.7	7488	53
P2 – UNIZH	2452.3	13.7	4296	24	12888	72 (29)
P3/P4 – CNRS/UPMC	1269	9.4	2124	15.8	6372	47.2

5 Information dissemination and exploitation of results

About six months before the end of the project also the effort on WP2 will be reinstated. The goal will be to capitalize on the whole set of experiments (robotic and psychology) to support the theory of intentionality presented in D2.1. The results of this last activity should provide a common view of the various approaches. Important to this end is also the contribution to the Handbook of Presence where Adapt plans to contribute with two chapters.

Since the project has a more scientific rather than applicative focus, project dissemination is mainly carried out in terms of publications of results. For the same reason there is not any result to exploit yet.

On the aspect of dissemination, it is worth mentioning that Adapt has participated to the Presence booth/exhibition at CeBit 2005. Results from all partners were presented through posters and videos. Some hardware implementation was also on display (not functional though).

5.1 Publications

L.Natale, G.Metta, G.Sandini. *A Developmental Approach to Grasping*. In Developmental Robotics. A 2005 AAAI Spring Symposium. March 21-23rd, 2005. Stanford University, Stanford, CA, USA.

NADEL, J., PREPIN, K., & OKANDA, M. (2005). Experiencing contingency and agency: first step toward self-understanding? Interaction studies: Social Behaviour and Communication in Biological and Artificial Systems, 4 (in press).

PREPIN, K., SIMON, M., MAHE, A-S, CANET, P., SOUSSIGNAN, R., & NADEL, J. (submitted). The effect of maternal mismatch between face and voice in 6-month-old infants.

NADEL, J. et al. (2004). Toward communication: first imitations in infants, children with autism and robots. Interdisciplinary Journal of interaction studies, 1, 45-75.

REVEL, A., & NADEL, J. (in press). How to build an imitator. In K. Dautenhahn & C. Nehaniv (Eds), Imitation in animals and artefacts. Cambridge: Cambridge University Press.

Tarapore, D., Lungarella, M. and Gomez, G. (2005). Quantifying patterns of agent-environment interaction. Robotics and Autonomous Systems (accepted for publication).

Gomez, G., Lungarella, M. and Tarapore, D. (2005). Information-theoretic approach to embodied category learning. Proc. of 10th Int. Conf. on Artificial Life and Robotics. (AROB 10): Proceedings of the 10th Int. Symp. on Artificial Life and Robotics, Beppu, Oita, Japan. pp. 332-337.