ADAPT

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Artificial Development Approach to Presence Technologies

Deliverable Item 4.1
Definition of experimental paradigms for developmental psychology

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Responsible Person: Prof. Jacqueline Nadel, CNRS Paris
Partners Contributed:

Short Description:
This deliverable describes the paradigm and the developmental psychology experiments that are going to be carried out (experimentation already started) within Adapt.

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I. Experimental designs for the study of early intersensory integration: a use of the habituation paradigm with haptic and visual stimuli (Arlette Streri & Coralie Sann)

The habituation paradigm is at the basis of all our experiments on early intersensory integration. This classical paradigm, widely used for the study of early perceptual and cognitive development, is a two-step method which relies on two main features of newborns: they are attracted toward novel stimuli, and they disengage from familiar stimuli (they "habituate").
The first step consists in a repeated presentation of the same stimulus until the infant will neglect it. The presentation may be a visual one (i.e. the infant is facing for instance a red wooden cylinder): in this case the neglect (test of habituation) will consist in looking somewhere else, or an haptic one (i.e. a red wooden small prism is put in the infant's hand without her sight): in this case the neglect (test of habituation) will lead the grasping to an end and the object will fall.
The second step consists here in a cross-target procedure. We present two stimuli, the familiar one and a novel one, so as to measure the infant's preference. Since infants prefer novel stimuli, they should explore more the novel one. Note however that the two stimuli are presented in another modality than previously (i.e. an haptic presentation if the habituation phase was visual, or a visual presentation if the habituation phase was haptic).

If there is an intermodal transfer between touch and vision, the infant will look less to the object that she has never seen but already touched. Similarly, if there is an intermodal transfer between vision and touch, the infant will touch less the object that she has never touched but already seen.

As we can understand by this description of the method, there is no use of synchronous stimuli, since the aim is to test the effect of a previous exposure to an object presented in one modality on the later recognition of this object presented in another modality.

Research report concerning intersensory integration.
Research is aimed at testing two hypotheses that can be modelled by IA partners: the hypothesis of a primitive unity of senses at birth, and the hypothesis of a later access to a general intersensory integration through perception-action coupling, and in particular through experiencing the specific properties that objects afford to action. We are now involved in testing further the first hypothesis.

Testing further the hypothesis of a primitive unity of senses.
We are testing the hypothesis, held by several source researchers (see for instance Maurer, 1999), of a primitive unity of senses at birth. This would lead to postulate that newborns are capable of intermodal transfer from hand to vision as well as from vision to hand. An experiment has been done and a second one is planned on this matter.

Experiment done (paper in preparation)
Two groups of 24 full-term newborns with an average weight of 3 kilos were randomly assigned to two habituation conditions. Newborns of Group 1 had a tactile habituation phase in

which they were given a small cylinder (for 12 of them) or a small prism (for the other 12) in their right hand. The test consisted in a visual presentation of a big cylinder and a big prism (see figure above). Results show that the majority of infants look more to the object that they have never seen nor touched. This accounts for an intermodal transfer from touch to vision, thus replicating on a larger population previous findings by Streri (2000). At least this is true as far as shape is concerned.

Newborns of group 2 had a visual habituation with the cylinder (for 12 of them) or with the prism (for the other 12). The test consisted in an alternate haptic presentation of the two shapes in the right hand. No preference was found. This does not account for an intermodal transfer from vision to touch, which in turn does not support the hypothesis of a primitive unity of senses. Again however we have to restrict these findings to the property of shape. What if we consider a more basic property like texture?

Experiment in progress
To test this question, we are presently using the procedure described above with two groups of newborns who are presented objects differing on texture instead of differing on shape. If a transfer is found from touch to vision as well as from vision to touch, it will differ from what was found for shape exploration. We will thus conclude that as early as at birth there exist different exploratory procedures for touch and for vision according to the property explored.

II.Experimental designs for the study of early detection of social contingency (Jacqueline Nadel, Guillaume Libert & Ken Prepin)

Detection of social contingency implies to establish relationships between ones' behaviour and the behaviour of another, i.e. to establish relationships between what we see the other doing and what we feel being doing (cross-modal transfer between perception and proprioception). We test the development of this capacity in young infants through an experimental teleprompter device. Mother (or experimenter) and infant (a 2 or 6 month old infant) can hear and see each other through TV monitors. The device generates a seamless shift from maternal contingency to non-contingency and from non-contingency to contingency again. Thus the infant faces sometimes a contingent mother and sometimes a non-contingent mother. In a version of the method, the non-contingent episode experienced by the child is a replay of a previous contingent communication of the mother. This allows comparing the behaviour of the infant facing the same gestural and verbal behaviour in two conditions: when the mother's behaviour is contingent to the infant's behaviour, and when it is not.

Hypothesis: cross-modal matching via imitation facilitates an early detection of social contingency

Experiment done (Nadel & Libert)
Fifteen 2 month-olds reacted to non-contingent episode by a decrease of gazing to mother, a disappearance of smile, a dramatic increase of frowning, thus replicating Nadel's previous results (Nadel et al., 1999). Exploring which parameters account for such a precocious detection of non-contingency, we found that the infants did not imitate during the non-

contingent episode, whilst numerous imitations were coded during the contingent episode. We interpret this results as providing evidence that non-contingent behaviour is an obstacle for experiencing a visual and auditory perception of what we are doing (i.e. experiencing other's agency in their mirroring of one's own behaviour),; which in turn is an obstacle to experience one's own agency in mirroring the other's behaviour. A paper is in preparation. Results of this experiment were reported in C*ontingency or agency: where is the mindreading pointer?* Invited address given at the European Conference of Developmental Psychology, Milano, August 2003.

Experiment in progress (Nadel & Prepin)

Another way to analyse which parameters account for a precocious sensitivity to non-contingent social behaviour is to evaluate separate or joint contribution of vision and audition. To this aim, we have rearranged our set-up so that the computer processes independently the channels for sound and vision. This operation allows sending to the infant via the mixer either

1) direct image and direct sound of the mother
2) or delayed image and delayed sound of the mother (here replay after 30 seconds)
3) or direct image and delayed sound of the mother
4) or delayed image and direct sound of the mother.

The interaction always starts with an episode of direct image and sound, followed in a counterbalanced order by one of the three episodes of delay.

The schema of the set up is given below. The design is ready for use. We have already started to present the modified procedure to several 6 month-olds.