ADAPT

Kick-off meeting

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The rise of expectancies for social contingency

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La Salpêtrière

A XVII° Century etching
Dr Jean-Martin CHARCOT (1825 - 1893)
Foundator with Guillaume Duchenne of modern neurology, but more famous for his controversial work on hysteria
BERNHEIM was able to demonstrate that hypnosis as described by Charcot at La Salpêtrière, with its 3 phases of: lethargy, catalepsis and somnambulism was present only when the patient knew about these phases. Only suggestion and imitation make them occur, he said.
Lab Vulnerability, Adaptation & Psychopathology

Team: *Early Processing of Human Stimuli and Precursors of intentionality*

Includes

- Jacqueline Nadel, Research Director at the CNRS, coordinator (ADAPT)
- Robert Soussignan, Associate Professor
- Pierre Canet, engeneery (ADAPT)
- Pierre Andry, postdoc, epigenetic robotics (ADAPT?)
- Nadra Aouka, PhD Student
- Priscille Gérardin, MD, child psychiatry, PhD Student
- Marie Maurer, PhD Student (ADAPT)
- Caroline Potier, PhD Student
- Claire-Marie Verdon, PhD Student
- Coralie Sann, master in Cognitive biology (ADAPT)

Areas: Early development - Developmental psychopathology - Imitation – Emotion - Causal reasoning - Social perception –
Focus

Perception of Social stimuli as

- Multisensory
- Synchronous
- Redundant
- Contingent
- Intentional

Stimuli in dynamic interactions

Searching for synchronous activities
I. Hampering contingency via experimental designs which disrupt the communicative flow

**Technically**

Do you detect non-contingent communication?

Maternal Live-Replay-Live TV communication

**In vivo**

Do you expect contingency from every human being?

Revisited Still-Face: SF/Interaction/SF
Hampering social contingency via experimental manipulations

Replay
TV Live-Replay Experimental Design and Equipment
(a modified version of Murray & Trevarthen design, by Nadel et al. 1999)

- Three independent rooms
- Mother and infant can hear and see each other through TV monitors
- The infant sees and hears continuously her mother. The mother is either contingent or non contingent

In project: voice synchronised or not with the lips
A videocomputer interfacing system allows:

- to get simultaneously on the screen the infant and the mother’s digitized single frames
- to synchronise the frames according to a LED signal
- to get automatically a stable frame to be coded (here, each 40/100th second

With our coding software:

- we describe the frame with all the categories listed
- we click on the mouse for the relevant item of each category listed
- we choose one and only one item of each category since the items are exclusive and exhaustive

During replay
2-month-olds can interact with a contingent mother through TV monitors.
2-month-olds are upset in front of a smiling but non-contingent mother
Gaze to mother according to communicative conditions

- Infants gaze away during replay
- Infants gaze more to mother during Live 2 than during Live 1
Smile to mother according to contingency conditions

- **Smile** to mother decreased during replay
- **Smile** to mother reappeared during Live 2
Mouth tightly closed according to communicative conditions

- **Mouth tightly closed (MTC)** indicates an absence of communicative prespeech.
- Duration of **MTC increased** significantly during replay.
- Duration of **MTC decreased** significantly during Live 2.
Detection of non-contingent communication and expectancies for contingency in infants of depressed mothers

- Infants of depressed mothers detect non-contingent behavior (they gaze away) but

- They do not seem to be upset or angry during the non-contingent episode:

- Why?
  - Usual non-contingent interactions of their mother?
  - Maternal contingent behaviors displayed are not the more efficient ones?

![Graph showing % behavior across Live 1 and replay conditions](image)
Contingent communication of ND and D mothers (L1)

<table>
<thead>
<tr>
<th></th>
<th>ND Mothers</th>
<th>Depressed Mothers</th>
<th>Student t</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Gaze to baby</td>
<td>M=96.4 (SD= 3.6)</td>
<td>M=93.2 (SD= 3.3)</td>
<td>NS</td>
</tr>
<tr>
<td>% Smile to baby</td>
<td>M= 90.7 (SD= 27.7)</td>
<td>M= 68.3 (SD= 24.4)</td>
<td>NS</td>
</tr>
<tr>
<td>% Speak to baby</td>
<td>M= 92.5 (SD= 6.04)</td>
<td>M= 75.7 (SD= 20.2)</td>
<td>NS</td>
</tr>
</tbody>
</table>

The frequency of contingent behaviors did not differ significantly in D mothers compared to ND mothers.
Contingent communication of ND and D mothers (L1): mirroring

- All ND mothers mothereesed almost all the time
- 9/10 ND mothers imitated their infant’s gestures or facial expressions
- Only 1 depressed mother mothereesed frequently
- Only 1 depressed mother imitated once

<table>
<thead>
<tr>
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<th>ND Mothers</th>
<th>D Mothers</th>
</tr>
</thead>
<tbody>
<tr>
<td>mothereese</td>
<td>M=92.5 (SD=.2.4)</td>
<td>M=27.2 (SD=43.6)</td>
</tr>
<tr>
<td>imitate</td>
<td>M=11.6 (SD=6.7)</td>
<td>M=.007</td>
</tr>
</tbody>
</table>
Hampering contingency via in vivo disruptions of social interaction: The Still Face Paradigm

TWO USES OF THE STILL FACE PARADIGM

Classical use
infant with a familiar partner
• Procedure:
Interaction - Still Face - Interaction
• Test:
Do you detect non-contingent behavior?

Revisited use
non verbal child with a stranger
• Procedure:
Still Face –Interaction –Still Face
• Test:
Do you have formed the concept of persons as intentionnally contingent agents?

(Nadel et al., 2000)
Significant changes in social behaviors of children with autism across still face conditions

- Low functioning children with autism showed no concern with the stranger’s first still face
- After having experienced an interaction with the stranger, they focused on her behavior during the second still face
- This demonstrates that they have not formed a concept of persons as social and contingent agents
First still face of the stranger

- The child focuses on toys
- Does not worry about the still adult
- Does not look upset
Imitative interaction

- The stranger imitates
- The child recognizes being imitated (tests, controls)
- Social contact is established
Second still face of the stranger

- The child focuses on the adult all along the 3 minutes
Toward the end of the 3 minutes of second SF....

- The child tries to initiate contact
- The child looks surprised and then upset
- The child is thus able to detect non-contingency, and to form social expectancies after having experienced the person as a person (no ontological expectancies)
PART II.
Facilitating sharing via experimental designs which afford almost perfect contingency via synchronic activities

- Identical objects afford synchronic imitation

*Synchronic imitation as almost perfect contingency*
Neonatal Imitation TP

BOY

Age 20 min

Weight 3060 gr.
Neonatal Imitation Eye Blinking

GIRL

Age 20 min
Weight 2900 gr.
Robotic mouth versus human mouth: a test of biological movement as a parameter of perception-action coupling

Potier, Viezzi, Gaussier & Nadel, 2002
First reciprocal imitations at 2 months
Imitation: Two functions for a single ability

EFFECTS

On physical world

On human world

Imitation Recognition

Learning

[Permanent function]

Communication

[Transitory function]
From birth to 6 months, some imitations disappear, while others start.

- Developmental Role of inhibition?
Imitation is not a unitary phenomenon

**Imitation**
- Facial birth
  - tp, mo, eb, fe
- Simple & familiar actions
  - 8 months
- Postural, manual
  - 2 months
  - mh, ma
- Complex & familiar actions
  - 12 months
- Achievement of the model’s goal
  - Imitation of non-affordable actions
  - 14-16 months
- Imitation of unfamiliar actions violating cultural learning
- Understanding initiation to imitate as an intention to communicate
  - 21 months

**Imitation recognition**
- Gaze birth
- Social responses
  - 2 months
- Explicit recognition of intentional imitation
  - Test the experimenter
  - 14 months
- Explicit recognition of intention to communicate via imitation: test with initiations of actions violating cultural learning
  - 21 months
- Loud and repeated laughs
  - 5 months
imitation: a language without words for prelinguistic children

IMITATOR IMITATED

• Two roles to switch according to rules of turn-taking

Imitate and be imitated:
A primary way to share intentions

More than a social behaviour, a communicative system

• Motor activity developed in social synchrony
In search of almost perfect contingency via redundancy
In search of synchrony
Result 3: contrasted to self-action

SPM99, p < 0.0005; voxel extent threshold 10
Results 4: contrast between imitation conditions

Imitate

Superior temporal gyrus

Be imitated

Pre-SMA

Inferior frontal gyrus

Superior parietal lobe

Relative rCBF increase (MNI: x=-10, y=-30, z=-8)

Self action □ To imitate □ To be imitated
ETIS group implementing the two functions of imitation (Gaussier, Revel & Andry)

Based on an on-line learning of visuo-motor coordination
Architecture :
Synchronisation of two systems

Teacher's key strokes:

![Graph showing key strokes](image)

Reward:

![Graph showing reward](image)

Reinforcement signal:

![Graph showing reinforcement signal](image)

Learned associations:

![Graph showing learned associations](image)

Score:

![Graph showing score](image)
Synchronic imitation between infants or robots

Interconnection of two systems. System 1 and 2 have the same architecture.
Each system has learned associations between its inputs and outputs. The two systems produce outputs (the same sequence of motor outputs for example) simultaneously.
Imitation in Infancy

Edited by
Jacqueline Nadel and
George Butterworth

Cambridge Studies In
Cognitive and Perceptual Development