Contextual, developmental and cultural effects on affective display in children

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Development of communicative skills

- As children grow older, they improve their skills to communicate with other people (lexicon, grammar, pronunciation)
- They also become better in using and interpreting **prosody** (expressive style)
- Prosody defined as the set of features that do not so much determine what people say, but rather how they say it
- Adults are very skilled users of prosody (see next example)
The adult...
The child...
...and the researcher

- Differences in audiovisual prosody between adult and child
  - (auditory) intonation, pausing, voice characteristics, ...
  - (visual) body language, posture, facial expressions, ...

- How does audiovisual prosody develop in a growing child?
Roots of audiovisual prosody (infants)

- The acquisition of prosody starts very early:
  - Intonation patterns, rhythm and features of the voice acquired while in mother’s womb (DeCasper & Fifer 1980; Mehler et al 1982)
  - Young infants can imitate facial gestures, like tongue protrusion and mouth opening (Meltzoff & Moore (1983)
  - Infants quickly learn to integrate information coming from different modalities (Spelke 1972)

- Importance of biological and physiological factors, such as:
  - Preference for low-ending contours (air pressure)
  - Facial expressions similar across the globe (genetically determined)
How about older children?

- But as a child grows older, audiovisual prosody becomes more functional in nature.

- A child learns to associate specific forms with specific communicative or social functions, and to manipulate forms.

- This is related to the fact that the child becomes more **socially aware**:
  - Increasingly varied environment (family, school, society)
  - Becomes more aware of another person’s perspective (Piaget)
Younger child

- Still largely egocentric
Older child

- More other-directed (socially aware)
This talk

- How is social awareness reflected in audiovisual prosody of growing children?

- This question is explored for 3 cases:
  - Cues to uncertainty
  - Cues to deception
  - Cues to emotion
About our methodology…

1. Child-friendly approach, …

2. applied to different age groups

3. Elicitation of production data through games that elicit different linguistic and social contexts

4. Recorded stimuli presented to observers to explore whether they can interpret audiovisual cues
Cues to uncertainty

(Swerts & Krahmer *J of Memory and Language* 2005;
Krahmer & Swerts *Language and Speech* 2005)
Uncertainty

- Speakers are not always equally confident about or committed to what they are saying.

- Suppose someone asks a question (Who wrote hamlet? What is the capital of Switzerland?)
  - Speakers may be sure about their answer, or rather uncertain.
  - Speakers may not know the answer, though it may be on the tip of their tongue.

- These differences in confidence level are reflected in the way adult speakers present themselves; cues relevant for addressee (social awareness).
Approach: A Quiz!

- Similar to Trivial Pursuit: let people answer a series of factual questions

- Experiment in three stages (Hart 1965):
  1. Answers to factual questions (*WISC, WAIS, Trivial Pursuit*).
  2. Test how certain subject is (s)he would recognize the correct answer in a multiple-choice test (*FOK-scores*).
  3. Recognition test (*Multiple-choice*).

- Subjects were filmed during first test; they could not see the experimenter.
Subjects and questions

- 20 adults
- Students and colleagues [20 – 50]
- 40 questions
- \( n = 800 \)

- Who wrote Hamlet?
- How many degrees in a circle?
- What is the capital of Switzerland?
- ...

- 20 children
- Group 4 [7 – 8]
- 30 questions
- \( n = 600 \)

- Who is the president of the U.S.?
- Where can you buy a Happy Meal?
- What is the color of peanut butter?
- ...

...
Who wrote Hamlet?  Whote wrote Faust?
Where does K3 live?  Capital of Netherlands?
Perception study

- For different speakers/judges: adults vs. children
- Task: judge level of (un)certainty
- Stimuli: answers, selected from production experiment

<table>
<thead>
<tr>
<th></th>
<th>Child answers</th>
<th>Adult-answers</th>
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<tbody>
<tr>
<td>High FOK</td>
<td>15</td>
<td>15</td>
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<td>Low FOK</td>
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- 80 subjects participated

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<thead>
<tr>
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<th>Adult speaker</th>
<th>Child speaker</th>
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<tr>
<td>Adult judge</td>
<td>20</td>
<td>20</td>
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<tr>
<td>Child judge</td>
<td>20</td>
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FOAK scores for children and adults

![Chart showing FOAK scores for adults and children, with high and low FOK categories.](chart-image)
Discussion

- Adults are “better” judges than children. (Detecting behavior one does not display is more difficult.)

- Adults are “better” judged than children. (What is not signalled cannot be detected.)

- Currently (with Mandy Visser):
  - look at the effect of type of context (competition vs collaboration) on a child’s expression of uncertainty
  - look at differences between younger and older children (8 vs 12 year old)
Cues to deception

(Swerts 2011, Laboratory Phonology)
Deception

- Many people have the intuition that nonverbal cues may reveal whether a person is truthful or deceptive (eye-gaze)

- How good are kids in telling lies, and when do they acquire the “skill” to deceive?

- Such questions are typically investigated in “theory of mind” models (children’s understanding of their own and others’ mental states)

- Is this increased social awareness of another person’s mental state helpful or harmful for a deceiving person?
Approach: a puppet show!

- Animated interactive story, in which input is expected from participating kids (they are “in control” of the story)

- They have to be truthful to a prince (the “good” one) and deceptive to a dragon (the “bad” one)

- Elicit minimal pairs from children (“in the castle”)

- The story elicits 2 attempts to lie and be truthful
Which one is the lie?
Perception study

- Stimuli from 38 children were presented to 60 adult observers
- Stimuli from younger and older children; below or above mean age (5 years and 7 months)
- Stimuli presented in pairs (truthful and deceptive utterances) from first and second attempts
- Task: guess which of the 2 utterances is the deceptive one
- Stimuli presented in 3 conditions (between-subject): audiovisual, auditory-only and vision-only
Results (% correct)

![Bar chart showing results for younger and older children across 1st and 2nd attempts.](chart.png)
Discussion

- Deceptive utterances can be detected above chance level:
  - Task easier with stimuli from older children
  - Especially when they are instructed to repeat the lie

- “Pink elephant” effect: it is harder to deceive when you are more conscious about it (cfr Vrij et al 2010)

- Other interesting effects:
  - Effects are true for unimodal and bimodal stimuli, …
  - But audiovisual and visual stimuli easier to judge than auditory ones
  - Lies are easier to detect when presented after truthful utterances
Cues to emotion
(collaboration with Suleman Shahid and Emiel Krahmer)
Emotion

- It is commonly believed that audiovisual prosody may reveal a speaker’s emotions (e.g. negative vs positive)

- Children express their emotions more openly than adults (Fabes & Martin 1991); somewhat dependent on temper and family background

- As a child grows older….
  - Internalization: children become less expressive as a function of age
  - Emotion regulation: children learn to manipulate their expressions (e.g. undesirable gift)

- A growing child becomes better in controlling a facial expression (social awareness)
Approach: a card game!

- Sequence of six cards from 1 to 10, first is open.

- Participants have to guess for each next undisclosed card whether it contains a higher or a lower number.

- Games were completely deterministic (PowerPoint simulations)

- “Rational choices” (make guess with highest probability) implies 3 winning and 3 losing games.

- Game done with pairs of children: 24 younger children (8-year old), and 24 older ones (12-year old)
8 2 7 1 9
8-year old                              12-year old
Perception study

- Stimuli: Responses (vision-only) to final card, from first won and first lost game

- Presented to 71 observers (Dutch students)

- Task: determine for each pair of children whether they had just won or lost a game (forced choice paradigm)
Results (% correct)

- 8-year old
  - Lost: 80%
  - Won: 70%

- 12-year old
  - Lost: 80%
  - Won: 40%
Discussion

- Older children are less expressive than younger ones about winning or losing a game.

- Crosscultural comparison: Pakistani versus Dutch
  - Pakistani overall more expressive than Dutch
  - Winning more visible than losing in Pakistani
  - Different conventions to show happy or sad reactions

- Presence effects: Children less expressive when being alone
Presence effects

- More questions about presence effects:
  - How robust is this effect?
  - How much does it depend on type of speaking partner?
  - Do partners have to be physically co-present?

- Two sets of experiments with card game:
  - Children playing with a robot (iCat)
  - Children playing in a mediated condition (eye gaze manipulation)
What if your partner is a robot?

- An increased interest in designing robots that have the ability to build an interpersonal relationship with humans (Breazeal, 2002)

- Such social robots are used increasingly not only in entertainment and education, but also in rehabilitation and therapy

- Question: can children interact and collaborate with a robot in a social and intuitive way? If so, how similar is this to how they interact with their peers.
Experimental set-up

- 256 children (Dutch and Pakistani) participated in one of three conditions (alone, iCat, friend).

- For the iCat condition: Wizard of Oz method to simulate both the verbal and non-verbal behavior of the iCat (tts-system; preprogrammed behaviors)

- The wizard was located outside of the child’s field of vision and relied on simple pre-programmed behaviors of the iCat in a contextually appropriate way.
Results

Results based on “fun” scores show that children had most fun when playing the game with their peers, and least fun when playing alone, and playing with iCat was in between those extremes.

Perception experiment
- random selection of 80 children who played games with the iCat, plus clips from ‘alone’ and ‘pairs’ condition
- 144 adult participants as observers (between-subject design)
- Task: “guess whether child has won or lost the game”
Correct classification

![Bar chart showing the percentage of correct classification for different conditions: Alone, Icat, Friend. The chart compares Dutch and Pakistan participants.](chart.png)
Discussion

- Playing with the iCat in this experiment appeared to represent condition somewhere in between alone and together with a friend.

- Children like the condition with iCat better than playing alone.

- Children are more expressive than when playing alone, but less expressive than with a friend (guessing experiment).

- Their behaviour is also reflected in nonverbal expressions that signal positive or negative affect (hugging, touching, disappointment).
What if there is no eye-contact?

- What exactly generates a feeling of co-presence in children? Can they feel co-present in mediated conditions as well (video conference)?

- In the current experiment, we are interested in the effect of eye-gaze

- Number of questions:
  - How does eye-gaze influence the players’ game experience
  - How does eye-gaze influence their perceived sense of presence in a technologically mediated environment
  - To what extent does this experience resemble that of a natural co-present environment.
Experimental set-up

- Video-mediated interaction in which children can see each other either with the possibility of mutual eye-contact, or without this possibility.

- Children were always in different rooms but could see each other through display on a screen (see next slide).

- 88 Dutch children (44 pairs) participated in this study of which 44 children (22 pairs) played the game in the ‘mutual gaze’ condition and the remaining 44 children played the game in the ‘no gaze’ condition.

- For comparison: data from 44 children who were co-present.
Mutual gaze contact
No mutual gaze contact
Children reported (using a “funometer”) to have most fun in the mediated mutual gaze condition, followed by co-presence condition, and no gaze condition.

A perception experiment.
Discussion

- Mutual eye-gaze has important effects!

- The ability or inability to look into the partner’s eye, even during playful interactions, can strongly influence the perceived social presence, game experience and player’s behaviours.

- This is true despite the fact that the mutual eye-gaze is not “ideal” (no perfect contact).

- In the future, we want to explore this further with eye-catcher set-up.
Overall discussion

- **Cues to uncertainty**: adults are better than children in showing their confidence level as a form of self-presentation

- **Cues to deception**: older children find it more difficult to hide their lies, possibly because of an increased cognitive awareness

- **Cues to emotion**: older children are less expressive than younger children about winning or losing a game (emotional control)
Overall discussion (2)

- Cues to affective display very much dependent on presence effects

- These effects are very robust, and are even true when children interact with a robot, or in a mediated condition (eye-gaze)

- In the future: more data on cultural differences (we are currently collecting data from Chinese children)
Remaining questions

- Developmental patterns:
  - Linguistic vs social functions (are good linguistic skills a result of good social skills, or is the other way around?)
  - Production vs perception (are children faster in productive than in receptive skills?)
  - Auditory, visual and audiovisual cues (are there reasons to assume that the development of auditory cues is in sink with that of visual cues?)

- Are there differences between children with typical and atypical development (e.g. autistic children)?
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