Parental Prenatal Attachment: Picturing the Unborn Child

Nadja Reissland
In contrast to Roberts (2016: 71) writing:
“...ultrasound is instrumental in cementing woman and foetus together”
I argue that visualizing the fetus establishes a separateness of the pregnant woman as one “person” and the fetus as another “person”. In separating mother and fetus we can look at engagement of the mother with the fetus as well as conceptualize reciprocal interaction. Such reciprocal behaviour includes health behaviour, maternal mental state, stimulation (e.g. light and noise) which have an effect on the fetus in terms of growth or movement for example, which in turn affect the mother. This can be seen using high quality ultrasound.
The context, e.g., maternal mental health including stress, depression and anxiety, has to be taken into account. Studies do that by examining not only attachment but also educational status, mental health and social context.
According to Sullivan et al (2011:2) “fetal attachment begins during the last trimester of pregnancy, when auditory and olfactory systems become functional, allowing the fetus to learn about the mother's voice and odours.”

Additionally fetuses react to light stimulation.

However attachment implies not only a fetus attaching to the mother but also the mother/father attaching to the fetus. A number of rating scales have been developed to measure such attachment.
### Attachment scales: Maternal/ Paternal Antenatal Attachment Scale

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<th>MAAS</th>
<th>PAAS</th>
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<td><strong>2)</strong> Over the past two weeks when I have spoken about, or thought about the baby inside me I got emotional feelings which were:</td>
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<tr>
<td>- Very weak or non-existent</td>
<td>- Very weak or non-existent</td>
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<td>- Fairly weak</td>
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<td>- In between strong and weak</td>
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<td><strong>3)</strong> Over the past two weeks my feelings about the baby inside me have been:</td>
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<td>- Very positive</td>
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<tr>
<td>- Mainly positive</td>
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<td>- Mixed positive and negative</td>
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<td>- Mainly negative</td>
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<td>- Very negative</td>
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<td><strong>5)</strong> Over the past two weeks I have been trying to picture in my mind what the developing baby actually looks like in my womb:</td>
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<tr>
<td>- Almost all the time</td>
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One of the criticism raised against the idea that imaging the fetus might have a positive impact on parental engagement with the fetus concerns the question whether fetuses react to the engagement activities of parents.

Before discussing the relationship between parent and fetus and the way to potentially enhancing that relationship we need to examine:

- The difference between an “objective” coding system used for research purposes and the “subjective” interpretation of fetal movements by parents.
We use 4D ultrasound to obtain high-quality fetal scans.

Fetal movement behaviours are then coded offline frame-by-frame.
4D Ultrasonography

4D ultrasound is considered to be safe when administered within appropriate guidelines.

We follow BMUS (British Medical Ultrasound Society) guidelines:

- Thermal Index (TIs) less than 0.5
- Mechanical Index (MI) about 1.0 (no contrast agents)
- Scanning time between 15 – 20 minutes

Figure adapted from: BMUS (2009). Guidelines for the safe use of diagnostic ultrasound equipment.
Using FOMS we classify all observable fetal facial muscle movements permitting an objective (emotion-free) assessment. The Observer Software for Coding Temporal Events: facial movement and touch.
Facial Touches (FTs)

Upper Face Touch (FT1)
Side Face Touch (FT2)
Mouth Touch (FT4)
Lower Face Touch (FT3)
Complex behaviours: Facial Gestalts

In this example, we can see five movements co-occurring to form the laugh gestalt:

- Brow lowerer
- Lip pull
- Nose wrinkle
- Nasolabial crease
- Lips parting
We do know that fetuses react to their mother’s voice (e.g., Kisilvesky), they react to certain external sounds, such as noise and vocalization (e.g., Reissland et al), and they are affected by maternal stress and depression (e.g., Glover). Hence not only are mothers (and fathers) of the fetus affected by the fetus (e.g. change in body shape or emotional state), but also the fetus is affected by maternal anxiety, depression and stress and health behaviours etc. Some examples are illustrated below.
Given that fetuses react to sounds they hear with variations in heart rate (e.g. Kisilevsky, 2008) and that babies imitate mouth movements from birth (e.g. Reissland, 1988) we expect that fetuses react to a specific sound: “ma”.

A mouth stretch is required to produce the “ma” sound and therefore we expect fetuses hearing “ma” to show more mouth stretches than a control group who do not hear specific sounds.
Results: Fetuses, shaped their lips significantly to reproduce the m“a” movement with the frequency of responses increasing from 32 to 36 weeks gestation. They did not produce lip pursing (an equally often observed mouth movement observed without stimulation) when hearing “ma”.

FETUSES EXPLORE THEIR BODIES THROUGH TOUCH.

- They hold on to the umbilical cord and experience the pulsating sensation of blood flowing through.
- They touch their face, head, ears, nose, mouth, hand & feet etc.
- They also explore the world with their mouth.
Even though we have come a long way to understand that development occurs prenatally, the pre-natal world of touch or haptic perception is still ignored.

Yamada et al (2016) found that the intra-uterine environment which is spatially restricted exerts pressure which leads to tactile sensory feedback correlated across body parts. They argue that these physical restrictions may be beneficial and enable the development of a cortical map of the body.
Yamada et. al. (2016) demonstrated with their robotic model that intrauterine movements provide specific organisational patterns relating to the body parts based on both proprioception and tactile sensory feedback which resulted in the learning of body representations.

These cortical maps might be affected by the mental health status of the mother (specifically stress). Fetuses of stressed mothers showed reduced right handedness and hence variations in touch behaviours.
Healthy fetuses were scanned four times from 24 to 36 weeks gestation. Self-touch behaviours which resulted in a touch of the fetal face/head were coded in 60 scans for 10 mins and analysed in terms of frequency of the fetuses using left and right hands to touch their face. The joint effects of foetal age, stress and sex on laterality were assessed.

Maternally reported stress level was significantly positively related to foetal left-handed self-touches (odds ratio 0.915; p < .0001). This longitudinal study provides important new insights into the effect of recent maternal stress on fetal predominant hand use during self-touch.

Yawn: the scientific approach

Example of the analysis of a single movement from the scientific point of view.

Although research has established that yawning can be observed from the end of the first trimester, (e.g. De Vries, Visser, & Prechtl, 1985), the definition of what constitutes a yawn is less well established.

McMagnus, Devine, & Brandsetter (1997) go so far as to argue that definitions of yawning are so varied that what has been labelled a yawn can be just a mouth opening or repeated set of mouth openings rather than yawns.

The aim of the present study was to establish in a repeated measures design the development of fetal yawning compared with simple mouth opening.

Petrikovsky, Kaplan & Holsten (1999), defined yawning in terms of the dynamic properties of a yawn as a “prolonged wide opening of the mouth followed by a quicker closure of the mouth”.

WHY STUDY FETAL YAWNING?

DEFINITION OF YAWNING
It is thought that yawning plays a vital function in normal craniofacial development (Walunsinski, 2010). The absence of yawning or swallowing might be indicative of neurological dysfunction (Prechtl, 1990) and might endanger the survival of the infant post-birth which will need to coordinate swallowing and breathing, both of which are associated with yawning (Walunsinski, 2010).

Although there are as yet no data on the association of an absence of yawning with fetal abnormalities, there are a number of congenital pathologies such as mandibular hypoplasia and the Pierre Robin sequence which point to the importance of an absence of yawning associated with these syndromes. For example, regarding the Pierre Robin sequence, mothers reported an absence of yawning at birth (Walunsinski, 2010).

Petrikovsky et al (1999) found that anaemic fetuses yawned more frequently.

There are a number of hypotheses for the causes of yawning. One of them concerns activity dependent brain maturation. Yawning could be one mechanism by which fetal sensory or motor experience can affect the course of neural development.
An exploratory analysis of the 15 fetuses showed a strong decline in the mean frequency of both yawns and non-yawn mouth openings as gestational age increased corresponding to observations of other researchers.

Means (with standard deviations in parentheses) for yawns at 24, 28, 32 and 36 weeks were respectively 1.93 (2.17); 1.40 (2.03); 0.73 (0.96) and 0.0(0.0); means and standard deviations for the same ages for non-yawn mouth openings were lower at 1.00(1.47); 0.53(0.83); 0.33(0.72) and 0.0 (0.0)
To assess the changing frequency of yawns over age and gender, a Poisson mixed effects model was fitted to the count of number of yawn events with age and gender as fixed effects, and person as a random effect, to account for the repeated measures design (Figure 3).

Gender was not significant, (chi-squared =0.109 on 1 df; p=0.74) but linear age was significant (chi-squared =33.42 on 1 df; p<0.001), with the counts declining with age.

A non-linear age effect was fitted using a natural cubic spline with two degrees of freedom, and the non-linear model showed a significant improvement over the linear model (chi-squared =7.01 on 1 df; p<0.01).

The same model was fitted to the number of non-yawn mouth opening events.

Gender was again not significant, (chi-squared =0.584 on 1 df; p=0.44) but linear age was significant (chi-squared =17.18 on 1 df; p<0.001), with the counts again declining with age.
WHAT DOES YAWNING TELL US?

- Yawning might trigger brain maturation.
- Experience dependent brain maturation (e.g. Yamada et al)
Sensorimotor coordination emerges early in development. The maturation period is characterized by the establishment of somatotopic cortical maps, the emergence of long-range cortical connections, heightened experience-dependent plasticity, and spontaneous uncoordinated skeletal movement.

Khazipov et al (2004) report that in the intact somatosensory cortex of the newborn rat in vivo, spatially confined spindle bursts represent the first and only organized network pattern. The localized spindles are selectively triggered in a somatotopic manner by spontaneous muscle twitches, motor patterns analogous to human fetal movements.
Visualization of the fetus and the parental fetal relationship

- According to Stormer (2003: 101) “The biological maternal-fetal relationship has not changed but the medical model of the relationship has shifted emphasis from unity to duality.”
- Hence the development of the fetus does no longer need to be inferred but can be directly observed.
- This shift from perceiving mother& fetus as a one unit to separating them and treating them as separate beings is emphasized when seeing the fetus in (4-D)moving images.
- This might have an effect of increasing attachment and improving health behaviours not only of the mother but also the father of the unborn child.
Making the fetus accessible not only through touch, which advantages the mother who can feel the fetus internally, but also vision might increase paternal prenatal attachment. Seeing the fetus develop before birth, likely contributes both maternal and paternal – fetal relationship establishing an affiliation before birth.
Visualization of the fetal face in the later trimesters gives parents a good impression of how the fetus will look after birth.
How to increase attachment to the unborn child?

- We might expect that in most cases of healthy planned pregnancies, 4D representations of the fetus via ultrasound may lead to increased parental attachment and with that better health behaviours including smoking cessation.

- According to the Public Health Consortium Costs to the NHS related to smoking during pregnancy related to infants (0-12 months) with increased risk of preterm delivery, low birth weight, Sudden Infant Death Syndrome, perinatal mortality, asthma, otitis media, and upper and lower respiratory infections are estimated to be between £12-23.5 million per year.

- [http://phrc.lshtm.ac.uk/papers/PHRC_A3-06_Final_Report.pdf](http://phrc.lshtm.ac.uk/papers/PHRC_A3-06_Final_Report.pdf)

- Hence the costs of 4D scans could be offset by reduced numbers of infants needing care.
MORE ANXIOUS MOTHERS “PICTURE” (FROM MAAS) THEIR UNBORN CHILD SIGNIFICANTLY MORE OFTEN THAN LESS ANXIOUS MOTHERS
Mental health and engagement with the fetus

Effects of maternal mental health (depression EPDS) on engagement in favourable health practices during pregnancy

Journal of Midwifery & Women’s Health
Volume 61, Issue 2, pages 210-216, 5 FEB 2016 DOI: 10.1111/jmwh.12407
Froggatt (2017) What do smokers and non smokers say about smoking during pregnancy?

Nicotine users scored significantly higher on perceived stress (PSS) \( (p=0.032) \) and depression (EPDS) \( (p=0.001) \). However, there were no significant differences in attachment \( (p=0.397) \). Rather smoking was associated with other factors including:

**Coping mechanism:** “It’s a stress relief and five minutes where you can go outside and just calm down”

**Nicotine replacement therapy:** “The doctor didn't tell me too much when I was pregnant. More about smoking is terrible for you but not too much about the replacement therapy” and “I went to the chemist and they gave me free nicotine patches”

**Habit:** “I was stuck at home with nothing else to do”
Paternal-fetal Attachment

Paternal-fetal attachment is important not only for the fetus but also for the support of the mother during pregnancy and beyond. 4D imaging might help. Below are the attachment scores of 7 fathers and mothers over 2\textsuperscript{nd} & 3\textsuperscript{rd} trimester of pregnancy having 4 scans.

Although paternal-fetal attachment is lower than maternal-fetal attachment during the second and third trimesters, observing their unborn child develop seems to increase attachment scores especially of the father as the fetus appears increasingly “baby-like”.
Do you think the following video-clip would help mothers to make healthy choices during pregnancy, such as eating well and exercising?

- Yes
- No
- No Comment
- Any comments, suggestions are gratefully received:
  n.n.reissland@durham.ac.uk
ENGAGING PARENTS IN THE PREGNANCY
YOUR UNBORN BABY AND YOU

HTTPS://WWW.YOUTUBE.COM/WATCH?V=T6DADCWVHVQ
ANY QUESTIONS?

YOUR UNBORN BABY AND YOU

Have you ever wondered how your unborn baby spends their time while growing in your womb?

Do you think this video clip would help mothers to make healthy choices during pregnancy, such as eating well and exercising?

Yes   Yes   No   No   Not sure   Not sure

Comments: ____________________________________________
THANK YOU