STSM 2014

Exploring the possible use of different parent-child interaction coding schemes in high-risk sibling studies

Chloè Bontick[1], Alicja Niedźwiecka[2] & Mirjam Pijl[3]

[1]*Ghent University, Belgium*

[2]*University of Warsaw, Poland*

[3]*Radboud University Nijmegen Medical Centre, The Netherlands*

Aims

Given the importance of parent-child interaction in child development and the predictive value of these interactions for different developmental pathways or outcomes, the main aim of this Short Term Scientific Mission (STSM) was to explore the usefulness of two selected parent-child coding schemes in high-risk sibling studies over the timeframe of 5 to 24 months age.

The *Dyadic Communication Measure for Autism* (DCMA) and the *Manchester Assessment of Caregiver-Infant Interaction* (MACI) were selected after an extensive literature review. Both coding schemes are based on a strong theoretical background, particularly with regard to Autism Spectrum Disorders (ASD). They have previously been used in studies investigating parent-child interaction in an ASD or at-risk group. Crucial differences between the two coding schemes include the type of coding (count vs. global) and the target age groups. The DCMA is a count coding scheme (i.e. measuring the frequency of given behaviours) and has been used in older children (<6 years) by the group of Jonathan Green (Aldred, Green, & Adams, 2004; Green et al., 2010). The MACI focuses on global aspects of parent-child interaction (i.e. evaluating the quality of behaviour) and has been used by the same research group in younger children (3-15 months; Green et al., 2013; Wan et al., 2012, 2013). The aim was to evaluate the coding schemes on the following criteria:

- Applicability in early infancy (5-24 months);
- Applicability to high-risk siblings and low-risk siblings;
- Variation of scores and sensitivity to individual differences;
- Interrater reliability;
- Duration of the coding process and training procedures;
- User friendliness.

Specifically, with regard to the first criterion, we aimed to explore the value of the MACI for older age groups, and the value of the DCMA for younger age groups. All findings should be interpreted carefully as this STSM was a very small pilot study (explorative evaluation) rather than a full scale pilot study. Moreover, the participants received only short training in the MACI and DCMA, while normally coders are required extensive training. The outcomes of this STSM might lead to a pilot study regarding the applicability of the coding schemes in both high-risk and low-risk infants and toddlers.

Method

The STSM found place from the 14th till the 25th of April 2014 at Manchester's University. To achieve abovementioned goals, the participants were familiarized with the use of the DCMA and the MACI in coding parent-child dyads. Introduction and consensus meetings were arranged with the authors of both measures. Each participant coded fifteen clips using the coding schemes. The clips were provided by Birckbeck, University of London and consisted of about 15-minute parent-child dyads in which parent and toddler were filmed during a free play interaction with a standard set of toys. Six consecutive minutes of a video were coded. Due to practical reasons, the sample consisted mainly of high-risk infants: five clips of 5-month-olds (3 HR, 2 LR), six clips of 8- to 10-month-olds (5 HR, 1 LR) and four clips of 24-month-olds (4 HR).

Evaluation of coding schemes

The DCMA and the MACI will be evaluated based on the criteria mentioned above. In order to do this accurately, first an evaluation on content level will be given, focusing on similarities and differences between the coding schemes.

Content

The DCMA and the MACI both consist of parent scales, infant scales and dyadic scales (see Table 1 for an overview). Regarding the parent scales, we found that the DCMA focuses mainly on *verbal* communication (accompanying non-verbal communication is only used to help define the intent of the utterance), whereas the MACI captures both. By focusing on verbal communication and distinguishing different communicative acts (e.g. imitation, expansion), the DCMA allows the assessment of aspects that are pivotal in infant's language development. In contrast, the MACI does not specifically focus on infant's language development, but rather gives a more global idea of the quality of interaction. An advantage of the parent scales in the MACI is that a distinction can be made between scaffolding or structuring on the one hand and directive behaviour on the other hand, which is especially important in the older age group. The DCMA doesn't allow such a distinction where both behaviours should be coded as asynchronous.

Regarding the infant scales, the MACI provides information on the infant's affect and liveliness, while the DCMA does not capture any information with regard to the infant's affective state and the infant's level of physical activity. Concerning the attention of the infant, the MACI provides a general rating of the infant's attentiveness to the parent, but it does not capture how the infant responds to the parent's behaviour or whether the infant makes initiations. The DCMA, on the other hand, does capture all infant's responses and initiations. By coding every response and initiation of each participant, the DCMA gives an overview of the dynamics of interaction, *i.e.* turn-taking, adapting the infant's behaviour to the other person.

On the dyadic scales the difference between the DCMA and the MACI can be understood in terms of quality and quantity. The DCMA focuses almost exclusively on the amount and duration of dyadic interaction. The coder can indicate whether the interaction is mutual or not, but cannot evaluate the quality. The MACI, however, evaluates both quantity and quality. Besides the duration of the mutual interaction, it also takes into account the intensity of mutuality.

Table 1. Scales of the two selected coding schemes used in parent-child interaction

	DCMA (primary codes)	**MACI**
Parent	Synchronous communication acts	Sensitive responsiveness
	Asynchronous communication acts	Nondirectiveness
	Other/unintelligible	
Infant	Initiation	Attentiveness (to the caregiver)
	Response	Positive affect
	Other/unintelligible	Liveliness
Dyad	Mutual shared attention	Mutuality
		Intensity of engagement

Applicability in early infancy

Overall, both coding schemes have proved to be applicable for use in early infancy. However, we encountered difficulties with the MACI in the 5- and 24- month old infants, as well as with the DCMA in the 5-month old infants.

Regarding the MACI at 5 months, most difficulties were caused by the limited motor skills of the child in combination with the absence of a chair or pillow on which the infant could lean. Most of the 5-month old infants were lying on the floor in supine or prone position, and were not able to move themselves into another position. This meant that parents were in control of the child's positioning, making it hard to determine whether the child's attentiveness to the parent was voluntary or not, and

whether the interaction was mutual or not. At 24 months, we found that the description of some of the constructs needed pivotal adaptations before they could be used in the older infants. Ming Wai Wan is already working on a version of the MACI for the older age group and is planning to conduct a pilot study. This adapted version deals with most of the issues we encountered (e.g. distinction between directive behaviour and structuring/limit setting, separate scales for positive and negative affect and modification of the liveliness scale).

Regarding the DCMA at 5 months, one difficulty that we encountered was similar to the MACI and concerned the positioning of the child (and its impact on mutuality). Furthermore, we found that some adaptations were needed for use of the DCMA at this early age. In consultation with Catherine Aldred, we have developed an adapted version in order to make it applicable for this age group (DCMA-Infant). In general, the suggested adaptations are related to the interpretation of infant's and parental communicative acts, parental synchronous vs. asynchronous behaviour, and dyadic mutuality[1].

Applicability to high-risk and low-risk siblings

The applicability of the coding schemes across different developmental groups (high-risk vs. low-risk) remains to be investigated. Due to a low number of low-risk clips we were not able to evaluate the coding schemes based on this criterion.

Variation of scores and sensitivity to individual differences

This paragraph presents data obtained for the fifteen clips coded by the authors. All findings must be interpreted with caution due to the lack of full training of the coders and very small sample size. Table 2 informs on the number of high-risk and low risk dyads in each age group. The 5-month and 8-month clips were coded using the DCMA, and all fifteen clips were coded using the MACI.

Table 2. Sample description

	High risk	**Low risk**	*Total*
5 m.o.	3	2	5
8 m.o.	5	1	6
24 m.o.	4	0	4
Total	12	3	*15*

[1] Our team, in collaboration with the team of Jonathan Green, is still working on the adaptations of the DCMA-Infant. We hope to share the finalized version with the PCI group as soon as possible.

- DCMA - descriptive statistics

The results for clips scored with the DCMA may only be interpreted in relation to themselves since an external point of reference does not yet exist. Table 3 gives an overview of the descriptive statistics.

For the infant codes 'Initiation' and 'Response' the number of observed behaviours were relatively small and individual variability was high. Standard deviations and standard errors were variable and large, and there was also a great range. Furthermore, the code 'Other' was very rarely used.

The parental codes 'Synchronous' and 'Asynchronous' (both point and state events) were scored more often than infant's initiations and responses. Standard deviations, standard errors and ranges were large. The parental code 'Off task' came out to be uninformative and should only be used to assess how much a given observation should be extended to obtain the full 6 minutes of interaction (the "Off task" periods are to be excluded from coding).

The dyadic code 'Mutual Shared Attention' proved to be very unspecific in 5 month-olds. It was coded almost throughout all observations. The 'Dyadic Attention' codes were only coded for 5 month-olds (which is included in the adapted version of the DCMA-Infant). Joint attention, as expected, was not observed. The 'Joint Attention' code would only be appropriate for an older age group.

Table 3. Descriptive statistics for clips scored with DCMA

Subject	**Subscale**	**Type of event [unit]**	**Age group**	**Mean**	**Standard error**	**Standard deviation**	**Range**
Infant	Initiations	Point [total number]	5 m.o.	4.00	.63	1.41	3
			8 m.o.	8.00	2.65	6.51	17
	Responses		5 m.o.	3.00	1.58	3.53	9
			8 m.o.	6.33	2.71	6.65	18
	Other		5 m.o.	0	0	0	0
			8 m.o.	.33	.33	.81	2
Parent	Synchronous	State [sec]	5 m.o.	78.34	37.99	84.96	170,50
			8 m.o.	49.78	13.41	32.87	75.32
	Asynchronous		5 m.o.	268.80	33.25	74.35	170.60
			8 m.o.	300.37	19.51	47.80	130.11
	Off task		5 m.o.	12.92	12.92	28.90	64.64
			8 m.o.	22.59	16.82	41.22	105.37
	Synchronous	Point	5 m.o.	10.00	4.08	9.13	20

			[total number]	8 m.o.	9.66	2.34	15.92	40
	Asynchronous			5 m.o.	22.80	7.12	15.92	40
				8 m.o.	20.16	4.74	11.63	29
	Other			5 m.o.	14.20	10.76	24.07	56
				8 m.o.	3.33	1.38	3.38	9
Dyad	Mutual Shared Attention		State [sec]	5 m.o.	346.14	12.72	28.45	64.76
				8 m.o.	266.73	30.27	74.14	191.56
	Dyadic attention	Mutual	State [sec]	5 m.o.	9.59	9.31	20.82	46.84
		Parallel		5 m.o.	89.09	38.55	86.20	182.88
		Joint		5 m.o.	0	0	0	0

NB: scored observation time (without Off task): 360 sec

- MACI – descriptive statistics

Distributions on the MACI are skewed and do not match normal distribution. For most of the subscales ranges are limited, meaning that the coders were unable to use all possible scores on coded videos. Table 4 gives an overview of the descriptive statistics.

For the 24 month-olds, for both parental scales, two infant scales and one dyadic scale, the means were lower than the expected mean. Moreover, for three scales ranges were very limited (equalling 1 while the MACI has a range of 6). This indicates that the use of the MACI for 24 month-olds requires adjustments of the scales.

Table 4. Descriptive statistics for clips scored with MACI

Subject	**Subscale**	**Age group**	**Mean**	**Standard error**	**Standard deviation**	**Range**
Parent	Sensitive responsiveness	5 m.o.	4.20	.91	2.04	4
		8 m.o.	4.66	.42	1.03	2
		24 m.o.	3.25	.62	1.25	3
	Nondirectiveness	5 m.o.	3.60	.67	1.51	3
		8 m.o.	4.50	.42	1.04	3
		24 m.o.	2.75	.47	.95	2
Infant	Attentiveness	5 m.o.	5.60	.40	.89	2
		8 m.o.	4.33	.55	1.36	4
		24 m.o.	4.50	.64	1.29	3

	Affect	5 m.o.	4.40	.50	1.14	3
		8 m.o.	5.00	.51	1.26	3
		24 m.o.	3.50	.28	.57	1
	Liveliness	5 m.o.	2.60	.67	1.51	4
		8 m.o.	5.16	.60	1.47	4
		24 m.o.	3.25	.25	.50	1
Dyad	Mutuality	5 m.o.	5.00	.31	.70	2
		8 m.o.	4.33	.71	1.75	5
		24 m.o.	3.75	.75	1.50	3
	Intensity of engegement	5 m.o.	4.00	.31	.70	2
		8 m.o.	4.16	.60	1.47	4
		24 m.o.	4.25	.25	.50	1

NB: expected mean for each scale = 4, minimum = 1, maximum = 7.

Graphs representing distribution of data can be found in Appendix.

Interrater reliability

We evaluated reliability for both coding measures using percentage of agreement. For the DCMA, we calculated exact percentage of agreement within our group (CB, AN, MP). The agreements were higher for behaviours coded as state event (Parent Synchronous/ Asynchronous – state and Mutual Shared Attention) in comparison with behaviours coded as point events (Infant Initiation/ Response and Parent Synchronous/ Asynchronous – state). See Table 5 for more details.

Regarding the MACI, we calculated percentage of agreement both within our group, and between our group and our trainers (Ming Wai Wan and Ami Brooks). In addition to the exact percentage of agreement, we calculated the percentage of agreement where a difference of one point was permitted on a 1-7 Likert scale (see Table 6 for details). Within our group, exact agreement percentages ranged from 20% (infant's liveliness) to 60% (infant's affect) and the *milder* agreement percentages ranged from 70% (infant's liveliness) to 86.7% (intensity of engagement). In comparison with our trainers, exact agreement percentages ranged from 0% (infant's attentiveness) to 33.3% (infant's affect, infant's liveliness and intensity of engagement) and *milder* agreement percentages ranged from 50% (mutuality) to 83.3% (infant's liveliness and intensity of engagement). However, given the very small sample size and the fact that the participants of the STSM did only receive a short training in both coding schemes, the percentages should be interpreted with caution.

Table 5. DCMA: percentages of agreement

	Agreement (%)	Mean
Infant	45.9 to 58.7	52,7
Parent (state[2])	79.9 to 98.2	91.1
Parent (point[3])	46.9 to 63.4	54.3
Dyad	85.9 to 90.9	88.0

Table 6. MACI: percentages of agreement

	Agreement (%) within our group		Agreement (%) with Ming/Ami	
Sensitive responsiveness	20 to 46.7 (*M=33.35)*	66.7 to 86.7 *(M=76.7)*	16.7	66.7
Non-directiveness	20 to 40 *(M=30)*	80 to 86.7 *(M=83.35)*	16.7	66.7
Infant's attentiveness	26.7 to 46.7 *(M=36.7)*	66.7 to 80 *(M=73.35)*	0	66.7
Infant's affect	40 to 80 *(M=60)*	66.7 to 100 *(M=83.35)*	33.3	66.7
Infant's liveliness	6.7 to 33.3 *(M=20)*	53.3 to 86.7 *(M=70)*	33.3	83.3
Mutuality	33.3 to 60 *(M=46.65)*	73.3 to 86 *(M=79.68)*	16.7	50
Intensity of engagement	33.3 to 46.7 *(M=40)*	80 to 93.3 *(M=86.65)*	33.3	83.3

NB. The 2nd and 4th column are based on the calculation of the exact percentage of agreement. The percentages of agreement in the 3rd and 5th column are based on calculations where a difference of one point was permitted.

[2] State events, as opposed to point events, are behaviours which last over time. The duration of those behaviours can be calculated, e.g. parent reading to the child.

[3] Point events are short behaviours, for which we can calculate the frequency or total number rather than the duration, e.g. parent saying "It's a book".

Training and coding procedures

The training procedures are very similar for both coding schemes. The training for the DCMA consists of a 2-day training program, followed by an intensive follow-up in order to maintain reliability. For the MACI, there is a 3-day training program, followed by an intensive follow-up period including reliability checks. Although coding procedures are very different, the duration of the coding process for both coding schemes is around 45-60 minutes (based on the experiences of the participants).

User friendliness

In terms of user friendliness of the coding schemes the participants found that both coding schemes were easy to use and detailed manuals were available. However, they experienced more difficulties to master the MACI in comparison with the DCMA. This might be due to extensive global descriptions per code on each scale of the MACI. Intensive training, supervision and acquiring experience seem to be extremely important.

Conclusions

The parallel use of the DCMA and the MACI in infant sibling research may be the most efficient way of exploring group differences and analyzing developmental trajectories. In addition to their individual strengths, these coding schemes complement each other and compensate for some of each other's limitations. Data provided by both the DCMA and the MACI would allow to assess parent-child interactions thoroughly, both in terms of quantity and quality. Moreover, due to the fact that one is a count and the other a global scale, each coding scheme may relate to different measures of infant development. However, further research is needed to analyse group differences and individual variability, to determine whether reliability across sites is feasible and to further elaborate the coding schemes with regard to the different age groups.

Recommendations

By combining the DCMA and the MACI the pivotal characteristics of parent-child interaction can be represented more comprehensively. Therefore, we propose to use both coding schemes in the EU-AIMS sibs study. The following procedure could then be followed:

1. *Pilot study* – investigating the applicability of the adapted manuals of the MACI (for older infants) and the DCMA (for younger infants). Ming Wai Wan is planning to conduct a pilot study for the adapted version of the MACI in the upcoming year. Mirjam Pijl, Chloè Bontinck and Alicja Niedźwiecka are planning to conduct a pilot study for the DCMA-infant at 5-10 months in both

high-risk and low-risk siblings (following the eurosibs bottom-up procedure), in which group differences will also be analyzed.

2. *Training* – a group of researchers from different sites (1-2 each site) could be selected to form a PCI coding group. This group could then be trained in both coding schemes.
3. *Obtaining and maintaining reliability* (both options still have to be discussed with the team lead by Jonathan Green)
    - Option A: regular checks with Jonathan Green's team. The frequency of these reliability checks can be determined in consultation with Jonathan Green (e.g. monthly).
    - Option B (low-cost option): coding reliability tapes every 3-4 months and discussing discrepancies across sites and reaching consensus during telephone conferences. The aim is to obtain and maintain reliability within the PCI coding group (independently of the team of Jonathan Green). An annual meeting with the Manchester team for re-training and reliability check could be arranged.
4. *Coding process* – coding all available clips twice a year during 2-3 weeks of intensive coding sessions (instead of coding the clips every time they become available). The idea is to plan these coding weeks during the same period at each site in order to be able to arrange telephone conferences during these weeks to discuss specific doubts and questions. We think this would be more efficient and result in higher reliability within and across sites.

In addition, other coding schemes or important characteristics of parent-child dyads could be investigated by proposing bottom-up studies.