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A new coding system: The Neuropsychomotor Video Analysis of parent and child interaction (NVA)

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Abstract
The study investigated the validity of a Neuropsychomotor Video Analysis of parent and child interaction (NVA), a new observational coding system for parent-child interactions. 73 mother-infant interactions were video-recorded and codified with NVA and with Care-Index to verify the instrument validity. Convergent validity was supported by significantly positive correlations between the NVA and the Care-Index categories. Moreover, analysis indicated correlations between NVA mother's codes and NVA infant's codes. These results suggest that the NVA has the potential to be a valuable rating system for assessing parent–child relationships.

Keywords: Parent-infant interactions;, neuropsychomotor development, parent sensitivity.

Introduction

Over the past 30 years various methods have been developed to evaluate maternal sensitivity in the adult-infant relationship during early childhood (Riva Crugnola *et al.*, 2013). Particularly in the area of the theory of attachment (Ainsworth, Blehar, Waters, & Wall, 1978; Bowlby, 1969), Mary Ainsworth - in order to investigate the development of child attachment styles during the first year of life – devised one of the first unidimensional scales of assessing maternal sensitivity that was able to discriminate between Sensitivity and non-Sensitivity behavior (Ainsworth, Bell, & Stayton, 1971). Ainsworth, who provided the most famous body of research offering explanations of individual differences in attachment, devised an assessment technique called "Strange Situation Procedure" in order to investigate how attachments may vary between children (Ainsworth & Bell, 1970). She identified three main attachment styles: secure, insecure avoidant and insecure ambivalent. She concluded that these attachment styles were the result of early interactions with the mother. A forth attachment style known as disorganized was later identified (Main & Solomon, 1990).

In the light of the contributions attained in this area, different coding systems were defined, which were able to evaluate not only the interactive pattern of the caregiver, but also the child's specific contribution in the dyadic relationship during infancy and childhood. Crittenden developed an observation coding system for caregiver-child interaction called "Care-Index" (Crittenden, 1998), focusing on maternal sensitivity, that seen as a dyadic construct constituted by any behavior pattern that pleases the child,

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increasing its comfort and attentiveness, and reducing its discomfort and/or lack of involvement, also taking into account its individual characteristics. This system differs in various aspects from other measuring procedures of maternal sensitivity in adult-child interaction. Unlike other similar methods, it produces specific information for the dyad, not by evaluating the individual, but the specific relationships. Moreover, unlike the Ainsworth sensitivity scale (unidimensional), it has two negative effects at the other end of the spectrum (control and unresponsivity). Finally, it presumes that adults as well as infants can fake their behavioral contingencies. For infants they are compulsive and inhibitory. For pre-school children these are coercive.

Based on the assessment of the video-recorded interactions it is possible to classify adults on three different scales: sensitivity, control, and unresponsiveness. The infant scales are four: cooperativeness (C), compulsive compliance (CC), difficultness (D), and passivity (P). The seven aspects of interactive behaviour that are taken into account are: facial expression, vocal expression, position and body contact, affection, turn-taking, control, and choice of activity.

The assessment scales built around the framework of emotional availability are also interesting (Biringen, 2008). Biringen set up an observation system to assess the emotional availability of the mother-child relationship on four scales with seven points for the adult (sensitivity, structuring, non-intrusiveness, and non-hostility), and two scales with seven points for the child (responsiveness to the adult and involvement of the adult). These scales allow discrimination between adequate, marginally adequate and inadequate levels of emotional availability. The study presented by Biringen observes the maternal structural level, seen as the capability of the mother to lead play so that it is interesting and suited to the age and interests of the child. On the other hand, this system limits itself to discriminating the mother's behaviour based on two opposing tendencies (responsive – inadequate intrusive/hostile), without describing the interactive aspects mainly characterised by withdrawal and passivity, which instead were taken into account in Crittenden`s study.

References present in literature has played an important role in defining studies in the early detection of risk factors and in the protection of the socio-emotional development in early childhood, by showing the existing connection between maternal sensitivity and the development of attachment styles, as well as promoting intervention models, aiming at favouring adequate interaction patterns in the relationship between the caregiver and child (Feldman, 2010; Riva Crugnola, Gazzotti, Spinelli, & Albizzati, 2010; Sroufe, Egeland, Carlson, & Collins, 2005). For example, Evans and Porter (2009) demonstrated an association between the quality of mother-infant dyadic co-regulation at six months and infant attachment patterns at 12 months. Other studies (Biringen, Matheny, Bretherton, Renouf & Sherman, 2000; Cassibba, van IJzendoorn, & Coppola, 2011; Easterbrooks, Biesecker, & Lyons-Ruth, 2000) showed that more emotional availability in mother–infant interactions in the first year predicted more secure infant–mother attachment.

One of the limits represented by these studies includes the difficulty in interpreting the categories and the outcomes of the assessment at macroanalytical level which tends to be broad as well as global. With this perspective *The Neuropsychomotor Video Analysis of parent and child interaction (NVA)* (Moioli, Gazzotti, & Walder, 2010) undertakes to integrate the informative aspects already present in the scales reported in literature. Its aim is on one hand (at a microanalytic level) to provide more specific and descriptive behaviour categories – easier to determine for operators working in the child observation

field. On the other hand, NVA allows, once the behaviour aspects are determined, to be outlined the interactional level of the parent and of the child through seven different profiles (at a macroanalytic level): Adult Controlling – Child Controlling, Adult Intrusive – Child Reactive; Adult Violent – Child Aggressive; Adult Sensitivity – Child Participating, Adult Collaborative – Child Collaborative; Adult Passive – Child Passive; Adult Expulsive – Child Avoidant. The scale is therefore structured so as to place an adequate interactive process at the core, with a dual negative polarity, which on one hand goes towards the distance keeping, and the other towards the excessive approach and intrusiveness.

It also needs to be mentioned how the points scored on the basis of the observations can allow for reflection both at a categorical level (e.g. a category with a higher or lower score) and at a dimensional level, by describing the specific profile of caregiver and child. A further advantage of this system is represented by the possibility of obtaining an overall score for the different categorical aspects (look; facial mimicry and facial activity; hand gestures; hand and arm gestures; body posture and use of space; use of the voice; use of words -from 12 months onwards-; use of objects and play) and bringing to light any positive or negative aspects in all categories for infant and mother behaviours.

The coding framework therefore becomes a reference consistent with literature, giving a broader microanalytical observation based on the revelation of specific behaviour, to be able to obtain both global and dimensional information on the parent-child dyad. It particularly allows focusing on the critical points and maternal contribution to the interaction and of child response in detail, which is particularly useful in intervention or early risk preventive projects.

The aim of the research is to validate the NVA in a sample of Italian mothers and children. For this purpose, the correlation between mother and infant styles of interaction codified with NVA were analysed and some associations were examined for potential existence: (a) between mother's Sensitivity style and child's Sensitivity style, (b) between mother's Intrusive style and child's Intrusive style and (c) mother's Avoidant/passive style and child's Avoidant/passive style. Moreover, we analysed the correlations between mother and infant styles categories codified with NVA and mother and infant categories codified with Care-Index.

Presentation of the Neuropsychomotor Video Analysis of parent and child interaction (NVA)

NVA is an assessment tool designed for the structural observation, evaluation and coding of video-recordings of caregiver-child interactions in the first three years of life. Unlike other methods of classification of the interactions, NVA focuses on the effect that one's action has on the other, or on what is visible. The term "neuropsychomotor" underlines the importance of corporeal and motoric interaction aspects that caregiver and infant use in free-play situations. This system is accessible online from any country and is available both in English as well as the original Italian version.

The coding carried out with NVA allows the observer to evaluate separately the behaviour of both the caregiver and the child one in relation to each other. Maternal and infant behaviors were analyzed for the all duration of interaction in order to evaluate the occurrence of specific behaviors. Infant and maternal behavior was coded separately, and at different times, by the same researcher. The evaluation of the behaviour of both caregiver and child takes place in 7 areas: "look", "facial mimicry and facial activity", "hand and arm gestures", "posture and use of the body", "verbal communication",

divided into "use of voice", which includes vocal, prosodic and sound aspects of communication and "use of words", which looks more specifically at the verbal and the semantic aspects, and "objects and games". This subdivision allows to underline a specific inadequate area of the interaction (for example only the verbal aspects), not only a global view.

For each one of the 7 areas, the instrument presents a list of questions that the observer must answer by selecting one or more options among the ones provided. The observer can choose the option that better describes the interaction that is being evaluated by clicking on it. The options are not mutually exclusive: if one answer is not enough to describe the interaction, it's possible to select a second additional answer. If it is not possible to provide an answer for a specific question, the examiner can left it unanswered. Once the information has been filled-in, the first thing to be considered is the percentage of the answers determined compared to the maximum number of possible answers per category.

The final coding of the interaction allows us to give a definition of the type of prevailing behavior of both partners based on the calculation of the frequency of the behavior itself and to assigned caregiver and infant in specific categories. Mother categories are: Intrusive, Controlling, Violence, Sensitivity, Collaborative, Passive, and Expulsive. Infant categories are: Intrusive, Reactive, Aggressive, Participating, Collaborative, Passive, and Avoidant. NVA provides also the possibility to visualize the mother's and infant's profile with graphics, allowing the operator swift comprehension of the amount of behavior brought about by the dyadic interaction. A graph showed a distribution both in all seven categories as well as in a more condensed form in the three macrocategories of approach, sensitivity and dismissal. Figures 1 and 2 represent an example of score distribution. A cut-off is also defined in order to establish when the maternal and the child style can be considered sensitive and the quality of behavior is adequate; this cut-off has been set to 50±5% of the score. Further bands have also been defined in which the percentage of the Sensitivity style of the mother and of the Participating style of the child falls: between 45% and 70% the style results as being "adequate", from 71% to 100% "very adequate", from 44% to 30% "at risk" and less than 29% is "high risk".

Figure 1. Distribution of mother's and infant's behavior in 7 areas
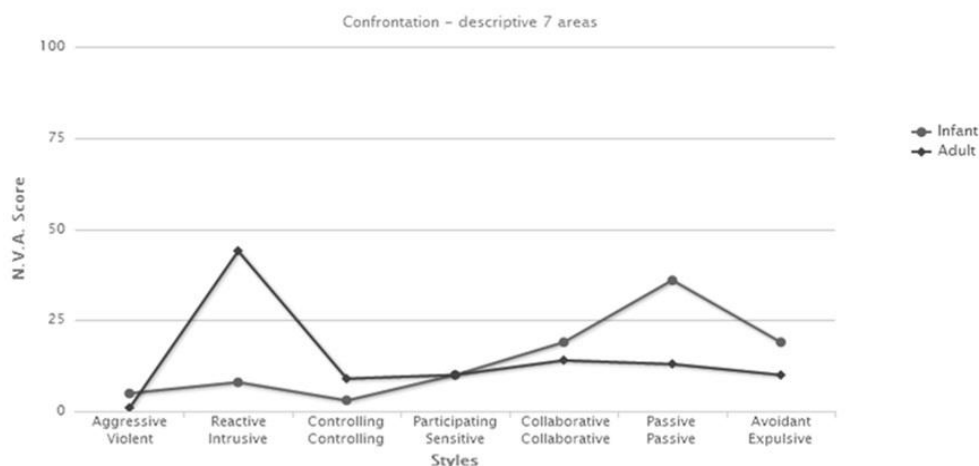
Figure 2. Distribution of mother's and infant's behavior in 3 macrocategories
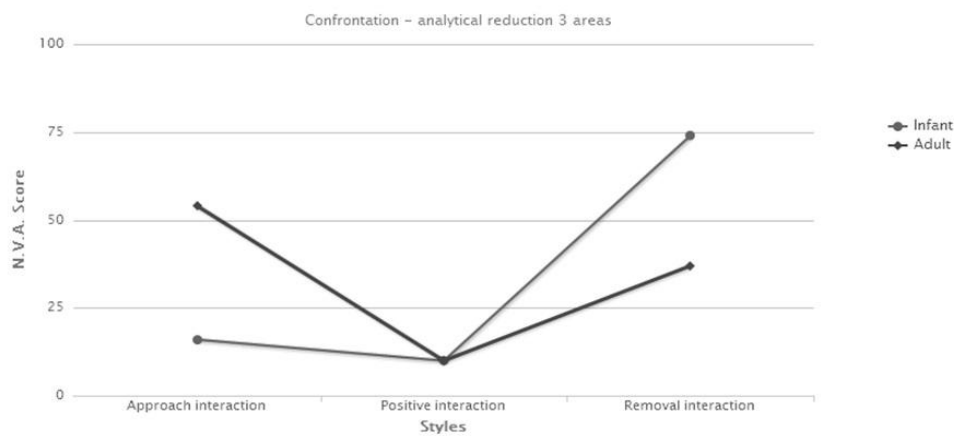
Methods

Participants

The study included 73 Italian mother-infant dyads that were recruited at the Infant Neuropsychiatric Unit of the San Paolo Hospital of Milan. The mothers were between 25 and 39 years old (Mean age=32.76; SD =3.60) and were nearly all primiparous. Most of the mothers were married (61%) or had partners (38%), only one was single (1%). The socio-economic level was 40% middle-class and 60% upper-class. The education level of the mothers had a range of between 8 and 18 years (55.2% had a degree, 34% an Italian High School Diploma and the remaining 10% an Italian Middle School Diploma at 14 years old). Nearly all mothers were working (92%). The children were all born full-term (33 females and 40 males) and with no pathology at birth.

Procedure

When children were 9 months old, the free play interactions of the mother-child dyad were video-recorded in a laboratory for 5 minutes. The laboratory was equipped with cushions, mattresses and appropriate games for the child's age. The video-camera was positioned in the room in front of the two in order to video-recorder their faces as well as the play and interaction behaviour.

Measures

Neuropsychomotor Video Analysis of parent and child interaction (NVA)

From the 7 categories defined both for the child as well as for the adult, a further central one is identified, which includes the behaviour of a working parent-child dyad where it can be observed that the two share the same play activity with pleasure. From this central category defined as Participating (corresponding to "Sensitivity" adult and "Participating" child) three other categories describing the behaviour macrocategory of "Approach" and three others of "Dismissal" increasingly outdistance themselves. The categories were examined in 5 minutes free-play dyadic interactions; mother and child were left alone in an equipped room.

The Adult Approach categories

Controlling. All the behaviour patterns in which the parent manages to interact together with the child are able to start a play but his/her posture, body language, look, and speech tell us that he/she will not allow himself to lose control and this doesn't allow him/her to manage the situation so that the other can move spontaneously or behave freely. There is a poor connection between the mother or father's "play activities" and those of the child. The definition of a controlling action does not include intrusive behaviour towards the other.

Intrusive. This type of definition of interaction shows the unaccepted behaviour of one towards the other. It is the type of behaviour that pursues the personal objective of the individual. It has an annoying and/or avoidance effect which interrupts spontaneous play. Intrusive action often has a controlling effect.

Violence. Verbal as well as physical behaviour appears in this area as part of the Controlling or Intrusive category but so exasperated as to become real aggression. Sometimes aggressive behavior can mean exclusion (Dismissal categories).

The Adult Participating category

Sensitivity. The category includes responsive behaviours of the parent. The caregiver is awareness and responds appropriately to the needs and emotions of the child. The interactions are adequate and create a shared, enjoyable and satisfying game between the two partners.

The Adult Dismissal categories

Collaborative. The meaning of collaborative defines the actions of an adult who does not start games but who is able to play together with the child, to share an object or an activity, but lacks that element of pleasure of being together which, on the other hand, is typical of the responsible caregiver. In this kind of interaction you can clearly observe a positive intention but this is characterized by few passive elements, such as depression or other elements that do not allow the mind to be totally free to enjoy the shared activity.

Passive. The behaviour is characterised by the non-response or by a response given at times which are unsuitable to the interaction. Partial or isolated interactions are highlighted, which involve the look or actions or speech which can often be disjointed and uncoordinated. The spirit of the mood is visibly lower. There appears to be no pleasure in sharing actions or objects.

Expulsive. The adult wards off actively and directly the contact and sharing attempts of the child. This category taken to excess can point out common elements of the Violent category that are part of the Approach behaviour area.

The Infant Approach categories

Controlling. The child's use of control upon the parent emerges thanks to some peculiar characteristics of its actions which clearly give the observer the idea of a child that doesn't want to give up the relationship with the other but cannot trust him completely. The child's way of playing shows him/her to be the dominating player. The Controlling category does not include reactive behaviour but is compatible.

Reactive. The child shows behaviour where the gesture is often the response to the other's actions and where we can see an excess of energy applied to the gesture, whether vocal or physical. Sometimes it is erratic meaning it ignites and burns out rapidly as a

reaction to certain actions of the parent. It aims to interrupt or move the ongoing action, but is not always effective.

Aggressive. In this category you can find aggressive behaviour, both verbal and physical, which in some cases is similar to that in the Avoidant category.

The Infant Participating category

Participating. The category includes behaviors in which the child actively seeks to play with the parent. Infant uses explorative behaviors of others and the environment acted in a context of emotional security where the exploration is shared with the parent and it sustained by the caregiver. The activity is engaging, produces pleasure and is based on alternation of child and parent in the play.

The Infant Dismissal categories

Collaborative. In this category it's possible to see all the behaviour patterns where the child is able to interact with the parent, but his/her actions are mainly in response to the stimulation received. The child's behaviour appears participative but with poor emotional engagement (i.e. the child only uses gestures without looking at the adult). The game appears to be shared but there is no pleasure or fun. The child sometimes seems to want to or has to humour the adult by foregoing his initiatives.

Passive. The behaviour is characterised by the non-response or by a response given at times which are unsuitable to the interaction. Partial or isolated interactions are highlighted, which involve the look or actions or speech which can often be disjointed and uncoordinated. The spirit of the mood is visibly lower. There appears to be no pleasure in sharing actions or objects.

Avoidant. The child is directly active in rejecting the attempts of contact and sharing with the parent. Even though this category is classified for the effect it has on the other in Dismissal, it must not be confused with extreme passiveness as it clearly moves towards an important activation which in some cases encounters aggression.

In our research, the coding of the NVA video-recordings was done by two judges independently, both judges are specifically trained to use the coding system, in as much as they obtained the reliability of this study after specific training. Therefore, Cohen's K (Cohen, 1960) was calculated to identify the agreement among the observers and the result was K=.80 for the infant categories and K=.88 for the mother categories.

Care-Index. The Child-Adult Relationship Experimental Index (Care-Index) was created by Crittenden (1998) to assess mother-infant interaction from birth to 36 months of age. The Care-Index evaluates the dyadic characteristics associated with attachment styles, in particular the sensitivity of the adult in a dyadic context (Crittenden, 1998). The structure of the Care-Index coding system is based on a fundamental framework, namely the sensitivity to the child's signals, and is considered to be a "dyadic construct" that can be measured in the mother-child relationship. During interaction the adult's behaviour is classified as being Sensitivity, which highlights a state of well-being and pleasure in the child, thereby reducing feelings of discomfort. A sensitive caregiver can suitably react to the specific individual characteristics of a child (Crittenden, 1998).

The coding procedure draws the observers' attention to the seven aspects of behaviour in both the adult and child: some of these measure aspects of affection (facial and vocal expression, position and body contact, expression of affection), whereas others measure cognitive aspects, such as temporal order and interpersonal contingency (the

rhythm of interaction, the control of activity and the development of the pertinence of the activity). There are three scales that evaluate the adult's behaviour: Sensitivity, implies responsive behaviour, appropriate to the child's emotions and activities; Control, includes controlling or interfering behaviour in the child's activity, characterised by implicit or obvious hostility; and Unresponsiveness which is characterised by behaviour marked by physical and emotional detachment from the child.

Instead, the child's behaviour is assessed in four scales: Cooperative, includes behaviour associated with the expression of positive emotions, focused on undertaking actions and accepting those proposed by the caregiver; Difficultness, includes behaviours that are obviously hostile and resistant to the caregivers' proposals; Compulsive-compliance, characterised by cautious behaviour, inhibited with an indirect and complacent approach towards the mother; and Passive, which includes behaviours that have the intention of limiting the physical and emotional contact with the caregiver.

The Care-Index procedure expects to assign points to each of the seven characteristics of the dyadic behaviour. The total score will measure the level of sensitivity of the mother. The scores of the scales can vary from 0 to 14, where a score between 8 and 14 shows that the interaction is adequate, a score between 4 and 7 shows that the interaction is worrying and at risk, whilst a score between 0 and 3 shows that the interaction is seriously compromised and at high risk. Also the coding of the mother-child interaction video-recordings through the Care-Index coding system was undertaken by two independent judges. Cohen's kappa coefficient was calculated to identify the understanding among the observers and it resulted in K=.85 for the infant categories and K=.80 for the mother categories.

Statistical analysis

The SPSS statistical analysis package was used. Using t-test, it was possible to point out differences between the genders compared to the NVA categories: males prove to have more reactive behaviours compared to those of females (t=-2.45, p=.01), the latter have more participative behaviours (t=-2.81, p=.006). There are no significant differences for the mother's behaviours in relation to child's gender. No significative differences were found with respect to the social-demographic variables such as mother's age, marital status and level of education, when coding with NVA as well as Care-Index. Therefore these variables were not taken into consideration in the following analysis.

Results

Correlations among infant and mother categories

On first analysis the associations among the 7 categories of the mother and the 7 categories of the child were identified in order to characterise the same associations in each category. Afterwards, based on the theoretical assumptions presented in the description of the study, the associations among the seven categories of the mother and the seven categories of the child were analysed. For each category, the analyses with the correlation r of Pearson show some significant associations among the child's styles and those of the mother's (see Table 1).

Table 1. Correlations among NVA infant's and mother's categories.

NVA	Mother Violent	Mother Intrusive	Mother Controlling	Mother Sensitivity	Mother Collaborative	Mother Passive	Mother Expulsive
Infant Aggressive	.45***	.29*	.27*	-.34**	-.16	.10	.30*
Infant Reactive	.33**	.44***	.29*	-.36**	-.10	-.01	.16
Infant Controlling	.24*	.34**	.34**	-.36**	.03	.00	.20
Infant Participating	-.38**	-.59***	-.38**	.91***	-.38**	-.47***	-.48***
Infant Collaborative	-.15	-.01	.18	-.20	.52***	.02	-.10
Infant Passive	.16	.35**	.13	-.70***	.31**	.59***	.40***
Infant Avoidant	.50***	.41***	.15	-.54***	.10	.25*	.48***

*p<.05, ** p<.01 *** p<.001.

The child's "Aggressive" category is positively correlated to the "Violent" (r =.45, p=.000), "Intrusive" (r=.29, p=.01), "Controlling" (r=.27, p=.01) and "Expulsive" (r=.30, p=.01) mother's categories and negatively correlated to the "Sensitivity" mother's category. The "Reactive" category is positively correlated to the "Violent" (r=.33, p=.004), "Intrusive" (r=.44, p=.000) and "Controlling" (r=.29, p=.01) mother's categories. The "Controlling" child's category is positively associated to the maternal "Violent" (r=.24, p=.04), "Intrusive" (r=.34, p=.003) and "Controlling" (r=.34, p=.003) categories and negatively with the "Sensitivity" (r =-.36, p=.001) mother's category. The "Participating" category is positively correlated to the mother's "Sensitivity" (r=.91, p=.000) category and negatively to all other maternal styles. The "Collaborative" category of the child correlates positively with the "Collaborative" maternal category (r=.52, p=.000). The "Passive" child's category is positively correlated to the "Collaborative" (r=.31, p=.007), "Passive" (r=.59, p=.000), "Expulsive" (r=.40, p=.000), "Intrusive" (r=.35, p=.002) mother's categories and negatively to the "Sensitivity" (r=-.70, p=.000) ones. The "Avoidant" child's category is positively associated with the "Violent" (r=.50, p=.000), "Passive" (r=.25, p=.03), "Expulsive" (r=.48, p=.000), "Intrusive" (r=.41, p=.000) mother's categories and negatively to the "Sensitivity" (r=-.54, p=.000) one.

Correlations among infant's and mother's macrocategories

The mother's and child's categories were grouped together into three macrocategories: Approach, Dismissal and Participating (see description above). The analysis undertaken with the Pearson's r correlation points out significant correlations (see Table 2).

Table 2. Correlations among NVA infant's and mother's macrocategories

	Mother Participating	Mother Approach	Mother Dismissal
Infant Participating	.91***	-.62***	-.57***
Infant Approach	-.41***	.51***	.00
Infant Dismissal	-.76***	.39**	.62***

*p<.05, ** p<.01 *** p<.001.

The "Infant Participating" macrocategory is positively correlated to the "Mother Participating" (r=.91, p=.000) macrocategory and negatively to the "Mother Approach" (r=-.62, p=.000) and "Mother Dismissal" (r=-.57, p=.000) macrocategories. The "Infant Approach" macrocategory is positively correlated to the "Mother Approach" (r=.51, p=.000) macrocategory and negatively to the "Mother Participating" (r=-.41, p=.000) macrocategory. The "Infant Dismissal" macrocategory is positively correlated to the "Mother Dismissal" (r=.622, p=.000) as well as the "Mother Approach" (r=.39, p=.001) macrocategory and negatively correlated to the "Mother Participating" (r=-.76, p=.000) macrocategory.

Correlation between NVA and Care-Index

Several analyses have been undertaken with the Pearson's r correlation coefficient to identify the degree of association of the NVA categories with the Care-Index categories, for the mother as well as the child (see Table 3 and 4).

Table 3. Correlations among NVA mother's categories and Care-Index mother's categories

| | Care-Index Mother's | | |
	Sensitivity	Control	Unresponsiveness
Violent	-.29*	.38*	-.06
Intrusive	-.46**	.66***	-.14
Controlling	-.39**	.53***	-.09
Sensitivity	.71***	-.48***	-.38**
Collaborative	-.22	-.09	.41***
Passive	-.40*	-.16	.72***
Espulsive	.21	.12	.14

(NVA Mother's)

*p<.05, ** p<.01 *** p<.001.

Table 4. Correlations among NVA infant's categories and Care-Index infant's categories

| | Care-Index Infant's | | | |
	Cooperative	Compulsive	Difficultness	Passive
Aggressive	-.27*	-.17	.46***	.05
Reactive	-.26*	-.07	.56***	-.09
Controlling	-.21	-.01	.44***	-.07
Participating	.71***	.02	-.35**	-.54***
Collaborative	-.21	.19	-.16	.27*
Passive	-.53***	-.01	-.00	.61***
Avoidant	-.46***	-.13	.38**	.30***

(NVA infant's)

*p<.05, ** p<.01 *** p<.001.

As for the mother's categories, the data shows that the "Violent", "Intrusive" and "Controlling" categories of NVA are significantly positively correlated to the maternal "Control" style (r=.38, p=.001; r=.66, p=.000; r=.53, p=.000) and negatively correlated to the "Sensitivity" style of the Care-Index (r=-.29, p=.001; r=-.46, p=.000; r=-.39, p=.001). The "Sensitivity" category of NVA is significantly positively correlated to the Care-Index

"Sensitivity" category (r=.71, p=.000) and negatively correlated to the "Control" (r=-.48, p=.000) and "Unresponsiveness" (r=-.38, p=.001) categories of the Care-Index. The mother's "Collaborative" category is significantly positively correlated to the "Unresponsiveness" style of the Care-Index (r=.41, p=.000). The "Passive" category of NVA is significantly positively correlated to the "Unresponsiveness" style of the Care-Index (r=.72, p=.000) and is negatively associated to the "Sensitivity" style of the Care-Index (r=-.40, p=.000). The "Expulsive" mother's category is not significantly correlated to any style of the Care-Index classifications.

Significant associations have also been found for the child, the "Aggressive", "Reactive" and "Controlling" categories of NVA are positively correlated to the "Difficultness" style of the Care-Index (r=.46, p=.000; r=.56, p=.000; r=.44, p=.00). The "Aggressive" and "Reactive" categories are negatively correlated to the "Cooperative" style (r=-.27, p=.02; r=-.26, p=.02) of Care-Index. The child's "Participating" category is positively correlated to the Care-Index "Cooperative" category (r=.71, p=.000) and negatively correlated to the Non-Sensitivity "Difficultness" (r=-.35, p=.002) and "Passive" Care-Index categories (r=-.54, p=.000). The "Collaborative" category of NVA is positively associated with the Care-Index "Passivity" style (r=.27, p=.020). The "Passive" child's category of NVA is correlated positively to the "Passivity" style (r=.61, p=.000) and negatively to the "Cooperative" style of the Care-Index (r=-.53, p=.000); the "Avoidant" category is positively correlated both to the "Passivity" style (r=.30, p=.01) and to the "Difficultness" style (r=.38, p=.001) and negatively to the "Cooperative" style (r=-.46, p=.000). No NVA categories are significantly correlated to the "Compulsive" style.

Discussion

The research tested the validity of the NVA tool in coding the interaction styles of the mother and child. The findings show effectiveness in the evaluation of parent-child interactions. Significant correlations have been found between the maternal and infant styles codified with the NVA and those codified with the Care-Index. With regards to the first objective, which is to identify the correspondence between the mother's and infant's style codified with NVA, the results confirm the initial theory showing how both partners are active during interaction in carrying out and regulating their behaviour. It is in fact clear that there is a significant correlation between "Mother Participating" and "Infant Participating", confirming the data found in literature that show that maternal response is associated to a child who interacts positively, capable of expressing and regulating his emotions, highlighting the importance of interactive exchange and dyadic coordination (Beebe *et al.*, 2010; Crittenden & Claussen, 2000; Feldman, 2003; Riva Crugnola *et al.*, 2013; Stern, 1985, 1995; Tronick *et al.*, 2005). Moreover, it was pointed out that Approach maternal behavior such as "Violent", "Intrusive" and "Reactive" are associated both with the child's Approach behavior like "Aggressive", "Reactive" and "Controlling" and Dismissal behavior such as "Passive" and "Avoidant".

These results are confirmed also by the analysis of three macrocategories where the maternal "Approach" behaviour is associated both with the "Approach" and "Dismissal" behaviour of the child. These data are in line with those of Crittenden (1998) who shows that in cases where there is a maternal intrusiveness it is easy to find a child with "Difficultness" or "Passive" behaviour. When they face excessive interference children usually react by adopting two different strategies, anger and protest or retreating from the interaction. It was also found that maternal "Expulsive" and "Passive" behavior is

associated with "Avoidant" and "Passive" behaviour of the child, confirming the correspondence of the dyadic styles.

With regards to the correlations between NVA categories and Care-Index categories, we found significant associations. In fact, the "Participating" maternal style of NVA is associated with the "Sensitivity" style of the Care-Index and inversely correlated to the two non-Sensitivity styles ("Control" and "Unresponsiveness"). This shows that the NVA system is well-able to identify both the competence and the adequate styles of the mother, as opposed to the non-optimal ones during the dyadic interactions.

Through an in-depth analysis NVA is also able to discriminate the different types of non-adequate maternal behaviour; the most pertinent categories to the mother's Approach and therefore behaviour within the "Intrusive", "Reactive" and "Violent" categories correlate with the "Control" style of the Care-Index, whereas the Dismissal aspects such as "Passive" and "Collaborative" are associated with the "Unresponsiveness" style and correlate negatively with the "Sensitivity" style. The "Expulsive" category does not correlate with any of the Care-Index aspects, this could be due to the ability of NVA to determine active dismissal aspects that are not differentiated in the Crittenden's coding system.

Moreover, another interesting factor that emerges, concerns the child's "Avoidant" behavior which correlates both with the "Difficultness" and the "Passivity" style of the Care-Index. This could be that in the "Avoidant" child's category not only one way of passive avoidance or looking away is taken into account, but also the active and voluntary avoidance of the mother. NVA could in fact be used to evaluate maternal and infant behavior by prematurely identifying, right from the first year of life, those styles of interaction that can create a risk or a protection factor for the constitution of an adequate/inadequate relationship in the following years, in forming emotional bonds and the problems found in the socio-emotional development (Evans & Porter, 2009; Ierardi, Riva Crugnola, Gazzotti, Ferro, & Albizzati, in press; Lorber & Egeland, 2009; McElwain & Booth-LaForce, 2006). For example, the parental conditions at risk of depression and maternal anxiety, psychopathology, drug addiction, low social-economic class, adolescence, premature birth influenced adult-child interaction (Beebe *et al.*, 2011; Field *et al.*, 2005; Muller-Nix *et al.*, 2004; Osofsky, Eberhart-Wright, Ware, & Hann, 1992; Reck *et al.*, 2011; Strathern & Mayes, 2010). Identifying specific aspects in the interaction between mother and child could emphasize those areas where it is more difficult with regards to the different parenting conditions at risk, to then carry out an early intervention to support the dyad.

Conclusion

Based on the findings, the validity of the NVA tool in coding the mother/child interaction was demonstrated.
Based on the results identified it would be interesting to increase the number of participants to confirm the results trend and to examine the critical points in the categories with the most extreme behaviour that shows a high risk for the mother-child relationship. Therefore, it would be possible to apply the NVA coding also to the mother-child interaction in clinical cases with parental conditions at risk, and disturbance in the autistic spectrum and mental retardation of children.

NVA could be useful in longitudinal researches to understand if the maternal or child styles change in time and how the quality of the interactive styles influences the

formation of emotional bonds of the child in his second year of life, highlighting those parent and child styles which could constitute a risk when developing an emotionally insecure bond, a risk factor for social-emotional problems in the future (Fearon *et al.*, 2010). It would be also interesting to be able to evaluate the interaction between father and child to be able to identify which are the associations between the caregiver style and that of the child and the eventual differences with the mother-child interaction. The multidimensional definition of the research gives the physician or the researcher the possibility of obtaining different functional profiles relative to the parent-child dyad. These profiles could be used to intervene in the case of interactions at risk to prevent negative consequences in the development of the child. In fact, the possible fields of applications include premature screening, diagnostic definition, planning of therapeutic intervention and evaluation of its effectiveness.

The NVA can also give significant support to the scientific debate on the role of the dyadic sensitivity in the process of intergenerational transmission of attachment models (van IJzendoorn, 1995; Zimmermann, 1999), to amplify the construct of maternal sensitivity introduced by Ainsworth and so pick up more factors of the maternal behavior that influences child attachment.

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