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Emotions and Emotional Dysregulation in Autism Spectrum Disorder: A Preliminary Study

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ABSTRACT

Emotion is a signal that there has been a change in the subjectively perceived state of the internal or external world, which is accompanied by a physiological response (external: impulse to action, or internal: mood altera-tion), each of which is expressed through a different configuration and designates different emotional responses (joy, sadness, fear, etc.; but also anger, rage, aggression, etc.). Moreover, emotions possess a strongly contextual-ised and specific social dimension that depends on the situation and interpersonal relations: the specific meaning is determined by the subjective and intersubjective evaluation that is attributed to the emotional event. These general considerations suggest both the importance of emotional experience in the course of development, its significance in the organisation of affective relations and its functional value as an adaptation (defence, offence, approach or control) capable of maintaining or modifying the individual's relations with his (physical and social) environment.

What happens when emotions are particularly intense and dysfunctional? Several studies have found that more than 60 per cent of individuals with Autism Spectrum Disorder (ASD) exhibit problematic emotional behaviour such as irritability, outbursts of anger, self- and hetero-aggressiveness, etc. In addition, these people experience high levels of anxiety and increased negative emotions, which can contribute to intensified feelings of distress and have a negative impact on daily functioning and quality of life. Controlling these negative emotions through self-regulation can prevent these behavioural problems.

Keywords

Autism Spectrum Disorder (ASD), Emotions, Emotional Dysregulation, Emotional Control.

Introduction

Our everyday life is characterised by the recurring presence of emotions of varying nature and intensity. They represent an important component of our species: a complex, multidimensional and processual experience with a strong cognitive-affective organisational function that mediates the relationship between the organism and the environment. In a general sense, emotion is the signal that there has been a change in the subjectively perceived state of the internal or external world, which is accompanied by a physiological response (external: impulse to action, or internal: mood alteration), each of which is expressed through a different configuration and designates different emotional responses (joy, sadness, fear, etc.). At the same time, emotion is a physiological, motivational, cognitive and communicative response, always accompanied by both a subjective and social dimension [1-3].

Human emotions are divided by experts into two classes, basic (also called simple or primary) and complex (secondary or self-aware). Present from birth, the former manifest themselves with specific and universal facial expressions [4]. The set of basic emotions is very restricted: there is happiness, fear, anger, sadness, disgust and, according to some, surprise [5,6]. Despite their early onset, primary emotions undergo major changes during childhood, changes that involve emotional experience, the way they are triggered and the level at which they are understood. The set of secondary emotions is rather vast, the most studied, including shame, envy, embarrassment, pride, falling in love and jealousy. At the physiological level, both the central and autonomic nervous systems come into play, which are responsible for specific bodily reactions related to the manifestation of various emotions, and the

endocrine system, which not only activates the central nervous system but also regulates stress and anxiety levels. The centres of activation, control and regulation of emotional processes are located centrally in the libido system, as the nervous signals coming from it can induce both the expressive-motor manifestations of emotions and their subjective components through connections with the cerebral cortex. Among the structures that form the libido system, two are particularly important in reference to emotions: the hypothalamus and the amygdala.

The hypothalamus coordinates the autonomic system (sympathetic and parasympathetic) and is the seat of central regulation of the body's internal environment. In general, posterior and medial hypothalamus stimulation predominantly produces sympathetic responses. In contrast, anterior and lateral hypothalamus stimulation produces parasympathetic responses, thus justifying the distinction between 'highly activated' and 'low activation' hypothalamic areas [7,8].

The amygdala resides at the centre of the emotional network and has multiple connection systems with other nervous structures [8]. In particular, the subcortical (precognitive) circuit constitutes a primitive system from an evolutionary point of view (thalamus-amygdala projection). It performs the function of automatically processing information and responding promptly to potentially dangerous stimuli. Whereas the cortical (cognitive) circuit constitutes a highly structured network of connections (thalamus-cortex-amygdala projection) that participates in the higher cognitive processes (abstraction, inference, etc.) of evaluating emotional events and attributing a given emotional meaning (mourning, gratification, punishment, etc.) [9]. In other words, cognitive evaluation makes it possible to attribute meaning to the organism's reactions and stimulate and guide the individual to cope with the event that triggered the emotion.

In fact, a motivational level directs action and modifies behaviour depending on desires and goals. Unpleasant events tend to be avoided, while pleasant ones are actively sought after. The motivational dimension gives rise to plans capable of regulating behaviour, establishing priorities, and creating response systems all aspects that, in the long term, contribute to forming interests, organising preferences, and orienting purposes. Finally, at the expressive and communicative level, it does not appear easy to inhibit or modify the manifestation of emotions, especially when they strike the individual suddenly. Every fundamental emotion has its own communicative configuration, originating essentially from facial movements, only partly determined by cultural differences and essentially common to all human beings. Although facial expressions are a privileged channel, other non-verbal manifestations should not be underestimated, such as bodily movements, tonic-postural set-up, tone of voice, etc., that enrich the meaning of individual reactions [10,11]. Moreover, emotions possess a strongly contextualised and specific social dimension that depends on the situation and interpersonal relationships: the specific meaning is determined by the subjective and intersubjective evaluation attributed to the emotional event. These general considerations suggest both the importance of emotional experience during development, its significance in the organisation of affective relations and the functional value of adaptation (defence, offence, rapprochement or control) capable of maintaining or modifying the individual's relations with his (physical and social) environment.

The processes described so far highlight not only the multi-componential and adaptability of emotional experience, but also the evolutionary modifiability of emotional processes sequenced by defined periods [12]:

Period 1: is characterised by the emotional reactions present at birth that are regulated by biological processes fundamental to survival. The hedonic system, through sensations of pleasure and disgust, is intended to stimulate the gustatory system; startle reactions are intended to protect against too intense light or acoustic stimuli, discomfort responses signal discomfort to painful stimulation, and interest responses signal attention to novel stimuli. Although these responses are congruent, appropriate to the context and easily recognised by the adult, they cannot yet be considered intentional forms of communication.

Period 2: begins around the second month and ends around the first year, and it involves major discoveries and changes as, thanks to social interactions, a child begins to communicate its intentions and implement the first forms of emotional control. In this phase, both the non-selective social smile in response to the human voice (between five and eight weeks) and to familiar people (around the third month) and the selective social smile (after the third month), which tends to be directed at the mother, appear. Between six and ten weeks, the emotions of surprise in the face of new stimuli become more evident, and around 3-4 months, the expression of three distinct basic emotions becomes clear: sadness, anger and joy. In the following months (5-7 months), the child develops the emotions of fear and circumspection in relation to progress in locomotion skills and the emergence of exploratory needs. At the end of this period (8-9 months), fear of the stranger also appears, manifesting itself in contact with unfamiliar people and indicating an affective bond of care and protection between the child and the person looking after him.

In this period, children between four and seven months old can distinguish variations of emotional expression in the mother's face, coherent response and expression of discomfort if the interactive sequences are incongruous with the rhythm of the interaction organised between mother and child [13]. These experimental data show that the recognition of emotions is quite precocious. At the same time, the understanding of their meaning is not so rapid: the evolution is marked by certain social and relational precursors. Trevarthen [14,15] observed that expectations are generated based on the meaning of emotion expressions in the interaction between mother and child. This type of response suggests that there is a form of anticipation of the emotional expressions that the child expects to see appear on the mother's face: children seem to be aware of the information conveyed by the other's expression

and draw indications from it to regulate and modify their own behaviour.

Period 3: begins after the first year, in which complex emotions such as shyness, guilt, shame, pride and envy appear, whose development can be said to be complete around the age of three. These are learned emotions, which are not immediately recognisable and identifiable through specific mimic indicators and which can manifest themselves through signals that are also common to other emotions. Unlike basic emotions activated by direct physical stimulation, complex emotions originate from forms of self-reflection or mental association and require self-awareness that enables them to assess themselves and their actions in relation to social norms and shared cultural standards. Furthermore, during this period, the child learns to recognise the emotional states of others and can react to them appropriately. At 14 months, for example, children can ask for and give comfort to siblings in difficulty and, in their second year, anticipate the emotional reactions of others both to activate consoling and helping behaviour and to understand what may annoy or cause annoyance and to decide whether or not to ask for adult intervention or help. Towards the end of the second year, the ability to pretend appears, to understand the 'as if', and to master the ambiguity of emotional expressions appearing in others. Thus, while at the age of two, children are negatively affected by adults who put on a serious face pretending to be 'naughty', at the age of three, they immediately understand the difference between reality and pretence and take great pleasure in the game [16]. The child also learns to deliberately modify emotions, adapting to social circumstances and thus showing that it has learnt what Ekman [17] has called 'rules of displaying emotions': to increase or decrease the emotion or to simulate, hide or pretend what one feels. For these reasons, it seems appropriate to distinguish between *recognition* of other expressions, which is achieved relatively quickly, and psychological *understanding* of one's own and other's emotions, which requires more refined skills and abilities. Complex emotions are, therefore, dependent on culture, expectations, and socially prescribed norms of behaviour and require a certain social competence to be identified and manifested.

Period 4: Around the age of four, children understand the rules of displaying emotions well. They can modify what they feel in relation to circumstances and rules of social behaviour.

A more evolved component in the understanding of emotions is the ability to realise that the other person's thoughts and concepts may be different from one's own. Although at an early age, the child reacts to and understands the feelings of others; it is only around the age of 4-5 years that he/she will be able to put him/herself in the shoes of others and develop an understanding of what is going on in the mind of others, both in terms of emotions and thoughts. The acquisition of this capacity represents an important breakthrough, thanks to which he can predict the emotional reactions of others according to context and situational antecedents without necessarily feeling those same emotions [18]. Children can formulate hypotheses about the emotional state of others with increasing precision. Around the age of 5-6, they are also able to represent and explain the reasons that might lead others not to show the emotions they actually feel [19]. Around the age of 6-7, they acquire the awareness that different emotions can be felt at the same time and the emotional combination of opposite valence that characterises ambivalence. Around the age of eight, it indicates the recognition of the co-presence of two emotions of opposite polarity, although still directed towards two different objects of interest. Finally, around the age of nine, the child can unify emotions of opposite valence with respect to the same object or event, achieving a complete and conscious representation of ambivalent feelings: for example, feeling and understanding that he can, at the same time, feel affection and jealousy towards his little brother.

Emotional Development and Autism

Autism is frequently associated with disorders of emotional expression. In autistic children, abnormalities of mood and emotional expression can be observed, such as laughing and crying for no obvious reason, poor or excessive reactivity, abrupt anger outbursts, and abnormalities in mood fluctuation [20,21]. Symptoms indicated by international diagnostic criteria also include anticipatory anxiety, a lack of fear of real dangers, and a strong fear of harmless objects.

The problems in expressing simple emotions do not lie in a general inability to express emotional state but rather in a reduced ability to do so in a context-appropriate manner. In fact, the results of studies on expressive abilities confirm that affective disorder exists but highlight that it is not generalised to all emotions: it emerges mainly in the expression of basic and complex emotions [22]. About basic emotions, it appears that the inhibitory mechanisms responsible for the social adaptation of emotional expression are poorly developed. For some complex emotions, on the other hand, the deficit may concern not only the capacity for social adaptation of expression but also the very ability to experience and express them. This deficit may be due to the lack of certain cognitive prerequisites necessary for their formation [22,23]. However, the distinction between ASD subjects with the occurrence of intellectual disability and those without the occurrence is very important here. The latter, in fact, have a better ability to recognise emotions than those with intellectual disability: in both groups, however, basic emotion recognition abilities appear, in many classification tasks, to be related to the general level of intellectual development [24,25]. Surprise, on the other hand, is not considered by all theorists to be a basic emotion, like fear or happiness, but is regarded as a cognitive emotion generated by the violation of an expectation [26]. Due to these characteristics and the assumption of a deficit in the theory of mind, surprise will be more difficult to recognise than other basic emotions, e.g. happiness and sadness, for children with autism [26]. However, research by Loveland et al. [27] showed that the emotion of surprise would be more difficult to recognise than happiness and fear regardless of the presence of developmental disorders in the subjects.

While many studies have been conducted on the recognition of simple emotions, experimental research on complex emotions

is only in its infancy: simple emotions are 'pure' or 'primitive', and complex emotions are 'aggregates' formed, for example, by simple emotions of opposite signs. The ability of children with ASD to associate events with the corresponding simple emotions seems to develop in a manner consistent with the development of their verbal skills [28-30].

The child who possesses the concept of 'belief' can understand emotions' subjective and private nature. He/she can also understand that an emotional reaction is usually not directly produced by a certain event but by how a person interprets it. In the autistic child, the difficulty in forming meta-representations should, therefore, hinder emotional understanding, especially that of complex emotions, which, unlike simple emotions, can never be understood without considering the representational and evaluative elements. Moreover, even the understanding of simple emotions, when it requires meta-representational attribution, should be particularly difficult for children with autism [31]. A dissociation between the understanding of complex emotions and that of simple emotions is reported by Capps, Yirmiya and Sigman [32], who asked autistic subjects without intellectual disability to describe an occasion when they felt happiness, sadness, pride and embarrassment. Responses on simple emotions were adequate, while those on complex emotions suggested poor emotional understanding. Recently, Dennis, Lockyer, and Lazenby [33] found that individuals with ASD without ID have a deficit in the ability to distinguish between authentic emotions and those not really felt but simulated for social reasons.

What happens when emotions are particularly intense and dysfunctional? Several studies [34,35] have found that more than 60 per cent of individuals with ASD exhibit problematic emotional behaviour such as irritability, outbursts of anger, self- and hetero-aggressiveness, etc. Furthermore, these individuals experience high levels of anxiety and increased negative emotions, which can contribute to intensified feelings of distress and have a negative impact on daily functioning and quality of life. Managing these negative emotions through self-regulation can prevent behavioural problems [27].

Emotional self-regulation (or 'emotional self-control' or, more simply, 'emotional regulation') is the **ability to control and manage emotions**, impulses and reactions in an intentional and conscious way to adapt to a specific situation or goal. When, on the other hand, there is **difficulty in effectively processing one's** emotions, overly intense emotional experiences are created that give way to dysfunctional strategies (frustration, anxiety, anger, etc.) that lead to emotional dysregulation [36-38] (Table 1).

Emotional Dysregulation Scale

Instructions. The assessment of Dysregulation is expressed with four scores: 0 corresponds to the absence of the behaviour; 1 corresponds to behaviour that is emitted sporadically (1-3 times every six hours) or that lasts 30 to 120 seconds in a row in an hour (even if it alternates with breaks); 2 corresponds to behaviour that is emitted a few times (4-10 times every three hours) or that lasts for two to five minutes in a row within an hour (even if alternating with pauses); 3 corresponds to behaviour that is emitted many times (> 10 times every hour) or that lasts for more than five minutes in a row within an hour (even if alternating with pauses)].

01) Emits maladaptive behaviours (stereotypes, compulsivity, etc.).	0	1	2	3
02) Wait less than 30s before you get what you want.	0	1	2	3
03) Pays attention to stimuli with little relevance to learning (details, objects in the environment, etc.).	0	1	2	3
04) Protests with crying, self- or hetero-aggressiveness, etc., if asked to change activity.	0	1	2	3
05) Shows agitation (generalised anxiety) in front of new situations.	0	1	2	3
06) Repeats the same actions more than five times.	0	1	2	3
07) Stops a task immediately as soon as he encounters difficulties.	0	1	2	3
08) Gets angry as soon as he makes a mistake or if he is reprimanded.	0	1	2	3
09) Expresses frustration (failures, taking away a game, scolding, etc.).	0	1	2	3
10) Immediately starts a new task without analysing it.	0	1	2	3
11) Shows panic (sweating, shaking, crying, screaming, anger, posture, etc.) for no apparent reason.	0	1	2	3
12) Has difficulty maintaining a stable emotional response for at least 30 seconds.	0	1	2	3

DYSREGULATION [DoD = (PO/36) x 100]			
Contexts	**OS**	**MOS**	**DoD**
Home		**36**	
School			
Rehabilitation Centre			
Other:			

Table 1 - The sum transcribed in the square with the highlighted sides of the Emotional Dysregulation Scale (EDS) for each context in which it was administered is reported in the column 'OS' (Obtained Score). The score is then divided by 36 (MOS: Maximum Obtainable Score) and multiplied by 100, and the result is transcribed in the column 'DoD' (Degree of Dysregulation).

This dysregulation can lead to intense emotional reactions out of proportion to the stimuli, making processing emotional experiences complex. The following formula can measure it:

$$DI = \left\{\left(\frac{\Sigma Q}{Z \times N}\right) \times R\right\} 100$$

in which:
- DI = Dysregulation Index;
- ΣQ = Sum of Obtained Scores (OS) on the Emotional Dysregulation Scale (EDS) in the contexts taken into consideration (School, Home, Rehabilitation Centre, Other);
- Z = 36 [Maximum Obtainable Score (MOS) on the EDS];
- N = Number of contexts in which the EDS was administered;
- R = Risk Coefficient (presence of inappropriate behaviour: Anger, Oppositivity, Motor Agitation, Self- and Hetero-aggressiveness, etc.), which is equal to '1' if the mean of the < DoD is ≥50 scores and to '2' if the mean of the DoD scores is 50.

The Emotional Dysregulation Index, by entering the values found by the EDS in the mathematical formula ID, is expressed with 4 'judgments': 'EXTREME RISK' of dysregulation if the score is equal to or greater than 80%, 'HIGH RISK' if it is between 50% and 79%, 'MODERATE RISK' if it is between 25% and 49% and 'LOW RISK' if it is less than 25% (Table 2).

The control of emotional dysregulation in subjects, such as the one presented in the example in Table 2, can be improved by adopting certain strategies, such as those listed below, which can help to reduce stress and improve the control of emotions:

1. ***Having emotional awareness***: learning to recognise one's emotions and accept them without judgment, trying to observe how they may influence one's thoughts and behaviour.
2. ***Practising mindfulness***: This practice allows one to **develop mindful attention** in the present moment, which can help develop self-awareness and improve the ability to regulate emotions.
3. ***Breathing deeply***: when you are at the mercy of your emotions, stop and take a few slow but deep breaths, which restore emotional balance.
4. ***Carry out pleasant and constructive activities***: take regular exercise or walks, enjoy relaxing hobbies, and find time to build a good social and friendship network.
5. ***Learn to express your emotions*:** train yourself to communicate your emotions clearly and respectfully, both to yourself and to others.
6. ***Do relaxation exercises*:** one can relax in many ways, such as taking a walk or a hot bath, listening to music, or practising one's hobby. You can also try specific techniques that provide a lasting sense of relaxation, such as meditation [39], autogenic training [40], or progressive muscle relaxation [41].

The choice of one of these strategies, or others, is always determined by the subject's competence (or functioning profile). After implementing the intervention for the control of Marco's emotional dysregulation, using, in a combined manner (strategies 2, 4, 5 and 6), the following form was administered for further confirmation of the ability to control emotions:

Emotional Self-Regulation Scale

Instructions. The rating of Emotional Self-Regulation is expressed with four scores: 0 corresponds to 'never' emitted behaviour; 1 corresponds to 'sporadically' emitted behaviour; 2 corresponds to 'sometimes' emitted behaviour; 3 corresponds to 'always' emitted behaviour.

Example: Marco a 25-year-old person with Asperger's disorder.

First, the GrD (Degree of Dysregulation) is calculated by reporting the values on the EDS:

DYSREGULATION [DoD = (PO/36) x 100]			
Contexts	**OS**	**MOS**	**DoD**
Home	**29**	**36**	**81**
School	**33**		**92**
Rehabilitation Centre	**28**		**78**
Other:			

into the following equation:

$$ID = \left\{\left(\frac{29+33+28}{36\times 3}\right)\times 1\right\}100$$

in which:
- ΣQ = Sum of Obtained Scores (PO) on the Emotional Dysregulation Scale (EDS) in the contexts taken into consideration (School, Home, Rehabilitation Centre, Other);
- Z = 36 [Maximum Obtainable Score (PMO) on the EDS];
- N = Number of contexts in which the EDF was administered;
- R = Risk Coefficient (presence of inappropriate behaviour: Anger, Oppositivity, Motor Agitation, Self- and Hetero-aggressiveness, etc.) which is equal to '1' if the mean of the GrD scores and to '2' if the mean of the GrD scores 50.

Obtaining:

$$ID = \left\{\left(\frac{29+33+28}{36\times 3}\right)\times 1\right\}100$$

ID = 83%

this result is to be compared on the scale of Tab. 1, from which it can be deduced that Emotional Dysregulation is of 'EXTREME RISK' and that the subject may, sooner or later, manifest dysfunctional behaviour (anger, rage, self-harm, etc.).

Table 2: Example of the application of ID calculation for the assessment of Emotional Dysregulation.

01) Accepts the 'interference' of others during a pleasurable activity.	0	1	2	3
02) Performs what is asked of him and completes it.	0	1	2	3
03) Carries out a task for at least 10' even in the presence of disturbances or distractions.	0	1	2	3
04) Changes activity, if asked, without protesting (crying, self- or hetero-aggressiveness, etc.).	0	1	2	3
05) Easily adapts to new situations.	0	1	2	3
06) Controls his emotionality without emitting maladaptive behaviour (stereotypies, compulsivity, etc.).	0	1	2	3
07) Spends at least two minutes analysing a new task before starting it.	0	1	2	3
08) Corrects his performance errors without getting angry.	0	1	2	3
09) Tolerates frustrating situations (failures, taking away a game, scolding, etc.).	0	1	2	3
10) Persists in a task, to the point of finishing it, even if he encounters difficulties.	0	1	2	3
11) Accepts delays (at least 3 minutes) in the delivery of what he wishes to have as soon as possible.	0	1	2	3
12) Relaxes (listens to music, lies down on the bed, etc.) if he feels tense, tired or agitated.	0	1	2	3

SELF-REGULATION [DoS = (PO/36) x 100]			
Contexts	**OS**	**MOS**	**DoS**
Home		**36**	
School			
Rehabilitation Centre			
Other:			

Table 3: The sum transcribed in the square with the highlighted sides of the Emotional Self-Regulation Scale (ESS) is reported in the 'OS' (Obtained Score) column and then divided by 36 (MOS: Maximum Obtainable Score) and multiplied by 100, the result is transcribed in the 'DoS' (Degree of Self-Regulation) column, which is expressed with 4 'judgements': 'EXCELLENT' if the score is 80% or higher (must be maintained over time), 'SUFFICIENT' if it is between 51% and 79% (must be improved to 80%), 'POOR' if it is between 25% and 49% (must be enhanced to reach the next cut-offs) and 'INEXISTENT' below 25% (must be fully taught). The final DoS score is always calculated by averaging the scores in the contexts where the assessment was made.

Marco's DoS was 73% (average DoS scores in all contexts where the assessment was made), which is a clear improvement in emotional control compared to the Dysregulation Index. Still, more control strategies are needed to reach the 80% DoS criterion (EXCELLENT).

Conclusions

Emotional dysregulation has a significant impact on the long-term quality of life of people with ASD. Anxiety, distress, explosive behaviour and maladaptive are effects that are most often found in these individuals if left untreated.

The inability to manage and recognise one's own emotions is at the root of these difficulties. This paper presented a way of assessing Emotional Dysregulation by determining a measure of it: the Dysregulation Index and of Emotional Self-Regulation after an intervention, in casework, on emotional control. Even though this intervention was tested on only 47 cases of different ages and with different functioning profiles, it guaranteed a significant improvement in the quality of life of people with ASD and emotional dysregulation problems. Further interventions with a larger number of users would probably provide more generalisable data and bring out other aspects that may not have emerged in the cases treated.

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