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# Humor(lessness) elucidated – Sense of humor in individuals with Autism Spectrum Disorders: Review and Introduction

**Keywords:** humor, laughter, positive psychology, Autism Spectrum Disorder, Asperger's syndrome

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## 1 Introduction

Humor is a crucial component in many different contexts of everyday life. Humor can be seen as social “glue” that helps to foster relationships, it relates to positive functioning, enhances quality of life, and is important for life satisfaction (see Martin 2007; Ruch 2008). Humor has adaptive functions, as have been shown in numerous studies of humor's impact on inter-personal relationships and intra-personal emotional functioning. However, there seems to be a population that encounters difficulties with humor. In 1944, Hans Asperger described humorlessness to be one of the characteristics of individuals with Asperger's syndrome (AS) or – in a broader sense – individuals with Autism Spectrum Disorders (ASD):

An essential characteristic of these children is their humorlessness. They do not understand jokes, especially when they are targeted at themselves. . . . They are unable to be cheerful in a relaxed manner and do not understand the world in a peaceful way which is the basis of genuine humor. If they are occasionally in a cheerful mood, this often appears awkward to others: overreaching, distorted, excessive: they jump and rampage about the room, lose their sense of distance, annoying, aggressive. Only in one sense they are often very competent, inventive even: in wordplay, beginning with verbicide, effects resulting from similarities in sound, and going to very sharply formulated, really clever and witty sentences. (127)

The goal of this special issue is to gain a better understanding of humor in individuals with ASD. One initial important question is why is it relevant to examine humor in individuals with ASD? First, it will help us to better understand humor and positive emotions in ASD, a disorder in which certain components of cognitive, emotional and social functioning are impaired. If we know which

components of humor are specifically affected in ASD, humor tests could potentially ameliorate the characterization of ASD. Second, it will allow us to use ASD as a model to learn more about humor. If we understand which social, cognitive, and affective deficits in individuals with ASD are associated with particular difficulties in processing and expressing humor, this will help us to understand better the components and abilities that contribute to (a good sense of) humor in typically developing individuals. Research in a population that is assumed to encounter difficulties in humor can help to illuminate these phenomena. Therefore, the potential benefit of this type of research is bidirectional: humor processing deficits might help to better understand autism, and ASD can serve as a model for understanding humor.

## 2 A short introduction to Autism Spectrum Disorders

Autism Spectrum Disorders (ASD) circumscribe a group of complex neural developmental disorders that affect mainly social interaction and communication and restricted and repetitive behavior with an early onset before a child is three years old (APA 2000). Around 1 of 88 children in the United States is nowadays identified as to be on the spectrum with five times more boys affected than girls (CDC 2008). ASD include several disorders such as autistic disorder, Rett syndrome, childhood disintegrative disorder, pervasive developmental disorder-not otherwise specified (PDD-NOS) and Asperger's syndrome (AS; it has to be noted that the new DSM V will not differentiate between subtypes anymore). Asperger's syndrome is one of the disorders characterized through preserved linguistic and cognitive development. However, it is questionable whether AS is distinct from high-functioning autism (HFA), which is, in contrast to low functioning autism, characterized through average or above average intelligence (Klin 2006).

Several theories and models attempted to explain the core symptoms of ASD, such as the mirror neuron system theory, which hypothesized deficits in the neural networks that are involved in imitation (Williams et al. 2001). This is in line with the approach that individuals with ASD have a deficit in Theory of Mind and therefore have difficulties in ascribing mental states to themselves and others. This is likely to be related to alexithymia, the difficulty of identifying and describing own emotions, which is very common in ASD (e.g., Berthoz and Hill 2005). Others postulated that the core deficits relate mainly to difficulties with executive function (e.g., Russell 1997), such as the Theory of Weak Central Coherence proposed, for example, by Frith (1989). It predicts that individuals with ASD have

difficulties bringing together complex information and tend to focus rather on details than on the coherent whole (local bias). In addition, Baron-Cohen (2009) assumed that autistic brains do naturally more often “systemize” and find it difficult to “empathize”.

It can be assumed that several of the affected domains in ASD might be related to humor appreciation and production. However – as will be clarified later – it is not very well understood yet which domains of the core symptoms of ASD are related to which humor components, and to what extent.

### 3 Components and functions of humor

When we talk or write about humor, we must ask how humor can be understood and defined. So far, there is no all-encompassing definition of humor and no one single test or instrument exists that would be able to cover all facets of humor (Martin 2007; Ruch 2008). The research over the past few decades demonstrates that humor has to be understood as a multi-faceted, heterogeneous phenomenon that spans from simpler types of humor to more complex types. Processing pre-fabricated jokes (or one of their simplest forms: verbal puns) and cartoons that are supposed to evoke exhilaration or mirth might be less challenging than the situational, context-dependent and spontaneous creation of funny remarks that are intrinsic to active wit. Coping humor intended to regulate emotions requires the ability to use humor even in the face of negative life circumstances to cheer up one's own or other people's mood. The ability to remain in a cheerful state and to see positive aspects of life even in the face of adversity is highly adaptive and might be one of the most complex, advanced forms of humor. If this form of humor is used not only occasionally, but on a habitual basis, it taps into humor as a temperament or personality trait, a habitual frame of mind, a humor style, and a worldview. This comes close to what Hans Asperger (1944) described as “genuine humor”.

One cognitive component that is involved in all forms of humor is the process of resolving incongruities, i.e., bringing together initially contradictory information (e.g., Suls 1972). This holds not only for understanding pre-fabricated jokes, but also for finding, for example, positive aspects in negative situations. In addition, playfulness – as a non-serious attitude or state of mind – might be relevant to many forms of humor (McGhee 1999), especially active creation, in which someone is not simply reproducing jokes and witty comments, but is able to see the positive side of life in a humorous way.

Since humor can be related to many different concepts, it is crucial to define beforehand what a researcher is focusing on. In many studies humor was

assessed through the presentation of jokes and cartoons or other humorous stimuli. Using this approach, paradigms were developed in relation to pure joke processing, such as choosing the correct joke ending when presented with several endings (see Emerich et al. 2003) and rating different types of humor stimuli that differ in structure (incongruity-resolution versus nonsense jokes, e.g., Ruch 1992). However, in the field of humor research, many instruments were developed that tap into the different domains of humor that go beyond joke processing in order to assess more diverse concepts related to humor. For example, certain instruments assess different mood and mind states that affect the susceptibility to humor (cheerfulness, seriousness, bad mood: Ruch et al. 1996, 1997), while others focus on different humor styles (Martin et al. 2003), or different humor behaviors (e.g., socially cold or warm humor, Craik et al. 1996).

In addition to the positive functions of humor that were previously described, it should be mentioned that there is a negative, dark side of humor. For example, humor and laughter can be used as a means to put other people down. The emotional consequences of being laughed at were recently explored in studies that evolved around the fear of being laughed at (gelotophobia, e.g., Ruch 2009). Whether good or bad in nature, understanding humor in a disorder such as autism could help improve the quality of life by enhancing humor competences in ASD. These might facilitate interactions with or among individuals with ASD or even simply increase awareness of the difficulties that individuals with ASD might encounter with humor in their daily lives.

## 4 Literature overview

Over the last three decades, about a dozen case reports and empirical studies have examined the existence and nature of humor in individuals with ASD. One of the earliest approaches reported that individuals with ASD enjoy slapstick comedy and simple jokes and that mildly autistic adults have a good but not very subtle sense of humor (Everard 1976; Ricks and Wing 1975). In one case report, a female with high functioning autism was able to produce puns, jokes, neologisms and word play. She even used riddles, sarcasm and irony, and was able to tease others – all concepts related to humor (Werth et al. 2001). In addition, several empirical investigations have shown that certain forms of humor exist in individuals with ASD. According to Van Bourgondien and Mesibov (1987) the jokes told by high-functioning autistic adults, such as jokes based on lexical or phonological incongruities, are on a lower humor stage than the individuals' actual age would imply. Also, St. James and Tager-Flusberg (1994) and Jones (2009) found that children with autism produce and appreciate humor to a limited extent in

naturalistic settings: specifically, they employ and understand simpler forms of humor such as humor based on rhyme, slapstick and funny sounds. In line with this, children with autism enjoy being tickled and they also enjoy slapstick humor (Reddy et al. 2002). Interestingly, these findings are consistent with Hans Asperger's observation that certain types of jokes are understood and appreciated.

However, the question remains as to why certain forms of humor cannot be enjoyed or understood by individuals with ASD and what the nature of these forms of humor is. For example, Reddy et al. (2002) showed that children with autism do not laugh at jokes that are based on socially inappropriate acts. Baron-Cohen (1997) found that children with autism were less able to understand another person's *intention* to joke. This hints at the possibility that individuals with ASD do not understand or enjoy certain forms of humor due to social cognitive deficits. One recent study confirmed that individuals with ASD and typically developing participants similarly enjoyed visual puns and semantic cartoons, but individuals with Asperger's syndrome (i.e., one of the autism spectrum disorders) had a diminished understanding and enjoyment of Theory of Mind cartoons – cartoons in which it is necessary to take into account other people's (false) mental states in order to understand the joke (Samson and Hegenloh 2010).

In addition to social cognitive deficits, there seem to be other cognitive components that affect humor processing in individuals with ASD. Two studies used a classical paradigm to test cognitive abilities related to humor by presenting jokes or cartoons with different possible endings. Participants with ASD chose the correct funny ending less often (Emerich et al. 2003; Ozonoff and Miller 1996). This suggests that cognitive inflexibility or weak central coherence might hinder their ability to understand jokes correctly and therefore to choose the correct ending (see Lyons and Fitzgerald 2004). Moreover, Samson and Hegenloh (2010) demonstrated that individuals with ASD have a more detail- and reality-oriented processing style, which leads them to concentrate on non-joke relevant details and lessens their engagement in playful, humorous behavior.

In addition to studies that have focused on processing of different humorous stimuli, one recent study focused on humor-related self-assessment scales. The study showed that adults with ASD remembered being teased in their childhood and youth more often than controls. There was a remarkably high percentage of gelotophobes, people who fear being laughed at, among the individuals with ASD (45% versus 6% in the control group). Moreover, individuals with ASD scored lower on gelotophilia (the joy of being laughed at), but did not differ on katagelasticism (the enjoyment of laughing at others), which is a more hostile form of humor (Samson et al. 2011).

To conclude this literature review, one study must be discussed that demonstrated the effect of humor training in six high functioning children with autism.

The authors were able to show an increase in the children's understanding of multiple-meaning words and could even show the effect of the training on the ability to answer riddles, which the children had not previously exhibited (Gill et al. 2011). Despite the methodological pitfalls of the study, this is an interesting approach that reveals great potential and flexibility in our capacity to enhance the comprehension of humorous material in children with autism.

#### **4.1 Related concepts to humor: Positive emotions, smiling and laughter**

In order to understand the phenomenon of humor in ASD, it seems important also to discuss related concepts such as positive affect in general, laughter, or reward processing, all of which may have relevance to humor. A few studies have focused on positive emotions in individuals with ASD. While a recent study showed the same level of self-reported positive affect in adults with ASD (Samson et al. 2012), most of the studies found a reduced level of positive affect and expression in those individuals (Kasari et al. 1990; Dawson et al. 1990; Snow et al. 1987). However, this might be related to the fact that these studies focused mostly on positive affect in social interactions. They found fewer positive emotions in social interactions, fewer joint positive emotions (not necessarily less positive emotions in general), less partner-oriented positive affect, but more object-oriented positive affect (in relation to toys) in individuals with ASD. Jaedicke et al. (1994) hypothesized that positive emotions in ASD are evoked by sources other than social interaction. This is in line with recent findings that demonstrated that children with ASD seem to produce fewer smiles during social interactions (e.g., Dawson et al. 1990; Joseph and Tager-Flusberg 1997; Yirmiya et al. 1989).

Hudenko et al. (2009) analyzed laughter acoustics in social interactions in children with autism. Their findings showed that children with ASD did not laugh less frequently in general, but laughed only to express genuine positive internal states. In other words, they expressed “voiced” laughter more often, instead of using laughter as a social communication tool (“unvoiced” laughter is more often associated with social functions as a means to “negotiate” social interactions: see Bacherowski et al. 2001). Interestingly, laughs from children with ASD were more liked by others than laughs from control children, probably given the nature of ASD laughter to express genuine enjoyment instead of expressing social motivations to influence others (Hudenko et al. 2012).

General reward processing might also be related to humor. Several papers found atypical responses in ASD to reward cues (e.g., Dawson et al. 1998, 2001), which were also shown in brain activity assessed by electroencephalography

(Kohls et al. 2011) or functional Magnetic Resonance Imaging (Schmitz et al. 2008). If individuals with ASD process reward cues differently, it might have an impact on the motivation to attend to reward signals, for example in social interaction (Kohls et al. 2011), as well as an impact on the domain of humor. However, this relationship has not been investigated yet.

## 5 The present special issue

The present special issue on humor in individuals with ASD presents a variety of studies that focused on humor in children and adults with ASD. Different methods and tasks were employed to shed more light on the world of humor in individuals with ASD. One study took the traditional approach using humorous stimuli (movies) to address humor appreciation, while two studies on adults with Asperger's syndrome and High Functioning Autism used self-assessment scales to better understand humor facets. One of these studies examined humor as a character strength in relation to other concepts in the domain of Positive Psychology.

**David Rawlings** examined the relationship between autistic traits in a non-clinical population, assessed with the Autism Spectrum Quotient (AQ, Baron-Cohen et al. 2001), and funniness and aversion ratings in six different humor categories (violent and non-violent: [i] jokes, [ii] events that happened to others, and [iii] events that happen to the self). The study presented evidence that AQ scores correlated with aversive reactions towards humorous situations that involve other people as well as humorous situations that involve the self. No correlation between the scores on the AQ subscales (social skills, attention switching, attention-to-detail, communication, and imagination) and the funniness ratings of pre-fabricated jokes were found. The strongest associations were found between the “attention shifting” subscale and aversion to humorous non-violent events involving self and others. This might be related to the fact that individuals with autistic traits engage less in spontaneous humorous behavior (see Samson et al. this issue). A closer look at the correlations revealed that items assessing the avoidance of novelty, the unexpected and the unpredictable seem to be related with negative reactions to humorous events. Additionally, the finding seems to be in line with the fact that individuals with ASD have a more reality oriented processing style in the humor domain (Samson and Hegenloh 2010).

**Weiss et al.** presented short film scenes from the animated movies *Ice Age* and *Madagascar* to 24 male children with Asperger's syndrome and 24 age-matched typically-developing participants to test the hypothesis that simple forms of humor are processed and appreciated on a similar level in both groups. The film scenes were carefully selected and piloted, and represented merely



language-free slapstick humor for which it was not necessary to attribute (false) mental states to others to understand the humorous elements. The humorous elements were simple and the jokes could be understood independently of Theory of Mind abilities, inferential demands and language abilities. Not surprisingly, the funniness experience and outward behavior in children with Asperger's syndrome were comparable to controls. However, they were less able to discriminate between non-humorous and humorous stimuli. Another very intriguing finding of this study was that the subjective experience of individuals with Asperger's syndrome was less coherent to their outward emotional expressions. Incoherence between expression and experience of mirth can contribute to the impression that individuals with Asperger's syndrome are less humorous.

**Samson, Huber and Ruch** utilized reliable self-assessment questionnaires in individuals with ASD and a control group to test Hans Asperger's observations on humor in a broader sense. In almost all scales and subscales, differences were found between individuals with ASD and the control group. Individuals with ASD were best described as low in cheerfulness as a mood trait and high in seriousness as a habitual frame of mind. Moreover, they had a low affiliative humor style, used more socially cold and more benign humor, used humor less as a form of entertainment and fun, and finally, they preferred simpler humor (incongruity-resolution) to more complex (nonsense) forms of humor (in line with Rawlings, this issue). This is the first study that focused on many different facets of humor in order to address Hans Asperger's observations on humor and cheerfulness in individuals with ASD. From this study, it can be concluded that in addition to difficulties in social cognition (e.g., Theory of Mind and social communication), mood traits, mind sets (low cheerfulness, high seriousness) and a reality-oriented processing style affect humor in individuals with ASD and impact individuals' susceptibility to humor.

**Kimmo Eriksson** examined the association between humor styles assessed with the humor styles questionnaire (HSQ, Martin et al. 2003) and autistic traits assessed with the AQ (Baron-Cohen et al. 2001) in a general population (N = 600). While the AQ, as well as the sub-scale "poor social skills", were linked to low scores on positive humor styles (self-enhancing and affiliative humor styles), but unrelated to negative humor styles (self-defeating and aggressive humor styles), the author found differential patterns for some of the sub-scales of the AQ: "poor mind-reading" was associated with lower scores on positive humor styles and higher scores on negative humor styles. Interestingly, "attention to details/patterns" stood out with an exceptional pattern: it was associated with higher scores on all humor styles. The author discussed possible reasons for this (e.g., the ability to spot things that are potentially funny, specific pattern recognition, and the association of attention to detail and openness to experience).

**Samson and Antonelli** presented self-report data on humor as a character strength in relation to life satisfaction and orientation to happiness in 33 adults with Asperger's syndrome (AS) and gender-, age-, and education-matched controls. Humor assessed with the Values in Action Inventory of Strengths (VIA-IS, Peterson et al. 2005) is closely related to what Asperger (1944) described as "genuine humor": positive, social, spontaneous, and benevolent in its nature. While humor is a highly valued trait in typically developing participants (e.g. Müller and Ruch 2011), it does not seem to play an important role in individuals with AS. Although humor was related to life of pleasure as one way to reach happiness, it was not related to life satisfaction, life of meaning, or life of engagement. This is in sharp contrast to the multiple findings that the enjoyment related to most jokes and cartoons is relatively intact (if more complex, social processes are not involved). However it is necessary to remember that humor is much more than appreciating pre-fabricated humorous stimuli.

## 6 Conclusion

This special issue brings together the latest research on humor in ASD and is representative of the enormous progress that has recently been made in understanding the phenomenon of humor in the context of ASD. In addition, the special issue highlights the role and utility of a multi-method approach for understanding the heterogeneity of humor (from very simple to more complex forms) and humor in ASD.

From the papers presented in this special issue and previously published studies, humor in ASD is becoming increasingly better understood. Individuals with ASD are able to appreciate humor stimuli such as jokes and cartoons, if they are not too complex or if they do not require the attribution of (false) mental states to the characters. This seems to be in line with Hans Asperger's observation that individuals with ASD are able to understand simple jokes (e.g. wordplays). However, we have to question how closely related the assessment of joke and cartoon appreciation in a "protected" environment such as an experimental setting (in which it is usually evident that the aim of the experiment is to examine humor) is to genuine humor and flexible, spontaneous humorous responses in daily life. This differentiation might explain the discrepancy between the studies that focused on simple joke and cartoon processing and the studies that focused on humor in a social context or assessed various humor-related aspects with self-assessment questionnaires. The next few paragraphs will discuss how stimulus characteristics, task requirements and symptom severity in different domains may affect humor in ASD.

*The influence of stimulus characteristics.* As reviewed above, simple verbal and visual jokes seem to be understood without any difficulty in individuals with ASD. However, as soon as the jokes become more complex or require the attribution of (false) mental states to the characters portrayed in it, difficulties emerge (Samson and Hegenloh 2010). Previous studies emphasized the importance of Theory of Mind in at least certain forms of humor (e.g., Gallagher et al. 2000; Howe 2002; Jung 2003; Samson 2012). Therefore it is important to consider stimuli characteristics and requirements related to social cognition, when examining humor in ASD.

One characteristic of humorous stimuli is how violent and aggressive they are. Hans Asperger (1944) claimed that the humor of individuals with ASD is more aggressive and without appropriate distance to others. However, this observation cannot be confirmed thus far. Most of the studies found no evidence that individuals with ASD have a more hostile sense of humor (Rawlings, this issue; Samson et al. 2011, this issue). However, poor mind reading skills were associated not only with lower positive styles of humor, but also higher negative humor styles (Eriksson, this issue). One possible explanation for this is that poor mind reading skills lead to the insensitivity to read other people's emotions after using more aggressive humor, as discussed in Samson et al. (2011).

*The influence of task requirements.* It seems to make a difference whether the dependent variable is just a simple comprehension or appreciation response or whether participants have to choose between different joke endings (Emerich et al. 2003; Ozonoff and Miller 1996). The latter approach seems to be more challenging and might reveal more difficulties in individuals with ASD possibly due to difficulties in cognitive flexibility (e.g., Frith and Frith 2003). In addition, letting participants *explain* how they understand a joke, reveals differences not only in quantitative humor processing (i.e., level of appreciation), but also in qualitative humor understanding (Samson and Hegenloh 2010). Differences, such as a more detail- and reality-oriented processing style, that might remain undetected in simple comprehension and appreciation ratings can be revealed by this approach. However, it has to be mentioned that under certain circumstances, attention to detail is positively associated with various humor styles (see Eriksson, this issue). One possible reason could be that if one has exceptional abilities in detail-oriented processing, but other autistic domains such as social skills are preserved, detail orientedness could be an advantage in terms of humor processing. However, this warrants further investigation.

Using self-assessment scales to examine various components of the sense of humor, humor styles, humorous behavior, etc., broadens the possibilities of understanding humor in a certain population. Of course this approach is limited in low functioning individuals with ASD or in very young participants due to limitations

in reading/comprehension skills. In addition, difficulties related to the understanding of one's own (emotional) states (i.e., alexithymia: Szatmari et al. 2008; Tani et al. 2004) might limit the ability to respond to self-assessment scales. However, self-assessment seems to be possible in individuals with ASD (see Berthoz and Hill 2005) and previous studies on humor that used questionnaires seemed to be successful (Samson et al. 2011, this issue; Samson and Antonelli, this issue).

Additionally, the involvement of social context seems to be a crucial factor. If researchers focus on humor in social interaction and social communicative aspects (e.g., Baron-Cohen 1997; Reddy et al. 2002; Samson et al. this issue) differences between ASD and typically developing individuals become evident. Emotional expressions can be understood (at least partially) as a means of communicating inner feelings. The incoherence of emotional response systems (experience of amusement, expression of smiles and laughter, Weiss et al. this issue) could be attributed to the fact that the social communicative function of emotions is disrupted in ASD.

*The influence of symptom severity in various domains.* Individuals with ASD are characterized by difficulties in the domains of social communicative aspects, cognitive flexibility and language and also exhibit a weak central coherence, repetitive behavior and sensory issues (APA, 2000; Frith and Frith 2003). Diminished cognitive flexibility and difficulties in social cognition and Theory of Mind have been previously discussed in relation to humor (see Lyons and Fitzgerald 2004). In addition, difficulties in imagination, stereotyped behavior, resistance to change and restricted interests and deficits in spontaneous pretend play (e.g., Wing and Gould 1979) most likely influence humor processing and the overall sense of humor. However, previous studies have not investigated symptom severity in these different domains in relation to humor. The paper by Rawlings (this issue) might be seen as the first approach to combine humor with the avoidance of unpredicted and novel information in relation to ASD.

In the beginning of this paper, it was suggested that investigating humor in ASD is fruitful as it can tell us something about the disorder, as well as something about humor in general. Indeed, the clinical observations are helpful as they facilitate our understanding about some of the fundamentals of humor. This line of research strengthens the claim that humor is a multi-faceted phenomenon that encompasses simple (e.g., the understanding of pre-fabricated jokes and cartoons) and complex forms such as humor as an emotion regulation strategy, coping skill, or as a worldview. In addition, we have learned the importance of various cognitive, emotional and social components in understanding humor and in developing a good sense of humor. Cognitive flexibility, Theory of Mind, social communicative aspects, emotional components (cheerfulness) and playfulness (as opposed to seriousness) as a frame of mind affect humor, especially

more complex forms. Future research should examine the degree and extent to which these components affect humor.

On the other hand, research on humor and laughter can give us important information about characterizations and aspects of ASD. Apparently the basic cognitive processes that underlie humor (e.g., incongruity-resolution) are not affected in individuals with ASD. If the humorous stimuli are controlled for social cognitive aspects (Theory of Mind), individuals with ASD understand these stimuli in ways that are comparable to that of the control group. However, social communicative aspects (e.g., affect sharing) seem to be diminished, and these deficits persist in the domain of humor. Cognitive restraints related to cognitive flexibility and Theory of Mind, and even seriousness as a frame of mind, hinder individuals with ASD in their ability to frequently engage in humorous behavior. Whenever humor, understood as cartoon and joke processing, seems to be intact, concepts related to more complex forms of humor (humor as character strength, mood state, frame of mind, humorous behavior, and certain humor styles) seem to be more affected. In the words of Hans Asperger, these types of humor would designate “genuine humor”.

## 7 Outlook

Even though research on humor in ASD has expanded over the past three decades, there are still open fields to explore and examine. For example, it would be interesting to shed more light on the relationship between the various domains that are affected in ASD and humor. ASD is a heterogeneous disorder and it is not clear how the severity of the different core deficits is related to humor. With the information that will hopefully be provided by future studies, it will be possible to come up with a model that explains the interrelations between symptom severity and the various domains in humor.

One area that has been neglected so far is how diminished pretend play and less imagination in children with ASD (e.g., Williams 2003) are related to humor. Most of the studies up to the present have focused on humor processing, but almost none of them has examined humor production in the laboratory or in everyday life. One way to do this would be with the experience sampling method in which the participant notes and explains several times over a certain time period in which he used humor. Another approach would be to ask individuals with ASD what their favorite jokes are or what makes them most amused, in order to understand why individuals with ASD seem to laugh more frequently in inappropriate situations or without obvious stimuli (see Reddy et al. 2002). Another possibility is an analysis of the types of humor distributed by the autistic community in the

Internet. One additional question is whether individuals with ASD are able to laugh at themselves (Beermann and Ruch 2011) or whether they use humor as an emotion regulation strategy (Samson and Gross 2012), both of which seem to be crucial parts of “genuine humor”. Whether individuals with ASD are less able to suppress laughter (Robbins and Vandree 2009) is related to emotion and self-regulation, in which individuals with ASD seem to experience difficulties (Laurent and Rubin 2004). Studying laughter suppression and self-regulation of emotion would further facilitate an understanding of humor in ASD.

Since individuals with ASD seem to be less cheerful and more serious (Samson et al. this issue), it might be worth exploring whether these individuals would benefit from cheerfulness trainings and interventions (e.g., Papousek and Schultze 2008). This might not only lead to increasing their susceptibility to humor, but also to more positive emotions and higher life satisfaction among individuals with ASD. One important question, which future studies will hopefully answer, is what actually leads to higher life satisfaction in individuals with ASD, since the study by Samson and Antonelli (this issue) barely found any relation between life satisfaction and character strengths or orientations to happiness. Understanding what factors contribute to life satisfaction and how to increase the effects of these factors on life satisfaction among individuals with ASD is a crucial question that holds a great deal of potential for possible treatments.

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## Bionote

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