# ASPERGER AUTISM AND IRONY: A PERCEPTION EXPERIMENT

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## ABSTRACT

One of the frequently cited characteristics of individuals with autism spectrum disorders (ASD) is their alleged inability to detect verbal irony. The purpose of the present study was to test this claim. We studied 13 male adolescent patients who had been diagnosed with Asperger autism and who were all living in an institution. They were asked to rate a total of one hundred single-word utterances as "serious" or "not serious". Given the brevity of the stimulus material, this task can be regarded as extremely difficult. Stimuli were taken from a previous experiment so that perception rates for typically developed controls existed.

The Asperger patients turned out to be significantly better at identifying sincere statements than the controls were, whereas the latter were more successful at identifying sarcastic utterances, this difference falling short of significance, though. Possible reasons for these results will be explored.

**Keywords**: Asperger autism, irony, sarcasm

## 1. INTRODUCTION

This contribution deals with two concepts which are highly controversial: autism and verbal irony. Firstly, there is no such thing as "the" autistic patient. There is general agreement that just about every case of autism spectrum disorder (ASD) is different [5]. A general distinction can be drawn between "high-functioning autism" (HFA) and "low-functioning autism" (LFA), the former being characterized by special gifts and the latter by a minimum of social interaction, [5]. The present study deals with HFA only, which still cannot be taken to imply group homogeneity.

The second variable is verbal irony. In most research, a defining element of verbal irony is considered to be a difference between what is said and what is meant [8, 22], sometimes narrowed down to saying the opposite of what is meant, cf. e. g. [19]. While this is generally correct, there are exceptions to this divergence. For example, someone who has just been in a car accident after having had a few beers in addition to being on medication might try to avoid further police investigation by replying "Yes, of course, and I also popped a few pills" in an ironic tone of voice to police questioning him. This could be called "fake irony", cf. [6, 13], where the content is factually correct, but the ironic tone of voice is used as a cover-up. While this is admittedly an exceptional case of irony, it nonetheless demonstrates that verbal irony is a phenomenon which is not easily described.

When talking about verbal irony, one important distinction has to be made: the one between sarcastic irony and kind irony. Sarcastic irony is the more frequent realization of ironic behaviour [15]. It consists of blame by praise, i.e. an outwardly positive remark like "great" is intended to signal a negative attitude. The opposite is true for so-called kind irony. Here, an outwardly negative utterance is intended as praise, as e.g. in "nonsense!" as a reaction to a very flattering toast. Previous studies have demonstrated that these two kinds of irony are signalled differently by speakers, cf. e.g. [3, 23].

As far as sarcasm is concerned, most researchers have found the ironic stimuli to be slower, lower-pitched, and more monotonous than the sincere ones [11, 21, 19, 3, 8, 4, 16, 22, 10]. On all parameters except tempo, though, there is some degree of disagreement, e.g., Schaffer [20] finds an increase in mean F0 and melodiousness for sarcasm. Results on intensity are mixed as well. Whereas Rockwell [19] and Scharrer et al. [22] describe an increase, some authors find reduced intensity in sarcastic utterances, e.g. Schmiedel [23] and Cheang and Pell [8] find no difference.

Kind irony, on the other hand, was found to be signalled by a longer duration, a higher voice pitch and melodiousness (measured in terms of mean fundamental frequency and its standard deviation) as well as a higher intensity as compared to sincere utterances [3, 23]. Those results suggest that it is not so much the difference between sincerity and irony which is signalled, but instead the underlying sentiment of the speaker [2, 6].

Perception studies have shown that ordinary listeners are able to identify sarcastic utterances well above chance, cf. e.g. [19, 13, 20, 9, 7, 17]. This even applies to very short stimuli (one word consisting of a maximum of two syllables) [16, 23]. The latter found average recognition rates of 69%. Recognition rates for kind irony were found to be slightly, but not significantly, above those for "classical" sarcasm [23].

As opposed to "typically developing" (TD) controls, Asperger patients are said to have problems

recognizing irony [14] and to take every utterance literally instead. This is supposedly related to their having a limited ability to empathize. Adachi et al. [1] even propose to use this as a differential diagnostic criterion for distinguishing attention deficit/ hyperactivity disorder (ADHD) from autism. The inability to process verbal irony forms part of textbook knowledge about ASD [5]. On the other hand, vehement opposition to this claim has been formulated by Gernsbacher and Pripas-Karpit [12]. They argue that the control groups were often ill-chosen and that in fact Asperger patients did not have any more problems with verbal irony than comparable TD subjects.

An interesting aspect which might help to explain the contradictory findings was discussed by Wang et al. [24] They studied the influence of contextual information vs. vocal cues only on the correct recognition rates in youths with ASD. They found that while their ASD patients performed significantly worse than the controls when prosodic as well as contextual information was available, their results did not differ significantly from those of the TD group when only vocal cues were present. Functional MRIs of the ASD group showed an increased activity in the temporal regions of the brain particularly when they were rold to focus on the tone of voice, indicating that they had to work harder on irony detection than TD youths. The authors interpret their findings as a weakness on the part of the TD subjects in the context-absent condition rather than a strength of the ASD patients and still maintain that ASD subjects "were interpreting the intended meaning of utterances in a more effortful manner […]" p. 941. Pexman et al. [18] found that high-functioning autism (HFA) children were as good as TD children at identifying sarcasm, however, they took longer to make their decisions. They take this as an indication of different processing strategies. Zalla et al. [25] also found ASD listeners to be able to decode sarcasm but somewhat worse than TD subjects.

The present contribution aims at studying the alleged disability of ASD patients in even shorter utterances than Wang et al. [24], i.e. based on single-word utterances comprising two syllables at the most. We asked the following research questions:

- Are HFA patients able to recognize sarcastic single-word utterances at a better-than-chance level?

- Are they able to identify these utterances at a level which is comparable to that of TD listeners

- In view of the fact that the time span which ss. had spent in the institution, undergoing some training, differed considerably (see 2. below), a third question was added: Is there a correlation between the time spent in institutional care and the listening performance?

## 2. MATERIALS AND METHODS

A total of 13 juvenile male patients who had been diagnosed with HFA were studied. They were 16.1 years old on average with a range from 13 to 21 years. All of them were living in an institution at the time of the experiment. They had been living there for a time period of 0;4 to 5;8 years. Eleven reported to be right-handed, and two were left-handed. The second author was working at that institution at the time of the experiment and therefore succeeded in securing the subjects' cooperation.

One hundred single-word utterances consisting of a maximum of two syllables each were used as materials. Stimuli were taken from a previous study [23]. Given the claims made in the research literature about the inability of Asperger autists to recognize irony, the authors chose to use sarcastic (blame by praise) stimuli only and leave kind irony (praise by blame) aside. This was decided because sarcasm is the "classic" case of irony and it was therefore assumed to be easier to handle for the Asperger patients than kind irony or even a mixture of the two.

In view of the fact that the Asperger youths tended to have a limited attention span, it was decided to (a) only use part of Schmiedel's [23] stimuli and to (b) split up the recognition experiment in several small chunks.

The stimuli had been recorded by presenting speakers with a number of scenarios which suggested a serious or sarcastic use of a word containing a maximum of two syllables. An example:

- Paul and Paula are going out to dinner. Paul (after looking at the menu): "Oh look, they've got your favorite pasta!" Paula: "Tasty!" [sincere]

- Paul and Paula are going out to dinner. Paul (after looking at the menu): "Oh look, they've got frog's legs and snails. How does that sound?" Paula: "Tasty!" [sarcastic]

In order not to make the task too difficult for the autistic listeners and risk frustrating them, a subset of 100 stimuli were selected from Schmiedel [23]. They were the ones produced by the five female speakers which had received the highest overall recognition rates in that study. Only female speakers were included in order to avoid distraction caused by changes in speaker sex during the listening experiment.

Subjects were tested individually wearing headphones and on four separate occasions with 25 stimuli each time within a total time span of three days. They were instructed to decide whether or not the speaker they were about to hear "really meant

what she said" ('*meinte es ernst*') when she uttered the word in question. This wording was chosen in order to approach as closely as possible their everyday experience. The 44 listeners analyzed by Schmiedel [23] served as controls in the present study. They were mostly young adults with an average age of 28.8 years[1].

Results were then compared to those of the controls. Statistical analyses were carried out using the SPSS software package, version 25.

The stimuli had been subjected to acoustic analysis in order to identify differences between the two sets (sincere and sarcastic) which listener judgement might rely on. The sincere tokens were found to be spoken faster, with a higher F0 mean, standard deviation and range, a lower HNR as well as a higher intensity than the sarcastic ones.

## 3. RESULTS

As mentioned earlier, the stimuli selected for this experiment form only a fraction of those used by Nauke and Braun [16], let alone [23]. In fact, they came from the speakers recognized best in the latter study. Since only overall recognition rates have been reported in Schmiedel's previous publications, the authors extracted the correct recognition rates for these selected stimuli in the Schmiedel [23] study. They are 76.1 and 85.0 per cent for the sincere and sarcastic stimuli, respectively. The detailed results for the ASD youths are depicted in Table 1.

**Table 1:** Rates of correct recognition in ASD listeners (N = 13).

|  | Total (%) | Sincere (%) | Ironic (%) |
|---|---|---|---|
| **All listeners** | **84** | **90** | **78** |
| S1 | 87 | 97 | 79 |
| S2 | 85 | 91 | 82 |
| S3 | 89 | 90 | 89 |
| S4 | 66 | 69 | 64 |
| S5 | 86 | 98 | 75 |
| S6 | 73 | 80 | 67 |
| S7 | 90 | 87 | 94 |
| S8 | 92 | 91 | 92 |
| S9 | 82 | 98 | 66 |
| S10 | 73 | 96 | 51 |
| S11 | 93 | 92 | 94 |
| S12 | 86 | 96 | 78 |
| S13 | 89 | 92 | 87 |

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[1] The groups were thus not perfectly age matched. However, there is no indication in the literature that adolescents and young adults differ in their ability to decode irony.

As is evident from Table 1, results are fairly consistent across participants. The tendency for higher recognition rates for sincere stimuli holds true for ten out of the 13 subjects individually. For four out of five speakers, the ASD listeners outperform the TD subjects for sincere stimuli and do slightly worse for the sarcastic ones.

The ASD youths recognize the sincere stimuli significantly better than the sarcastic ones ($p < 0.000$; two-ttailed *t*-test). This indirectly confirms expectations that Asperger listeners have problems identifying irony. However, the absolute recognition rates are still very high. Since Schmiedel [23] found no significant difference according to listener sex, the fact that this experiment is confined to male listeners is not expected to influence the results.

As indicated above and somewhat unexpectedly, the Asperger patients' performance is superior to that of Schmiedel's listeners as far as sincere stimuli are concerned. The difference between Schmiedel's results and those of the present study is highly significant for the sincere ($p = .001$) but not for the sarcastic ($p = .61$; two-tailed t-test) stimuli. This is even more remarkable considering that listeners had to base their decisions on a single (stressed) syllable. Evidently, the prosodic cues contained in that short a stimulus were sufficient to let them make correct decisions more often than the TD subjects.

This finding confirms the results reported by Zalla et al [25] and Pexman et al [18] with respect to the ASD group. A comparison with the results of Wang et al [24] is not possible since they do not report separate results for sincere and ironic stimuli.

**Figure 1**: Recognition rates by the ASD and the TD groups compared.
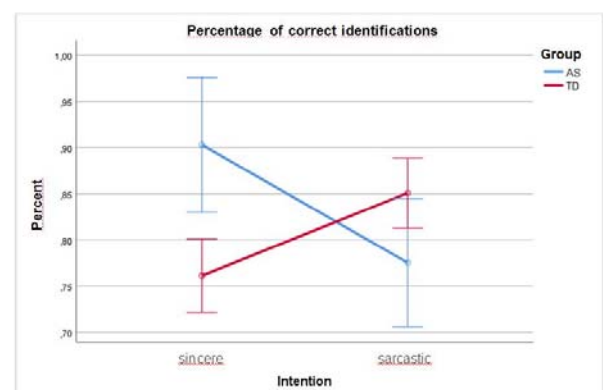


One potential explanation for these findings is that the excellent performance of the ASD subjects can be attributed to an effective therapy while living in the

institution. In order to look into this possibility more closely, the time spent in the institution is plotted against the per cent correct in the present experiment in Figure 2.

**Figure 2:** Time spent in institution vs. per cent correct in Asperger patients.
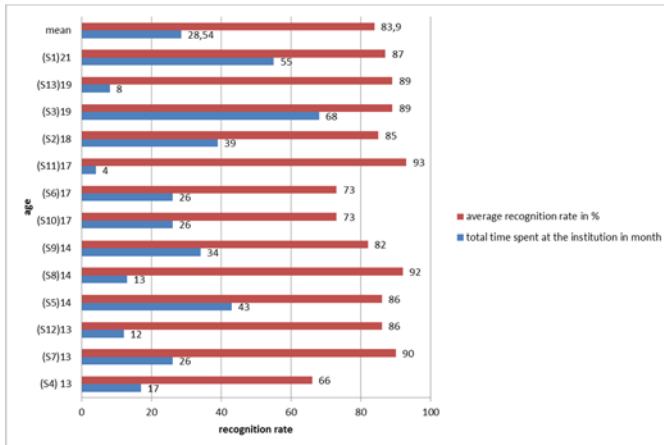


It is evident from merely looking at the graphs that there is no correlation between rates of correct recognition and the duration of stay at the institution. Indeed, statistical testing shows a slightly, but not significant negative correlation between those variables (r = -.26; Spearman rank correlation).

## 4. DISCUSSION

As far as ASD listeners are concerned, the expectation that sincere utterances are easier to process than sarcastic ones is confirmed. Sincere stimuli were decoded far more correctly than ironic ones. However, the same does not apply to our TD listeners. Their recognition rate is higher for the sarcastic stimuli. This can possibly be attributed to the way the stimuli were selected: The speakers showing the highest overall recognition rates in the Schmiedel study [23] happened to be the ones for whom sarcasm was recognized very well. When all 20 speakers were considered, the same listener group was better at identifying the sincere stimuli.

The fact that the ASD youths did significantly better at recognizing sincere stimuli than the TD subjects and did not do significantly worse for the sarcastic stimuli obviously calls for an explanation since it contradicts much of the literature on ASD [5, 14]. One possible explanation is that (HF) Asperger autism as opposed to other manifestations of ASD simply does not produce the expected behavior. The present authors came across incidental evidence to that effect when trying to increase the number of subjects by testing four more ASD youths (two of them high functioning and two low functioning) in a

different institution. According to informal reports by the caretakers, the patients did not have a good understanding of irony in everyday life. None of the youths tolerated being tested even though they knew the person who administered the test well. Instead, they demanded to be told who was talking to them, remarked that they did not like the voice etc. In other words, those ASD patients who can be tested form a subset whose performance is probably not representative. This may help explain why an inability which figures so prominently in the textbooks is frequently not observed in empirical studies.

One factor which clearly had no significant influence on the identification rates is the time our subjects had spent in the institution prior to the experiment. Something which we cannot reliably assess, though, is the amount of training which they may have received prior to being admitted to the institution, but the mere fact that they were institutionalized suggests that they may not have been behaving all that unobtrusively before.

However, a more daring hypothesis might be worth considering in future work. It touches upon the processing of cues for verbal irony on a more general level. Strictly speaking, what we tested was the decoding of phonetic cues to sarcasm. What we did not test was the role of context information. It may be inferred from our results that the problems of ASD patients are not about phonetically coded information on sarcasm. Instead, context information may be a disturbing factor, somehow "blurring the picture" and creating an information overload. In this respect, our results – even though they are based on shorter stimuli – confirm those of Wang et al. [24]. While they make a point of not interpreting their results as an indication that ASD patients are just as good as TD subjects if no context is given, we feel rather confident to specifically make this claim and would encourage further research in this direction.

It might thus be that ASD patients are able to process the phonetic cues to sarcasm at a level which is comparable to TD subjects but are still unable to assess contextual cues. This would imply that the lower-level processing of the phonetic cues is intact while the higher-level processing which takes context into account may present a problem.

In summary, this is yet another study casting doubt on the easy claim that Asperger patients are unable to detect irony. On the other hand, it confirms the notion of different processing strategies. On a final note, the question of representativeness in ASD studies arises., because it is obviously not easy to test these individuals, and thus those who agreed to take part in a study may have constituted a positive and yet non-representative sample.

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