ORIGINAL ARTICLE

Autism spectrum and cheaters detection

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Rutherford and Ray think that human beings have mental mechanisms that help them to detect individuals that, deliberately, do not follow a rule. In the same way, they hold that autism is not a disorder in which these mechanisms are damaged. This idea seems contrary to the thesis, supported by some researchers, that autistic people have a theory of mind deficit. This is because of, if Rutherford and Ray are right, autistic people can detect other people's intentions. In this paper, Rutherford and Ray's experiment is analyzed and it is concluded that they do not prove that people with autism can understand intentions. Such an experiment only shows that autistic people and general population share common logical-linguistic abilities.

INTRODUCTION

Education faces many challenges at present. One of them refers to the need to address students that, for whatever reason, do not have the same intellectual abilities as general population. Research on autism spectrum disorders is especially relevant in this way. Undoubtedly, it is important to detect, and to know, the real thinking and reasoning abilities that students with autism have in order to plan and schedule educational interventions adapted to their true needs and their personal characteristics.

In recent times, from cognitive science, interesting studies intended to analyze autistic thought have appeared. Thus, a famous experiment that has been replicated many times is representative: the false belief task. Van Lambalgen and Smid (2004) state that this task is often used in order to check the way in which autistic people reason with regard to other people's beliefs. They expose several versions of the false belief task, but, in general, it can be said that such a task consists of the following: the participant, the researcher, and a witness (the witness can be, for example, a doll or participant's mother) see that an object (for example, a chocolate bar) is put into a place (for example, a box). When the witness leaves, the object is put into another place (for example, a drawer). When the witness

comes back, the participant is asked where the object will be looked for by the witness.

According to Van Lambalgen and Smid (2004), there is a critical age. Children under three and one-half years of age usually answer that the witness will think that the object is where it is really, that is, in the second place. Nevertheless, children older than three and one-half years of age generally answer that the witness will think that the object is in the first place because he (or she) has not seen that the object has been put into another place. In this way, Van Lambalgen and Smid (2004) indicate that the problem is that autistic children older than that age continue to believe that the witness will think that the object is in the second place. In their opinion, those results have been considered to be a demonstration that autism is linked to a theory of mind deficit[a]. They say that that idea was raised by Leslie in 1987 and that it is based on the hypothesis that human beings have, as a result of evolution process, a reasoning module that is related to the understanding of the other person's minds and that is thought to be damaged in autistic people.

Nonetheless, Rutherford and Ray (2009) seem to question this idea. In their view, it is not clear that a theory of mind deficit can explain autism. In clinical setting, autistic people is thought to

have difficulties regarding the interpretation of other people's mental states and their intentions, but Rutherford and Ray (2009) state that these theses, which, in their opinion, are similar to those that can be found in papers such as the one of Baron-Cohen et al. (1985), are debatable, and that their experiments do not support them.

It is obvious, therefore, that this issue is clearly relevant in the educational sphere, because an appropriate knowledge of the autistic mind is necessary in order to design adequate teaching strategies for students with autism, and in order to pose objectives, contents, and didactic methods for that kind of students. For these reasons, it is advantageous to analyze the research presented by Rutherford and Ray (2009). It is important to check whether that research offers new data about autism spectrum, or whether, on the contrary, their experimental results can be interpreted in accordance with other approaches that are more consistent with the previous researches on this problem area. The next part of this paper reviews the arguments exposed by Rutherford and Ray (2009).

1. SOCIAL CONTRACTS AND AUTISM

According to Rutherford and Ray (2009), usually, it is thought that it is not difficult for autistic people to detect the other individuals' intentions in a general way, but in a specific way. People with autism can capture the other persons' needs and wishes, and physical causality related to objects and human beings. It is only problematic for them to note other people's intentions, and, in their opinion, this thesis is held by Baron-Cohen (1995).

However, they do not seem to share this approach and think that there are evidences that can question it. In their view, if: a) there are adaptive rules and evolved mechanisms that regulate social exchanges; and b) specific experiments are designed to analyze them; then c) it can be shown that, at least apparently, people with autism can detect, to some extent, other individuals' bad intentions.

The theory that states that there are such adaptive rules and evolved mechanisms is well-known in the field of psychology of reasoning and in the area of cognitive science. That theory, which is

the theory that Rutherford and Ray seem to assume, is called the social contracts theory (Cosmides, 1989; Gigerenzer and Hug, 1992; Fiddick et al., 2000; Fiddick and Erlich, 2010; Cosmides et al., 2010). The researchers that support the social contracts theory often use versions of the famous Wason selection task (Wason, 1966, 1968) in which a situation of social exchange is described in order to get experimental support for their theses. Thus, they try to compare the results of those versions with the results of versions of the same task that do not describe situations of social exchange. In this way, it is argued that, given that the versions with social contracts (that is, with social exchanges) generally offer, in a significant way, better results than the versions without social contracts, it is obvious that human mind has mechanisms and rules related to social exchanges. In their opinion, the selection tasks with social contracts trigger the action of such rules and mechanisms, which, in essence, are useful in order to detect agreements violators and rules offenders.

Nevertheless, Rutherford and Ray (2009) seem to assume that there is an element that is the most important one in order to trigger the mechanisms and rules related to social contracts. That element is not that the version of the task is expressed as a social contract. It is that the version indicates the need to detect malicious cheaters in which trust cannot be put. This need is really important for people, because, if they want to achieve their purposes in society and to avoid difficulties and problems in their daily lives, they must know who usually respect agreements and who generally does not follow norms.

Based on those assumptions, Rutherford and Ray (2009) raise two different types of versions of the selection task with social contracts, so that both autistic participants and non-autistic participants execute them. In the first kind of selection task, participants are asked to detect cheaters and, in the second one, they are asked to look for individuals that, acting honestly, unintentionally infringe a rule. The most remarkable aspect of their research is that, in the two experimental groups, the versions with malicious cheaters clearly leaded, with significant differences, to more correct answers than the versions with

honest individuals, and that the results in this way offered by the autistic group were not significantly different from the results offered by the non-autistic group.

This is surprising because the versions of the task with malicious cheaters used by Rutherford and Ray show, obviously, individuals that act without intention to accomplish their part of the agreement. On the other hand, the other versions maintain the same scenarios and only change this aspect (that is, describe people that also violate norms but without intention to infringe them). Thus, it can be thought that the negative results obtained in the versions with honest individuals and the positive results obtained in the versions with malicious cheaters reveal that it is not clear that autistic people cannot note other people's intentions.

Nonetheless, it is possible to interpret the results presented by Rutherford and Ray (2009) in other ways. For this reason, it can also be thought that such results do not really provide information about the relationship that can exist between autism and a possible theory of mind deficit. It seems that the different versions of the selection task used by Rutherford and Ray are not truly comparable between themselves, and the next parts of this paper try to demonstrate it. However, previously, it can be appropriate to explain in greater detail, and more clearly, the fundamental characteristics of the texts used by Rutherford and Ray (2009).

2. TWO STORIES: THE DINNER PARTY AND THE SOLDIERS

Four versions of the Wason selection task are raised by Rutherford and Ray (2009). Two versions are based on a story about a dinner party and the other two versions are based on the work that must be realized by certain soldiers. As indicated above, each of the two versions corresponding to each story, describes individuals with different ethical attitudes. In one case, the individuals commit an *Innocent Mistake* and, in the other case, the individuals are, clearly, *Cheaters*.

Rutherford and Ray (2009) call their versions WST1, WST2, WST3, and WST4. WST are the acronyms taken from the expression *Wason Se-*

lection Task, and the numbers are used in order to organize and distinguish those versions. In this way, WST1 and WST2 refer to the party dinner story, and WST3 and WST4 refer to the soldiers story. WST1 and WST3 are versions with an innocent mistake, that is, versions that show honest individuals that infringe the rule without malicious intent, and WST2 and WST4 are tasks related to cheating individuals, that is, tasks related to individuals that violate the norm with malicious intent.

In particular, in WST1, the participant is asked to imagine that is going to invite some friends to a dinner party, and that he (or she) has no time to prepare food. Thus, he (or she) establishes this rule:

"**If you want to come to my party, then you must bring a food dish to the party**" (Rutherford and Ray, 2009, p.114, bold in text).

Nevertheless, he (or she) knows that his (or her) friends, in some cases, are very busy and, in other cases, do not prepare food perfectly. For these reasons, he (or she) knows that, although they want to collaborate with food, not all of his (or her) friends are going to follow the rule.

The participant can see four cards. Each card refers to one person, and one side of these cards indicates whether or not that person collaborated with food and the other side indicates whether or not that person accepted the invitation. In this way, the participant is shown "brought a food dish" (Rutherford and Ray, 2009, p.114) on the first card, "Did not bring a food dish" (Rutherford and Ray, 2009, p.114) on the second card, "Is at your dinner party" (Rutherford and Ray, 2009, p.114) on the third card, and "Is not at your dinner party" (Rutherford and Ray, 2009, p.114) on the fourth card. In this scenario, the participant must choose the card or the cards that it is necessary to review (observing its hidden side) in order to detect friends that infringe the rule.

It is easy to deduce the logically correct answer in this version if each card is analyzed separately:

-*Brought a food dish*: it does not need to be chosen. If its other side shows *Is at your dinner party*, the card refers to a friend that has followed

the rule, and, if its other side shows *Is not at your dinner party*, the card can refer, for example, to an altruist friend that, although he (or she) did not join the dinner party, collaborated in preparing it. In any case, this person did not violate the rule.

-*Did not bring a food dish*: this card must be selected because, if its other side shows *Is at your dinner party*, it refers to a friend that did not follow the rule.

-*Is at your dinner party*: this card must also be chosen because, if its other side shows *Did not bring a food dish*, it also refers to a friend that did not follow the rule.

-*Is not at your dinner party*: it does not need to be selected because it is not possible that this friend has infringed the rule. If he (or she) is not at the dinner party, it is irrelevant whether or not he (or she) collaborated with food.

WST2 is very similar to WST1. The only difference is that in WST2 the participant must imagine that some of his (or her) friends are sluggards and they are not going to collaborate. Therefore, the most important difference is that in this version the friends can violate the rule with malicious intent.

Instead, WST3 describes an army base in which contact with the outside world is limited. A show is going to be performed shortly but there is a rule with regard to it:

> "**If you go to the concert, then you have to work a four-hour shift digging ditches**" (Rutherford and Ray, 2009, p.116, bold in text).

In this version, it is possible that some soldiers do not know the rule and that, for this reason, enjoy the concert without digging, that is, commit an innocent mistake.

Again, the participant is shown four cards. In this scenario, each card refers to a soldier, and one side of these cards indicates whether or not that soldier enjoyed the concert and the other side indicates whether or not that soldier worked. In this way, the participant can see "Worked a shift at digging ditches" (Rutherford and Ray, 2009, p.116) on the first card, "Did not work a shift at digging ditches" (Rutherford and Ray, 2009,

p.116) on the second card, "Did not go to the concert" (Rutherford and Ray, 2009, p.116) on the third card, and "Went to the concert" (Rutherford and Ray, 2009, p.116) on the fourth card. In this version, the participant is also asked to choose the card or the cards that it is necessary to check in order to detect individuals that violate the norm.

Given that the logical structure of this version is similar to that of the version related to the party dinner, the valid cards are also obvious in this task. If each card is reviewed separately, it can be said, about each of them, the following:

-*Worked a shift at digging ditches*: it does not need to be chosen. If, on its other side, appears *Went to the concert*, the rule has been fulfilled. If, on its other side, appears *Did not go to the concert*, the rule has not been violated because it does not establish that, if a soldier digs ditches, that soldier must go to the concert. The rule only establishes that, if a soldier wants to go to the concert, that soldier must dig ditches.

-*Did not work a shift at digging ditches*: this card must be selected because, if its other side shows *Went to the concert*, it refers to a soldier that did not follow the rule.

-*Did not go to the concert*: it does not need to be chosen because it is not possible that this soldier has violated the rule. If he (or she) did not go to the concert, it is irrelevant whether or not he (or she) dug ditches.

-*Went to the concert*: this card must be chosen because, if, on its other side, appears *Did not work a shift at digging ditches*, this soldier infringed the rule.

WST4 is very similar to WST3. The difference between them is that in WST4 the participant is asked to assume that it is thought that some soldiers, intentionally, have not respected the rule, that is, that, with the knowledge that it is wrong, they have gone to the concert and, however, they have not dug ditches. Therefore, the only aspect that it is changed is the aspect linked to the soldiers' intentions, because, in this version, they know that the rule has been established. Obviously, the logically valid cards in WST4 are the same as those that have been

indicated for WST3.

3. THE HYPOTHESES HELD BY RUTHERFORD AND RAY

As mentioned above, the results obtained by Rutherford and Ray (2009) were, in principle, rather surprising. Both the autistic group and the non-autistic group achieved higher rates of correct answers in WST2 and WST4. This fact seemed to lead them to several hypotheses:

1.- Indeed, there are mental mechanisms that allow detecting cheaters, and those mental mechanisms are not damaged in people with autism.

2.- Their experiment detected a fact that cannot be noted by means of other methods: autistic people can understand intentions and have, in some way, theory of mind.

3.- The selection task describes fictitious social situations and does not refer to real situations. Thus, it is possible that people with autism can correctly resolve artificial problems in which an intention is presented, and that, nevertheless, they cannot reason in a similar way in their everyday life (and that, therefore, they cannot detect real people's true intentions).

Rutherford and Ray (2009) seem to prefer the hypothesis 1. Nonetheless, it can be thought that, in fact, none of those hypotheses can be conclusively demonstrated by means of the results of their experiment or by means of the results of similar experiments, because other reasons can be offered in order to explain why WST2 and WST4 provide better results than WST1 and WST3. It is possible that the positive results of both WST2 and WST4 are not related to the described characters' intentions, but to other characteristics of those tasks. In this way, other variables not controlled by Rutherford and Ray (and not linked to evolved mechanisms or adaptive rules) can be considered in order to interpret the results achieved by general population and autistic people in those versions of the Wason selection task. The next sections explain these last statements.

4. GENERAL POPULATION AND CHEATERS DETECTION

It can be appropriate to review, first, the results corresponding to the participants that are included in the non-autistic group by Rutherford and Ray (2009). It can be said that the cards selected by them do not reveal evidence that, actually, the hypothesis of the social contracts theory referring to the existence of adaptive mechanisms and evolved rules on human mind is correct. As indicated, it is possible that WST1 and WST3 present worse results than WST2 and WST4 for several reasons that are not linked to hypothetical mental abilities for cheaters detection.

The first of those reasons is that all the versions of the Wason selection task used by Rutherford and Ray (2009) do not have the same difficulty level. WST1 and WST3 are more complicated versions, and, therefore, it is less easy to process them, to interpret them, and to understand them. WST1 and WST2 seem identical versions in which there is only a different paragraph, and something similar can be said with regard to WST3 and WST4, in which it can also be observed that their only difference is one paragraph. However, the problem is that the paragraphs corresponding to WST1 and WST3 present important difficulties that cannot be noted in the paragraphs that appear in WST2 and WST4.

As far as WST1 and WST2 are concerned, the different paragraph is the third one. In WST1 is as follows:

> "All of your friends who can go to your dinner party tell you that they can make a dish for the party. However, you know that some of them are really busy with work and do not have time to cook a dish for the dinner party tomorrow night but they really would like to go. You also know that some of your friends are not good cooks and may make an honest attempt to cook their dish but burn the food so that it cannot be brought to the party. So some of your friends may have broken this rule, you must find out if they have broken this rule" (Rutherford and Ray, 2009, p.114).

Nonetheless, in WST2 this paragraph is deleted and this other appears in its place:

> "All of your friends who can go to your dinner party tell you that they can make a dish for the party. Your friends are supposed to follow this rule but you suspect that some of them will be too lazy to make food and intentionally not bring a food dish to the party. So some of your friends may have broken this rule, you must find out if they have broken this rule" (Rutherford and Ray, 2009, p.115).

It is clear that WST1 has a characteristic that makes it a more difficult task. It is a longer text. Undoubtedly, the fact that there are more words in a text leads to a harder processing, and this circumstance, by itself, can explain why the participants select fewer logically valid cards in WST1.

But, if this fact is not considered to be enough, it can also be thought that, while WST2 raises only one hypothesis, that is, that the friends are very lazy to cook, WST1 raises two hypotheses, that is, that some friends have a lot of work to do and that other are bad cooks. Obviously, this circumstance could also influence the poor results that were offered by the participants in WST1. In addition to more sophisticated reflections, more complicated information processings, and more difficult mental representations elaborations, two hypotheses need to establish more relationships between concepts.

Besides, other important point is that WST1 in itself is not a coherent and consistent text. It exposes that there are honest individuals that cannot follow the rule because they have a lot of work or they are bad cooks. However, by considering that information, the participants can think that, if they are really honest, those individuals are not going to infringe the rule if they can avoid it. The participants can suppose that an individual with truly good intentions is not going to go to the party without a dish, even if he (or she) has justifiable reasons for this. An individual authentically honest knows that, if he (or she) cannot follow the rule and cook a food dish, he (or she) cannot go to the dinner party, even if the causes of this situation are beyond his (or her) control. He (or she) also knows that, if he (or she) goes to the party, at least, he (or she) must talk to the host about this problem. It is because of this that, in this scenario, the host does not really need to check whether their honest friends have followed the rule. Thus, it can be thought that the story described in WST1 can be interpreted by the participant as an implausible story, and doing so the task cannot be adequately executed.

For these reasons, it can be stated that the paragraphs of WST1 and WST2 are so different that their results cannot be compared, and that those tasks cannot be used in order to prove that human beings have evolved mechanisms that lead them to detect individuals that violate agreements. Therefore, it seems that those two versions of the task do not reveal the existence of the mentioned mechanisms.

But the relationship that can be established between WST3 and WST4 is very similar. The paragraphs that are different in these versions are so disparate that it is also inappropriate to compare their results. Again, the third paragraph is the important paragraph. In WST3, it is as follows:

> "The soldiers are supposed to follow this rule but you suspect that some of them were not aware of the commanding officers order to dig the ditches. They may have made an honest mistake and gone to the show without digging the ditches. So they may have broken this rule, you must find out if they have broken this rule" (Rutherford and Ray, 2009, p.116).

However, in WST4, the third paragraph is the following:

> "The soldiers are supposed to follow this rule but you suspect that some of them have skipped their duties intentionally and still went to the concert. So they may have broken this rule, you must find out if they have broken this rule" (Rutherford and Ray, 2009, p.117).

It is true that WST3 is not as WST1 because WST3 does not raise two hypotheses (and, therefore, in this particular way, it is not more difficult than WST4). Nevertheless, it can be easily appreciated that the paragraph of WST3 is longer than the paragraph of WST4. As far as the number of words is concerned, the difference between WST3 and WST4 is not as obvious as the difference between WST1 and WST2, but the paragraph of WST3 is, in essence, more extensive than that of WST4, and this circumstance is very probable to influence participants' selection. As indicated above with regard to WST1 and WST2, a longer paragraph needs a more elaborate information processing and a more complex mental representations elaboration. In this way, this fact, by itself, can question the hypotheses held by Rutherford and Ray (2009), because it demonstrates that the intentions assigned to the characters are not the only differences between WST3 and WST4.

However, the most controversial point related

to WST3 and WST4 can be that these tasks are only similar in appearance. Actually, each of them asks the participants to think about different situations. In WST4, the rule is established and it is necessary to look for cheaters. Nevertheless, there is a different situation in WST3 because a previous work needs to be made: it is necessary to check whether the rule is really established (recall that, in WST3, the participant is not sure that the soldiers know the order). Although it is explicitly indicated that it is necessary to check whether some soldiers have infringed the norm, the general context in WST3 suggests that it is important to verify that the soldiers know that they must dig if they want to go to the concert. If the participant understands the task in this last way, he (or she) can choose not to elect the card *Did not work a shift at digging ditches*, one of the logically correct cards, but the card *Worked a shift at digging ditches*, because this last card can show *Went to the concert* on its other side, and a card with *Worked a shift at digging ditches* on one of its sides and *Went to the concert* on its other side can increase his (or her) confidence that the rule was adequately understood. Indeed, this argument is not a new argument. Yachanin and Tweney (1982) noted that all the versions of the selection task do not present the same problem. Some of the versions present the rule as an existing and current rule, and it is necessary to check whether or not such a rule is followed. However, other versions present the rule as a hypothetical rule, and it is necessary to check whether or not the rule really exists. Obviously, the versions of this second type are more difficult and WST3 can be thought of as a version of this type, while WST4 can be thought of as a version of the first type. Therefore, it can be said that WST3 is a task more complicated than WST4 and that it is not appropriate to compare their results.

Based on the previous arguments, it can be accepted that the experiment presented by Rutherford and Ray (2009) does not prove that people have mental abilities related to detection of malicious individuals that deliberately violate rules. Certainly, it is incorrect to say that their paper shows that such abilities do not exist, but, in the same way, it is correct to state that their results do not demonstrate that human beings have adapted and evolved mechanisms linked to cheaters detection.

Nevertheless, the preceding analysis has only considered the results obtained by the non-autistic participants (representing general population) in the experiment presented by Rutherford and Ray (2009). The next part of this paper revises, from this same perspective, the results corresponding to the autistic group.

5. AUTISM AND CHEATERS DETECTION

It The previous arguments seem to indicate that, based on the experiment raised by Rutherford and Ray (2009), it is not possible to find evidence about the relationship between autism and a theory of mind deficit. Apparently, the cards selected by the autistic participants in their versions of the selection task support the hypothesis that, in a certain way, they can detect other people's intentions, but the preceding arguments can be also applied to the autistic participants' results.

Indeed, a correct execution of WST2 and WST4 does not need an ability related to a theory of mind. As indicated, the characters' intentions are not the only differences between WST1 and WST2, and between WST3 and WST4. There are more differences, which, as also mentioned, refer to the length of the texts, their internal contradictions, and the type of problem that must be solved (the versions do not ask to do the same in all the cases), and such differences can also affect, undoubtedly, the experimental group with autism. It is necessary to consider that papers such as that by Pijnacker et al. (2009) reveal that autistic people can integrate and process new linguistic information. Therefore, it can be supposed that differences existing between the versions used by Rutherford and Ray (2009) can also influence people with autism.

In this way, it can be said that, in the experiment proposed by Rutherford and Ray (2009), the autistic participants were influenced by facts such as that some versions transmit more information than other versions, that the situation described in WST1 is inconsistent, and that WST3 is different from the other three tasks. The four tasks have the same logical structure but the

mentioned aspects could affect the participants with autism in the same way as general population.

From this perspective, the results offered by Rutherford and Ray (2009) do not clearly support any of the three hypotheses raised by them in order to explain the selections made by their participants. The first of those hypotheses, which is the hypothesis that they seem to prefer, refers to the idea that human mind has a mechanism that is preserved in autistic people and that leads to detect offenders. This idea is not demonstrated by their experiment because logical and linguistic criteria can explain why their versions of the selection task had different results. WST2 and WST4 have a structure that causes that the participants (autistic and non-autistic) select the logically valid cards. On the other hand, WST1 and WST3 have internal problems that hamper the correct selections in the two experimental groups.

Their second hypothesis suggests that the methods used by them have shown results that other methods cannot show, that is, that the methods used by them have shown that people with autism have a certain theory of mind. However, the arguments exposed in this paper clarify that the results offered by Rutherford and Ray (2009) do not indicate that their participants necessarily had a theory of mind. If they had a minimum logical ability and were capable of processing linguistic information, they could get such results.

Finally, their third hypothesis raises that autistic people can only detect other people's intentions in fictional situations, but not in real circumstances or in daily life. Nevertheless, as explained, the characters' intentions are not the most important factors of the versions used by Rutherford and Ray (2009). What matters more is the internal structure of those versions. As a consequence, if people with autism have difficulties in real contexts, it is not proved by Rutherford and Ray (2009).

Thus, it seems that the results of the experiment presented by Rutherford and Ray (2009) cannot be used in order to solve problems related to the possible theory of mind deficit in autism. Nonetheless, their experiment is relevant and it must be acknowledged. Their experiment offers important information concerning autistic mind and its possibilities to process natural language and to reason. In particular, such an experiment shows that autistic people can understand logical exercises (a significant proportion of their autistic participants solve WST2 and WST4), that the length of the texts influences them in the same way as it influences general population (the results achieved by the autistic participants in WST1 and WST3, which are more extensive tasks, are worse), that they note contradictions in texts (it seems that the inconsistency of WST1 is noted by the autistic participants), and that they are capable of understanding the instructions of different exercises (it also seems that the autistic participants understand that WST3 is a different task and that such a task does not ask to detect cheaters, but to check whether or not the rule is known). These findings are, obviously, important for a teacher that works with autistic students.

CONCLUSIONS

This paper has not tried to demonstrate that autistic people have problems linked to a theory of mind deficit, but to show that the experiment offered by Rutherford and Ray (2009) cannot be used in order to check whether or not people with autism have such problems, because their results can also be explained if other mental abilities are considered. However, their research reveals important information. It shows that it is possible that autistic people have relevant intellectual abilities that must be taken into account by educationalists. It also shows that, through such intellectual abilities, autistic students can execute academic activities that, at first, can seem to be impossible for them. Therefore, more research about autistic intellectual behavior is needed in case we wish to offer an appropriate educational answer for autistic students. Maybe the difficulty is that purely quantitative analyses, such as those of Rutherford and Ray (2009), do not revise important aspects. As indicated, the participants' choices in the selection task may be due to different causes and reasons, and such choices can be interpreted in accordance with various frameworks and perspectives.

The Wason selection task is a reasoning ex-

ercise in which participants' choices are not the only relevant data. It is also interesting to know the causes of such choices. It seems that, if the choices are only statistically reviewed, those causes cannot be detected and this fact raises a difficulty. It is possible that other methods are necessary, for example, methods such as those used by Van Lambalgen and Smid (2004) or Stenning and Van Lambalgen (2001), which refer to the need to interview participants by means of Socratic dialogues tutorials. Given that, evidently, it can be thought that those methods are the only methods that can reveal the true causes of the choices in the Wason selection task, it seems appropriate to raise researches in this way. Such researches can provide important information for being used in classrooms in which it is aimed that diversity in general and autistic students in particular are adequately considered. And it is important to keep in mind that even the arguments that have been exposed in the previous pages need a confirmation, which can be got through interviews with participants in which the real reasons of their choices are explained by them.

Thus, theses such as those indicated above, that is, the thesis that autistic people can make logical inferences, the thesis that the amount of the linguistic information that is transmitted can influence them, the thesis that they can detect inconsistent stories, and the thesis that they can distinguish types of reasoning tasks, need to be validated by means of qualitative researches in which the participants show the intellectual processes followed by them in order to solve certain exercises. . This research work becomes urgent in case scientists think that autistic people can have potentialities that can surprise, if known.

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Endnote - a: In general, 'theory of mind' is used in order to designate the ability to note other people's thoughts and intentions. Nevertheless, the concept and its relation with autism are controversial. Different views of the issue can be found in the literature on cognition. Some interesting approaches in this way can be, e. g., those Baron-Cohen (1995), Baron-Cohen et al. (1985), Dapretto et al. (2006), Happé (1995), Hobson (1995), Leslie (1991), Tine and Lucariello (2012), and Van Lambalgen and Smid (2004).

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