

The Concept of Creativity in Art and in Science: Are Autistic People Creative?

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Introduction

According to the diagnostic criteria included in internationally accepted texts such as American Psychiatric Association (1994) or World Health Organization (1993), people with autism have a number of distinctive characteristics, including a certain tendency to the routine repetition of behaviors and movements, a striking tendency to revise details, very particular and defined personal interests, and a limited creativity. Thus, autism is considered to be a pervasive developmental disorder that can have important consequences for social life and personal fulfillment.

Nevertheless, autism spectrum disorders can be analyzed from another perspective. Such a perspective is the perspective offered by the neurodiversity concept (Armstrong, 2011). That concept, according to Armstrong (2011), was first used by Judy Singer, who questions that autism is an impairment, and allows thinking that, really, the individuals that are considered to be autistic do not have a disorder and that they are only individuals with a particular way of being. Based on those ideas, it can be said that autism is only a kind of personality that, to a greater or lesser extent, characterizes certain people.

Several analyses can be found with respect to this issue. For example, López Astorga (2010a, 2011a, 2011b) exposes that the results offered by autistic participants in certain logical reasoning exercises are often much better than the results offered by non-autistic participants in those same exercises. According to López Astorga, what is interesting is that such differences between the results offered by autistic participants and the results offered by non-autistic participants are, on several occasions, considered to be proofs that there are certain problems or certain difficulties that are linked to autism. He says that this fact is surprising because those differences only show that the participants with autism are precisely the participants that more frequently solve exercises related to logical reasoning

abilities in a correct way, and, therefore, in his view, it is hard to accept that a logically valid answer is the symptom of a disorder.

Nonetheless, a paper presented in the Seventh Global Conference organized by the project *Creative Engagements: Thinking with Children*, and held in the Mansfield College, in Oxford (United Kingdom), is also relevant in this sense because it reveals that it is possible that a characteristic usually attributed to autism, lack of creativity, is not truly linked to it. Such a paper is the paper presented by McKenzie (2011), in which it is argued that psychology assumes a particular concept of creativity and that that concept can be understood in a different way. In reality McKenzie (2011) does not adopt the neurodiversity perspective. In fact, that perspective is not her perspective in other papers that she has written with other collaborators (for example, McKenzie, Evans, & Handley, 2010, 2011), but the arguments that she exposes in the paper presented in the mentioned conference can be interpreted from such a perspective, and can help show that autism is a way of being and that autistic people do not have certain problems habitually attributed to them.

Thus, in this paper, the theses raised by McKenzie (2011) are going to be commented. Equally, the possible consequences of her theses in other fields are also going to be analyzed. In particular, the consequences in fields related to research and scientific discovery are going to be especially reviewed. In this way, an interesting thesis is going to be presented because it is going to be argued that, in a sense, the type of creativity that, according to McKenzie (2011), can characterize people with autism is a type of creativity that can be thought to be more effective and more appropriate for scientific progress.

Obviously, as can be appreciated, those problems are very relevant for people that work with autistic people because a better knowledge of the characteristic abilities that can be observed in people with autism can mean a better development of such abilities and, therefore, a further social progress. However, it seems appropriate, in order to a better contextualization of the idea based on the neurodiversity perspective, to begin by commenting the essential theses and arguments presented in some papers that hold that autistic people have logical reasoning abilities that are not only adequate but also more optimal than those that can be noted in general population.

Autism and logical reasoning

As indicated, López Astorga (2010a, 2011a, 2011b) holds that it can be said that, in a certain sense, autistic people have better logical reasoning abilities than non-autistic people. Nevertheless, a detailed exposition of the three mentioned papers presented by López Astorga does not seem very opportune if the aims of this paper are considered. For this reason, the only arguments that, for illustrative purposes, are going to be commented are the arguments presented in López Astorga (2011b). This last paper seems appropriate because it not only analyzes logical reasoning in autism, but it also links the problem to imagination, an ability related, certainly, to creativity.

López Astorga (2011b) reviews an experiment raised by Scott, Baron-Cohen, and Leslie (1999). In such an experiment, Scott et al. (1999) try to compare the results obtained by autistic and non-autistic children in reasoning exercises in which counterfactual sentences are included, that is, in which sentences expressing situations that are inconsistent with the world known by the children are included. An example of such exercises is the following:

“(p1) All bananas are pink

(p2) John is eating a banana

(c) Is the banana pink?” (Scott et al., 1999, p. 361).

Perhaps it is important to indicate that, in that experiment, before the first premise (p1), it is said, “I have a story where...” (Scott et al., 1999, p. 361), and that, before the conclusion (c), it is said, “In my story...” (Scott et al., 1999, p. 361). In any case, the most relevant data is that the results obtained by their autistic participants were significantly different to the results offered by their non-autistic participants. Their autistic participants tended to accept (p1) and to state, in the case of the previous example, that the banana was, certainly, pink. Nevertheless, it was hard for their non-autistic participants to admit that the John’s banana was pink because, probably, they tended to consider the true color of bananas.

But Scott et al. (1999) raised other experimental condition in which, before presenting an exercise with a similar structure, an additional instruction was added. They asked their participants to “make a picture in his or her head about each of the stories” (Scott et al., 1999, p. 353). This new instruction seemed to cause surprising effects because it, apparently, reversed the results. In this condition, their non-autistic participants tended to accept the premises indicated in the exercises and to answer in accordance with the described story, and not in accordance with reality.

On the other hand, their participants with autism tended to ignore the transmitted information and to answer in accordance with reality, and not in accordance with the described story.

Based on those results, Scott et al. (1999) think that there are two possible explanations: 1) It is difficult for autistic children to imagine and 2) It is difficult for them to understand other people's intentions. Nonetheless, López Astorga (2011b) states that Scott et al. (1999) do not pay attention to an important fact: in the first experimental condition, the correct answers are the answers offered by their autistic participants because, in such a condition, it is expected that the participant forgets his or her previous knowledge and that he or she answer in accordance with the information indicated in the first premise (in the mentioned example, it is expected that the participant forgets that bananas are not pink and that assumes that bananas are pink). Therefore, in a sense, as it can be appreciated, the autistic participants were the participants that offered a better execution in the first condition.

In this way, López Astorga (2011b) argues that it is possible that autism researches can be influenced by a preconception. It seems that it is assumed that autistic people have a cognitive deficit and that, for this reason, any experimental result, including positive results, is considered to be proof that that cognitive deficit really exists. However, in his view, results such as those presented by Scott et al. (1999) can be reviewed and interpreted from the neurodiversity perspective, and, from such a perspective, it can be thought that those results lead to different conclusions. In particular, López Astorga (2011b) thinks that such results can reveal that autism is characterized by a different cognitive style, and not necessarily by a cognitive deficit.

Thus, López Astorga (2011) holds that the experiment raised by Scott et al. (1999) only shows that non-autistic children reason according to the semantic content of exercises, that autistic children, on the contrary, reason according to the formal structure of exercises, and that, if it is wanted that a non-autistic child between four and five years old (that is the age of the children that participate in the experiment proposed by Scott et al., 1999) spontaneously reason paying attention to formal structures, that is, that they reason in the same way as autistic children, an additional indication is needed, as it is demonstrated in the second condition of the experiment raised by Scott et al. (1999). This information is really important for the education professionals that work with autistic children, because it seems to show that, in a sense and if a particular age is considered, children with autism can execute in a natural way exercises that non-autistic children can only execute if additional instructions are presented. The idea seems to be that it is easy for an

autistic child to assume the data of the story and reason from them, and that that same activity is difficult for a non-autistic child.

On the other hand, López Astorga (2011b) questions the two possible explanations offered by Scott et al. (1999). Firstly, he states that it is complex to admit that the experiment proves that imagination is limited in autism because Scott et al. (1999) included in it questions in order to check whether or not their participants had chances of imagining, and their autistic participants answered correctly some of those questions (for example, a question related to a pig that was flying and in which it was asked whether such a pig was in sky or on earth). Secondly, the hypothesis that autistic people cannot understand other people intentions, according to López Astorga (2011b) is also controversial because it links the issue to the problem of theory of mind (that is, the concept referring to the ability that allows putting oneself in the place of others and understanding their mental states). Based on Stenning and Van Lambalgen (2008), López Astorga (2011b) states that abilities related to theory of mind are not autonomous or isolated, that human cognition is characterized by relations between different abilities and functions (it is, therefore, hard to hold that the problems of autism only refer to particular abilities or functions), and that autistic people can note other people's wishes and interests.

The paper presented by McKenzie (2011) that is going to be reviewed in the next pages can lead to interpret, equally, that the experimental results offered by Scott et al. (1999) do not clearly prove that imagination is limited in autistic people, because it allows considering a concept of imagination different to the concept usually accepted by psychology. Furthermore, the arguments raised by McKenzie (2011) are also important because the autistic participants in the first condition proposed by Scott et al. (1999) could offer the formally correct answer, and this fact can mean that, at least in a sense, they could reason from fictional or not present scenarios, and that, at least in a way, they could imagine. This evidence is not considered by Scott et al. (1999) but, given that it seems incompatible with the first of their explanations, it is relevant.

Therefore, it seems that all the chances of learning that children with autism can have do not have been taken into account in previous researches. It may even be thought that they can have thinking styles and abilities that, as it is going to be shown below, can be very useful for scientific progress. Nevertheless, before commenting those issues, it can be appropriate to review, based on the arguments exposed by McKenzie (2011), the psychological tests that are used in order to measure imagination ability at present, and to show, also based on those same

arguments, that maybe they do not measure that ability, but the ability related to divergent thinking.

Imagination tests and divergent thinking

McKenzie (2011) states that the most used tests for measuring the imagination of individuals are Torrance tests (Rosenthal, Demers, Stilwell, Graybeal, & Zins, 1983), the design fluency test (Jones-Gotman & Milner, 1977), and The Creativity Assessment Packet (for now on, CAP) (Williams, 1993). She also says that there are other tests that are very similar to these tasks and that have minimum differences with respect to them, such as the *magic door* task, which is, according to McKenzie (2011), a version of a task proposed by Karmiloff-Smith that is considered by Low, Goddard, and Melsner (2009). In her view, all those tests seem to have certain characteristics in common. Based on an initial data or drawing, for example, an incomplete figure, the participant must draw the largest number of figures that he or she can make for a particular period of time.

In this way, given that the results obtained by autistic people in such tasks are often worse than the results offered by general population in those same tasks, it is thought that autistic people have problems related to imagination and creativity. Nonetheless, McKenzie (2011) thinks that it is easy to explain why the results obtained by autistic people in the mentioned tasks are poor if papers about creativity such as that of Lui, Shih, and Ma (2011) are considered. Lui et al. (2011) compared the results offered by participants with Asperger Syndrome, which is a syndrome usually included in autism spectrum disorders, in CAP with the results obtained by participants without Asperger Syndrome in that same task, and they noted that their participants with Asperger Syndrome made very detailed figures and designs related to particular interests. According to McKenzie (2011), these results are not surprising because they are consistent with conclusions such as those exposed by Frith (1989), which reveal that details are really important for autistic people and that it is difficult for them to have overviews. Thus, McKenzie (2011) argues that it is possible to understand the concept of creativity in several ways, and that psychology considers creativity to be only an ability that can be quantified and that is related to divergent thinking. Obviously, if the largest number of designs that can be drawn from an incomplete figure is the only data that is considered to be interesting in order to measure creativity, creativity and imagination are considered to be linked to divergent thinking. However, McKenzie (2011) holds that other perspectives, associated with art, can be possible.

In her opinion, the abilities that cause that the autistic participants to obtain poor results in tests such as the mentioned tasks are, paradoxically, very important in art field. At present, artists often repeat a same figure in which only particular details are modified, draw designs slowly, do not make figures quickly, and, frequently, their interests are clearly defined. Art critics do not only accept those procedures and characteristics, but also value them, and, therefore, it seems necessary to explain why those procedures and characteristics are understood as evidence of problems linked to creativity and imagination when they are observed in people with autism.

Thus, if McKenzie (2011) is right, it cannot be said that the results obtained by autistic participants in the mentioned tasks show that they have certain limitations or disabilities. On the contrary, it can be held that those tasks reveal that autistic people have interesting cognitive abilities that are very valued in some culture fields. And this fact can lead to understand autism as a set of characteristic features of personality (which are present in some individuals), and not as a disorder or an impairment. For these reasons, it can be argued that autism is not a difficulty that inhibits human integral development, but a condition in which individuals have important abilities for progress in different relevant areas. It seems appropriate, in this way, to analyze in more detail the arguments raised by McKenzie (2011) with regard to the abilities that are very valued in the art field and that, according to her, are present in autistic people. The following part reviews such arguments.

Creativity and art

McKenzie (2011) thinks that there are autistic artists that are well-known, and that it is admitted that autistic people can have the necessary abilities for art. A good example in this regard can be, in her view, the work made by Stephen Wiltshire, who is an artist of great renown.

She states that the *Outsider Art Movement* has been the movement that has supported autistic art. Based on Thévoz (1994), it can be thought that the Outsider Art Movement refers to the art that is elaborated by socially marginalized individuals, who do not pay attention to the conventional aesthetic canons and create thinking only of themselves. Nevertheless, McKenzie (2011) says that, despite this, such a movement is not really marginal. It is internationally recognized and there is a journal on these themes (*International Journal of Intuitive and Visionary Art*). Furthermore, in her opinion, it must be admitted that the autistic artists linked to that movement can be considered to be creative and imaginative, and that they can master different artistic styles.

But she also comments that educational professionals often state that it is possible to observe abilities related to imagination and innovation in students with autism. Equally, she says that many parents claim that art can be used in order to communicate with autistic children. Obviously, those facts are, according to McKenzie (2011), inconsistent with criteria such as those established by World Health Organization (1993), which seem to link autism to problems related to certain abilities, including, of course, creativity. Likewise, it can also be said that such facts are inconsistent with the criteria offered by American Psychiatric Association (1994) and with the results of the tests for measuring imagination used by Rosenthal et al. (1983), Jones-Gotman and Milner (1977), and Williams (1993).

However, McKenzie (2011) presents arguments that allow understanding those contradictions. In her opinion, tests such as those mentioned, as indicated, measure, basically, divergent thinking and the results obtained by autistic participants in them show that they have characteristics and behaviors that are appreciated in art field. In fact, many artists that cannot be included in the Outsider Art Movement have been interested in very concrete matters, and their work has been slow and meticulous. An example in this regard that is cited by McKenzie (2011) is the work made by Cézanne. She comments that similar figures with very little variation between them can be observed in that work, and that those figures can recall, certainly, the results obtained by autistic participants in tests for measuring divergent thinking. Besides, McKenzie (2011) also refers to postmodern art, in which repetition is very important and subtle differences are very relevant. She states that other artistic movements can be mentioned in this way, but she seems to insist that postmodern artists have redefined interesting concepts, such as those of reinvention, repetition, and originality, and that this fact is sufficiently illustrative. In any case, she indicates that history shows that several great masters did not work in a manner consistent with the ability that is measured by the mentioned tests. History offers many examples of detailed creations, and it is not easy to relate such creations to rapid works such as those expected by psychological tests for measuring divergent thinking. In her view, some of those examples can be Michelangelo's David and De Vinci's Mona Lisa.

All these arguments suggest that clinical diagnostic and researches can be considering a view of autism that is not the appropriate view. It seems that there are important differences between the concept of creativity used by psychology (a concept related to divergent thinking) and the concept of creativity in art world. Nevertheless, the neurodiversity perspective can lead to think that the traditional view of autism is wrong, and facts such as those described by McKenzie (2011) can support the idea that autism is not a disorder or an impairment. As indicated, McKenzie (2011) does not refer to the concept of neurodiversity, but it can be

thought that her arguments can be used in order to hold that it is necessary to know and respect human neurological diversity, and that is not adequate to categorize people based on their cognitive differences, since such differences are not necessarily limitations. In fact, as exposed, it is possible that autistic people are creative and imaginative. It is true that the creativity and the imagination that can be observed in autistic people are different to the creativity and the imagination that can be observed in general population, but it is also true that the creativity and the imagination that can be observed in autistic people are very similar to the creativity and the imagination that can be observed in great masters of painting.

Nonetheless, it is obvious that creativity is not only necessary in painting world or in art world. Creativity is necessary in all areas of culture, including, of course, science. A priori, it can be thought that the kind of creativity that characterizes general population (which, as indicated, is the kind measured by tests and is related to divergent thinking) is more appropriate in scientific field, because, in certain situations, different quick solutions can lead to very positive consequences and, therefore, can promote scientific progress, especially in medical science area, in which the solutions can be, in some circumstances, urgent. However, the history of medicine can reveal, if certain episodes are analyzed, that the abilities that are valued and recognized by artistic movements such as the Outsider Art Movement can also be very useful in order to find solutions to problems. It is checked in the next section, in which a historic event that led to an important scientific discovery in medicine field and that has been studied extensively by philosophy of science is reviewed. Such an event is linked to the difficulties faced by Doctor Semmelweis, who noted that, in his hospital, the maternal mortality rate in one maternity ward was significantly greater than that observed in other maternity ward.

The relevance of details and subtle differences in scientific discovery processes

The case of Doctor Semmelweis has been, as mentioned, analyzed on many occasions. Data, reflections, and comments have been exposed, for example, by Sinclai (1909), Hempel (1966), or López Astorga (2010b). He faced a very complicated situation. In his hospital, there was an evident difference between the number of women that died in one maternity ward and the number of women that died in other maternity ward. This situation became an important problem that needed an immediate solution.

It was thought that the problem of the maternity ward in which more women died was that such women contracted puerperal fever, but it was necessary to detect the

causes that the number of cases of puerperal fever was clearly higher in one of the two maternity wards. Several hypotheses were raised (some of them were very imaginative) but the most interesting hypothesis for this paper is the hypothesis that finally proved to be the right one. It was discovered that more women died in one maternity ward because the medical students that examined them, before doing it, had practical classes with cadavers, handled bodies, and did not disinfect their hands when their work was completed, but physical contact was immediate.

It is obvious that, before contrasting a scientific hypothesis, such a hypothesis must be proposed in an imaginative way. Nonetheless, it can be said that the kind of imagination that McKenzie (2011) observes in autistic people can be the most useful kind in circumstances such as those that Doctor Semmelweis faced. It can be assumed that a detail-oriented person that can note certain details can find elements that distinguish similar scenarios, and, therefore, it can be thought that a person with such characteristics is very appropriate to solve problems such as that experienced by Doctor Semmelweis, in which it was necessary to identify different elements in similar situations. Note, in this way, that, in the case of Doctor Semmelweis, it was very important to detect that working routines were not exactly the same in the two maternity wards.

After all, the cause of the problem was discovered in a casual way. Accidentally, a student cut himself while working with cadavers and died after experiencing symptoms similar to those of the women with puerperal fever. A person with attention dedicated to details, as indicated, could have noted that better hygiene was necessary in order to solve the problem before the student died. For this reason, it can be said that the abilities valued by the Outsider Art Movement are the abilities that, in situations such as that described, can be more adequate for scientific research. It is evident that a person that regularly reviews all the little variables related to situations with great meticulousness can be the most likely to detect which of these variables are crucial, which of them can determine or condition events, and which of them can lead to negative consequences.

Those arguments, of course, can be questioned. It can be stated that, in the case of Doctor Semmelweis, a trial and error process was used in order to find the cause of the high number of puerperal fever deaths, that such a process was a mechanic and methodic activity that was not linked to imagination, and that identification of details in similar scenarios is an ability that is not related to creative thinking. Nevertheless, as held by López Astorga (2010b), who is based on approaches raised by contemporary philosophy of science such as that of Hempel (1966), scientific discovery processes are never automatic or mechanic deductions because, if that was the case, such processes would be infinite. It is always necessary an

indicative framework or a certain idea that leads researches and that delimits the fields in which the causes of some particular problems can be searched. Without frameworks or ideas, analyses can deviate from issues of direct concern for researches. However, an indicative framework or idea is only possible if there is a previous creative and imaginative hypothesis with regard to the problem that it is being researched.

Thus, it is clear that the rigorous and careful behavior that can be appreciated in autistic people can be considered to be the optimal behavior in art world (at least according to certain movements, for example, as mentioned above, the Outsider Art Movement or postmodern art) and in science and scientific progress area. Nonetheless, the previous arguments also clearly show that, despite the fact that art and science are thought to be very different cultural activities, they are closely linked. Education systems and curricula around the world seem to suggest that certain divisions are needed when students are completing the years of school corresponding to secondary or middle-level education, and that, from adolescence, it is appropriate to differentiate programs of formation, which can refer to arts and humanities or to scientific and technical areas. However, in light of the above, it can seem opportune to review those widespread education proposals because, as it can be appreciated, the abilities that are needed in several fields and in different areas can be similar. In fact, the only difference between such fields or areas can be that the abilities are applied to different aspects of reality.

But the most important point for this paper is that those common abilities that are relevant in different cultural areas can be clearly noted in people with autism. It can lead one to think that it is necessary to pay greater attention to the intellectual and cognitive potentialities that can be present in autistic people and to the fact that they can offer many possibilities of cultural and social development. Undoubtedly, the neurodiversity perspective can help in this way, but a contemporary theory from cognitive science field, the dual-process theory, can also contribute to a better understanding of the autistic cognitive style, showing equally that such a style can be very productive in different human activities.

A characteristic thinking style for autism: System 2

Descriptions and arguments about the dual-process theory can be found in several papers and books (for example, Evans, 2008; Inglis & Simpson, 2006; Reyna, 2004; Stanovich, 1999, 2004, 2012; Stanovich & West, 2000). The basic thesis of this theory seems to be that human beings do not have one mind, but two minds

(or, if it is preferred, that there are two kinds of mental processes in human beings). The functions of these two minds are clearly different and, although diverse terminology is used in order to refer them, the terms *System 1* and *System 2* are very common. Generally, System 1 is said to be related to intuitions and heuristics and System 2 is said to be linked to logical and analytical reasoning. The two systems are different in several ways, but the relevant distinction for this paper is that both systems do not work at the same speed. The heuristics and intuitions of System 1 cause a quick thinking, but, when System 2 is used, individuals reason more slowly.

López Astorga (2011a) holds that people with autism tend to prefer to use System 2 and that they use System 1 less frequently. He is based on the fact that the authors that support the dual-process theory often argue that the participants that execute very easy logical or mathematical reasoning takes sometimes make mistakes and do not offer the correct answer because they do not use System 2 in order to solve such tasks, but System 1. In particular, this last idea is help in papers such as that of Inglis and Simpson (2006). Nevertheless, López Astorga pays attention to other interesting fact with regard to this problem. He comments that, when those same tasks are executed by autistic participants, the results seem to improve on a number of occasions, and he says that this circumstance can lead one to think that people with autism do not reason in the same way as general population and that they use the system that is truly appropriate in such tasks, that is, System 2.

His analysis is mainly based on the Linda Problem (Tversky & Kahneman, 1983). The difficulty of this problem is that the participants that execute it generally commit a fallacy. Such a fallacy is the conjunction fallacy and it consists of considering a fact composed by two events to be more probable than a fact composed by only one event. This fallacy is, therefore, inconsistent with the most basic principles of the probability theory. In the classic version of the Linda problem, Linda is described in the instructions and it is said that she fought against social injustices and that she was highly critical of the political system when she was younger. Then, different alternatives with regard to her situation at present are proposed and the participants must indicate which of those are less probable and which of those are more probable. Usually, the participants think that a scenario in which “Linda is a bank teller and is active in the feminist movement” (Tversky & Kahneman, 1983, p. 297), which is one of the possibilities that are often presented, is more probable than a situation in which, simply, “Linda is a bank teller” (Tversky & Kahneman, 1983, p. 297), which is other of the options that often appear. As it can be appreciated, this conclusion is not correct because, as indicated, the probability theory does not allow considering a fact composed by two events (the event that Linda works as a bank teller and the event that she

participates in the feminist movement) to be more probable than a fact composed by only one event (the event that Linda works as a bank teller). Thus, most participants are led by the initial information transmitted about Linda and, as mentioned, generally commit the conjunction fallacy.

However, López Astorga (2011a) states that the experiments presented by Morsanyi, Handley, and Evans (2009) show that autistic people, when face exercises similar to the Linda problem, commit this fallacy less often than general population and that the difference in this regard is significant. This fact can be another proof that autism is linked to a way of being and a thinking style, and not to an impairment, and it clearly reveals that the neurodiversity perspective can be an appropriate perspective. Nevertheless, Morsanyi et al. (2009) interpret this fact in a different way. In their view, a better logical or mathematical reasoning is not the cause that their autistic participants do not commit the conjunction fallacy. The true reason is that it is difficult for autistic people to contextualize the information that they receive. Thus, the thesis held by Morsanyi et al. (2009) is, broadly speaking, that the autistic participants that execute tasks such as the Linda problem cannot combine the initial data presented in the instructions with the information included in the alternative options following that description (that is, in the particular case of the Linda problem, they cannot combine her initial description with her possible situations at present), and they cannot, precisely, because they are autistic.

Nonetheless, the approach proposed by López Astorga (2011a) is based on other assumptions. On the one hand, he pays attention to the fact that an important characteristic of autism is that autistic people tend to interpret linguistic information literally, and states that such a tendency can have an influence on their execution of exercises such as the Linda problem. Strictly speaking, if it is said that *Linda is a bank teller*, it is not denied that she *is active in the feminist movement*. If it is only said that she *is a bank teller*, in that scenario, it is possible that she is not active in the feminist movement, but it is also possible that she is active in such a movement. If this last circumstance is noted, the other option (that is, *Linda is a bank teller and is active in the feminist movement*) is clearly understood as a more restrictive alternative. This last fact composed by two elements (*Linda is a bank teller and is active in the feminist movement*) can only be considered to be more probable than the other previous fact composed by only one element (*Linda is a bank teller*) if, and only if, this last fact is not interpreted literally and an information that is not really included in it is added (that is, that Linda, besides being a bank teller, is not active in the feminist movement). According to López Astorga (2011a), autistic people can have an advantage in this kind of problems because they can understand statements such as *Linda is a bank teller* literally, and

general population, however, in similar tasks, tends to interpret that type of statements adding information (for example, as indicated, that Linda is not active in the feminist movement at the same time). In this regard, it can be important to keep in mind that papers such as that of Kanner (1943) allow assuming such a tendency towards literalness in autism.

On the other hand, López Astorga (2011a) indicates that the results of other tasks included in the research presented by Morsanyi et al. (2009) suggest that autistic people can somehow integrate and combine information, and that, therefore, the explanation offered by them with regard to the results obtained by their autistic participants in tasks similar to the Linda problem cannot be totally accepted. In this way, López Astorga holds that his arguments can lead to an alternative explanation of the results presented by Morsanyi et al. (2009). According to him, that alternative explanation can easily be understood if the autistic people's potentialities, not their limitations, are considered and the dual-process theory is assumed.

The idea exposed by López Astorga (2011a) is, as it can be deduced from the previous comments, that it is important to pay attention to the thesis raised by Inglis and Simpson (2006) with regard to the Linda problem, that is, that, in such a problem, general population often answers incorrectly because System 2 is not used. In their opinion, the participants resolve that task quickly and intuitively, and, based on the initial information that describes Linda, they only use System 1. Thus, López Astorga (2011a) thinks that, if this argument is true, the better results obtained by autistic people in this exercise can mean that, in contrast with general population, people with autism execute this task using System 2, which is, according to Inglis and Simpson (2006), the appropriate system. However, López Astorga (2011a) does not hold that autistic people are more logical than general population. His thesis is that autistic people reason using logic more often than general population, and that, in situations in which general population use intuitions and heuristics (System 1), autistic people use their analysis and logical reasoning capabilities (System 2).

But, if this last thesis is accepted, it can also explain why autistic and non-autistic people obtain different results in the psychological tests for measuring imagination that refer to divergent thinking, for example, the tests proposed by Rosenthal et al. (1983), Jones-Gotman and Milner (1977), and Williams (1993). It can be said that non-autistic people, when they face such tests, by using System 1, that is, their intuitions and their heuristics, can quickly offer models and designs that can be considered to be valid in accordance with the instructions of those tasks. On the other hand, autistic people, when they face those same tests, by using System 2, that is, their logical reasoning, think analytically and slowly and pay attention to

small details and the small modifications that can be made on the basis of an initial situation or of a first sketch such as those that appear in the mentioned tests.

Likewise many works of art linked to the Outsider Art Movement seem to be the result of the analytical abilities related to System 2, and this fact can also be noted in other pictorial artistic expressions that do not necessarily belong to the Outsider Art Movement, for example, the expressions mentioned in the third section of this paper. In this way, it can be thought that creativity is not only related to irrationality or to System 1. System 2 can also have its form of creativity, which, given that this last system seems to be the most used by people with autism, can be considered to be the form of creativity that, apparently, mainly characterizes autistic people. Obviously, this idea does not mean that autistic people are necessarily (or exclusively) characterized by System 2. It only means that people with autism prefer such a system to a greater extent than non-autistic people.

Equally, it is evident that, in certain scientific research processes, predominance of System 2 can be extremely advantageous, in particular, in circumstances such as that faced by Doctor Semmelweis. Analytic, slow, and detailed procedures are adequate in those situations because the key can be, as commented, modification of small variables (such as, for example, the act of washing hands –or failure to do so– before checking patients). System 2, along with its particular form of creativity, can be the more appropriate system in order to find the explanation of certain facts, and, therefore, it can be said that the idiosyncrasy that characterizes autism can be very useful to support scientific progress. Based on these arguments, it is hard to understand that a logically or mathematically valid answer (for example, a correct ranking of probabilities in the Linda problem) is considered to be evidence of an impairment in researches such as that of Morsanyi et al. (2009).

Conclusions

The previous sections appear to show clearly that autistic people can offer an important contribution to cultural, social, and artistic development, and that perhaps their help can become invaluable. The reflections about the Outsider Art Movement presented by McKenzie, if related to the neurodiversity perspective, can lead one to think that people diagnosed with autism have relevant abilities that do not necessarily limit their possibilities, and that such abilities, if adequately considered, can mean an increase in quality artistic production and in interesting scientific proposals consistent with facts and with current theoretical approaches.

A priori, it can be thought that people with autism have important intellectual difficulties, but, as exposed, it seems that their problems are not related to logical reasoning (it has been shown by means of the mentioned previous studies) or to the abilities linked to imagination and creativity (it has been shown by means of the McKenzie's arguments about the reality of the Outsider Art Movement and other artistic manifestations). The indicative frame of reference with regard to these issues must be the neurodiversity concept. By considering such a frame of reference, it can be held that, although it is well-known that autistic people share certain common characteristics (for example, communication and social interaction problems), the idea that they have intellectual limitations such as those commented in the preceding pages can be questioned. That frame of reference reveals that it can be opportune to accept the view that, really, autistic people have a different cognitive style, which, in strict sense, is not necessarily worse than the cognitive style that characterizes general population. In this way, the autistic cognitive style, which is based on the search for details and the interest for minimal modifications, seems to be very appropriate and adequate when certain methodologies are used, both in art and in science. The rigor of this autistic style can be very useful for the development of different areas of knowledge, and such a style can be easily linked to the theses established by the dual-process theory because, in essence, it can be said, in a manner consistent with López Astorga (2011a), that the autistic style is a style with a greater tendency to use System 2 (that is, the system related to analytical and logical reasoning), that leads to orderly and systematic procedures that are slowly executed, and that ensure the necessary accuracy.

Maybe the problem is that, usually, when autism is researched, a premise is assumed. Such a premise refers to the idea that autism is a disease or a disorder. Thus, if it is noted that autistic people have a distinctive feature that cannot be seen in general population, that distinctive feature is considered to be a problem that can reveal a deeper inability and that must be corrected. However, the neurodiversity perspective offers many possibilities. That perspective allows noting, in a clear way, that autistic people have certain qualities that can be very positive. In principle, the fact that an individual has a rigorous logical reasoning and can analyze small details does not mean that such an individual has a problem, because those characteristics are not necessarily negative. Nevertheless, in the context of autism research, such characteristics seem to be interpreted as clear signs of a disorder. Undoubtedly, such an interpretation can be blocked if the neurodiversity perspective is accepted and it is understood that that interpretation is not the only possible interpretation.

Finally, it can be opportune to state that it is necessary to keep in mind that all human beings have both positive abilities and limitations, and that, for this reason,

it is important to assume that every human being can contribute, to the extent of their possibilities, to the cultural and social development. A person can have particular difficulties but those difficulties can be compensated by the other people's capabilities. If this fact is considered, perhaps the autistic people's abilities can be adequately valued.

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SUMMARY

The concept of creativity in art and in science: are autistic people creative?

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Usually, autism is said to be characterized by certain difficulties related to lack of creativity. In this paper, based on the arguments offered by McKenzie and paying attention to the neurodiversity perspective, it is held that the concept of creativity has not been understood correctly, and that, if the artistic field is considered, it can be stated that people with autism can be creative, because creativity can be linked to repetition and details. In this way, it is argued that the repetitive and thorough actions that autistic people often make can have beneficial impacts on art, on the development of scientific knowledge, and on social progress in general.

Keywords: art; autism; creativity; neurodiversity; scientific knowledge