

INFERENTIAL PROCESSES IN READERS WITH DOWN SYNDROME

[Los procesos inferenciales en lectores con síndrome de Down]

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Abstract

The aim of this work is to know if the source of the difficulty in making inferences, readers with Down syndrome, is in access to prior knowledge or constructing ideas from purely textual knowledge (based on Saldaña and Frith, 2002 for autism). Involved a sample of 20 students with Down syndrome and mild mental retardation (mean IQ = 60) and a control group of 20 children without cognitive deficits. They were matched as to their extent read metal age via Prueba de Evaluación del Retraso Lector (average 8 years). We created two experimental situations: a) subjects had to generate inferences based on physical knowledge, b) social inferences about knowledge. The ability to check and reaction times in the activation of inferences about physical and social knowledge. We also analyzed the influence that the effect *priming*. Results showed: a) a rate of correct inferences similar verification tasks between the two groups, b) Down subjects take longer to access knowledge that the previous text, c) reaction times used by subjects Down were higher in activating physical inferences, d) there were no significant differences in the population without reaction times gap between physical and social inferences e) subjects without deficits benefited effect "priming" in both types of inferences f) Down subjects only improve reaction time in the inferences of social nature.

Keywords

Inference; Down syndrome; reading comprehension; prior knowledge.

Resumen

Este estudio pretende conocer si el origen de la dificultad para realizar inferencias, en lectores con Síndrome de Down, se encuentra en el acceso al conocimiento previo o en la construcción de ideas a partir del conocimiento puramente textual (basándonos en Saldaña y Frith, 2002 para autismo). Participó una muestra de 20 alumnos con Síndrome de Down y discapacidad mental leve (media de C.I.= 60) y un grupo control de 20 alumnos sin déficit cognitivo. Ambos fueron igualados en cuanto a su edad mental lectora medida a través de la Prueba de Evaluación del Retraso Lector (media 8 años). Creamos dos situaciones experimentales: a) los sujetos tenían que generar inferencias basadas en el conocimiento físico; b) inferencias acerca del conocimiento social. Se evaluó la capacidad de verificación y tiempos de reacción en la activación de inferencias sobre conocimiento físico y social. También se analizó la influencia que el efecto "priming" sobre ambas situaciones experimentales. Los resultados mostraron: a) una tasa de inferencias correctas similar en las tareas de verificación entre ambos grupos; b) los sujetos Down tardan más en acceder al conocimiento textual que al previo; c) los tiempos de reacción empleados por los sujetos Down fueron mayores en la activación de inferencias de carácter físico; d) no se encontraron diferencias significativas en los TR en la población sin déficit entre inferencias físicas y sociales; e) los sujetos sin déficit se beneficiaron del efecto "priming" en ambos tipos de inferencias; f) los sujetos Down sólo mejoran el tiempo de reacción en las inferencias de naturaleza social.

Descriptores

Inferencias; síndrome de Down; comprensión lectora; conocimiento previo.

Activation of prior knowledge is an important aspect in learning from texts, which has made the study of inferential processes has become in recent years the main focus of the research in reading comprehension.

Models about reading comprehension, which we used as framework in this study, have tried to explain how subjects build the mental representations during comprehension (Kintsch, 1988, 1993, León & van den Broek, 2000; Otero, León & Graesser, 2000). In these models, inferential processes are very important because they allow explain how we do when we try to give textual coherence, about their construction and essential cause. It explains the core of human understanding, its interpretation and explanation (Graesser, Singer & Trabasso, 1994; McKoon & Ratcliff, 1992; Sharkey & Sharkey 1992).

We access to information implicit through inferences (Ford & Milosky, 2008). Thus, it has been found empirically that children show greater difficulties in inferential processes (Cain & Oakhill, 2006; Cain, Oakhill & Lemmon, 2004).

But, despite the interest in the study of these comprehension processes, there is little research in the field of special population in our country, saving exceptions like the research of Aguado, Ripoll, Zazu & Saralegyi (2007). Therefore, this study aims to examine the processes of reading comprehension in individuals with Down syndrome, from the analysis of the automatic processes and access to prior knowledge.

First, we will make an approximation of what literature found about cognitive processes in this population through reading comprehension tasks.

Cognitive analysis of people with Down syndrome is a risky and compromised by the large number of studies, experiences and work in this field. Most have been conducted with different models and their interpretation has been made from various cognitive perspectives, what has generated different actions both in the design of

social welfare policies and professional practices as conceptual and research field (Melero Lopez, 1983, 1997, Martin-Caro and Otero, 1999).

But despite this, the main researches in this field allow us to maintain that the difficulties showed by subjects with Down syndrome when they have to process textual information, can be explained, as is the case in other special populations, through a cognitive functional analysis (Mahoney, Perales, Wiggers & Herman, 2007; Roberts, Price & Malkin, 2007; Stenberg, 1985, among others).

In this sense, it remains that people with intellectual disabilities often have problems in reading comprehension tasks both sequential memory, leaving them unable to record and retain several verbal commands continuously, as when they have to use their metacomponents or higher order processes (Martin-Caro & Otero 1999, Molina & Arraiz, 1993, Rondal & Ling, 1996; Troncoso, 1992; Troncoso & Cerro, 1991, 1998). Planning, control and evaluation of a task can show an inability to define the different terms of a problem (Wishart, Willis, Cebula & Pitcairn, 2007). When they have to find a solution, they need a very detailed and explicit instruction of the task (Butterfield, Wambold & Belmont, 1973; Campione & Brown 1978, 1979; Jarrold, Horn & Stephens, 2009; Martín-Caro & Otero, 1999). Perhaps all these produce some rigidity to change the strategy and consider the problem partially.

Individuals with Down syndrome spontaneously use strategies, but they have several problems to make explicit it. Verbal and strategic difficulties seem to cause these metacognitive difficulties, causing significant differences between subjects with and without intellectual disabilities, when they have to code and organize the problems in terms of analogies. Individuals with this disability have some variety of performances, but they do not know as they can use them (Galeote et al., 2008; Jarrold, Thorn & Stephens, 2009; Schalock 1999). Individuals with Down syndrome have not an overall or-

ganization, even though they use it rather than other cognitive disabilities.

From the above it follows that the operation of the lower-order processes are deficient in Down syndrome. For example, when these subjects are trying to use the coding component called stimuli of the problem, prove to have some difficulty using the stored information. Besides, they find a deficient application or extrapolation of the implicit rule to elements of analogies. So, if asked to compare and justify solutions, children with mental retardation show some difficulty verbalizing the solution. That is, are common problems that have to integrate information and partial knowledge, establish relationships that allow them to achieve a more integrated. In this sense, they can be difficult to transfer learning of a specific situation to another, and to generalize the acquisitions (Martin-Caro & Otero, 1999).

We can argue that individuals with Down syndrome have a disability when they have to employ executive processes necessary information to use in solving a given task, lack of access to information spontaneously. In the same way, it can be the case of the mental disability in Down syndrome score. It is very low on analogical reasoning problems when they require the use of these components.

Besides, through on-line measures, primarily related to planning, there are also significant differences in relation to the population without deficit. It has been found that they show latter spend more time in planning and coding of information, although they run faster responses. Instead, individuals with Down syndrome are more impulsive at the time of planning and code but they are slower (Feuerstein, Rand, Hoffman & Miller, 1980; Heath, Grierson, Binsted & Elliot, 2007; Lott and Dierssen, 2010). Obviously this fact influences their control when making the task, thus children with Down syndrome also show some difficulty in this regard metacognitive (Wishart, Willis, Cebula & Pitcairn, 2007). In general, they show certain shortcomings to analyze the whole process of the problem, in which point in the solution they

are (Brown, 1978). Down's syndrome is related difficulty metacognitive control and it seems to be explained by language delay makes. It can not be used as a regulator of thought. In this sense, Butterfield & Belmont (1977), Butterfield & Nelson (1989), or more recently, Price, Roberts, Vandergrift & Martin (2007) found that individuals with mental disabilities show a lack of active and deliberate planning through a deficit in access and coordination spontaneous cognitive processes. It makes slower their answers.

However, current studies (Levorato, Roch & Beltrame, 2009) showed that contextual facilitation in this population is highly and significantly related to reading comprehension skills. Specifically this paper shows that when the task of reading comprehension is presented within a context brief, subjects with Down syndrome have better results.

Our general objectives are:

- a) To analyze inferential processes (access to social vs physical knowledge);
- b) To explain the automatic processes through on-line measures;
- c) To analyze the effect of contextual facilitation in reading comprehension processes.

Our research is based, in regard to design, in Saldana & Frith (2007) which examine the ability of making inferences about physical vs. social knowledge in autistic subjects. By contrast, our research attempts to replicate the effects found called validation by Singer, Halldorson, McLear & Andrusiak (1992) on perceptual inferences with different materials and with children. Our participants were individuals with Down syndrome matched in their reading level and mental retardation (mild).

Our working hypotheses argue that:

- Comprehension problems about textual in subjects with cognitive deficits are determined by an inability to access the relevant textual information. This will be mostly reflected in inferences about physical knowledge vs. social knowledge.

This hypothesis argues about the fact that the subject builds knowledge from their interaction with the physical and social environment, but the product will depend on the development of their cognitive abilities. Due to cognitive deficit we maintain that the physical knowledge will mostly hurt against social knowledge. And although the perception of social stimuli depends on how they are categorized and interpreted by the subject, how the information is organized, selected and simplified, mental structures necessary to build social knowledge are considered easier to access than which are necessary to build physical knowledge, as these students learn from the experience. Therefore we test this premise in order to verify experimentally.

- Down Subjects will show automatic processing problems, or in any case the access to the relevant information will be slower.

- Subjects with cognitive deficits will be the greatest benefit in generating inferences in the presence of a facilitator information (priming effect).

Method

Participants

Fourty participants of both sexes were used as participants, 20 with Down syndrome and 20 without cognitive deficits. The sample was selected from the realization by the subject of an assessment test of mental age reader. We used PEREL (Maldonado et al., 1992) to measure this variable. According to the scores 16 Down subjects were selected (reading mean average of 8 years and 5 months and 12 years and 5 months of chronological age). Subjects without deficit had a reading mean age of 8 years and 4 months, and a mean chronological age of 8 years and 3 months in reading mental age. At the same time, through the information provided by the school where students were enrolled, we obtained new information concerning the IQ (evaluation of less than one academic year). Its level was mild or slight delay (mean IQ = 65). Besides, subjects in each group were selected based on their educational experience and their instrumental learning reader.

Materials

- To test about their read mean age we used PEREL (Maldonado et al., 1992). This is a test of individual application that was designed to identify children with problems in learning to read and allows us to establish the mental age of the student reader.

- To try to make inferences with and without priming effect, we rely on the study Saldana and Frith (2007) which developed the measurement tasks inferences following the work of Singer, Halldorson, McLearn & Andrusiak (1992) designed to examine the mental process of bridge or backward inferences in discourse comprehension.

Then, we built a single application test with 8 tasks about physical knowledge and 8 tasks about social knowledge. Basically, in the first situation, readers are provided with textual information necessary to solve the task, compared to the second where the reader has to use prior knowledge to resolve the matter. The tasks consist of two sentences and a question.

An example of the work of social knowledge: "Andrea studied mathematics yesterday afternoon. Andrea was in her grandmother's house. Can you pass without studying hard?". And note that the question refers to the story read in itself, but knowledge of the world that the reader probably has. It is also a necessary knowledge for inference about whether it can pass without studying much. Faced with these select other physical that did not involve prior knowledge, the information is derived from the same experimental context: "Luis had a washing machine at home. Luis took all his clothes dirty. Did Luis wash many pants? ".

We used 8 tasks (4 had priming effect and 4 have not priming effect. The effect of priming refers to the influence of a stimulus in the subsequent performance of the processing system (Schacter, 1995). The semantic priming should allow inferences about the nature of mental representations underlying implicit information. The semantic priming, the established in our experimental situation, has been used in many previous situations which also requires concep-

tual processing of stimuli. So in the following table we can observe the condition of physical knowledge "being very thirsty" acts as a facili-

tator of "drinking a lot" and social knowledge "cut" of "pain".

Table 1 - Examples of such tasks as knowledge and without priming

Priming taks Physical knowledge	Taks without priming Physical knowledge	Priming taks Social knowledge	Taks without priming Physical knowledge
-John was very thirsty.	-Jorge had in his house a washing machine.	-John was cut with a knife	-Andrea studied mathematics yesterday afternoon
-John grabbed a glass of water	-Jorge took all his dirty laundry	-John went to the doctor	-Andrea was in her grandmother's house
-Did John drink a lot?	-Did Jorge wash many pants?	- Did John feel pain ?	-Can you pass without studying hard?

Design

We use a simple experimental design, with a dependent variable with two levels: production of inferences (verification and reaction time) and two independent inferential variables (social vs. physical knowledge) and the presence vs. absence of priming effect.

Procedure

First, we administered the PEREL, to verify the reading mental age of the subjects (both the control group and the experimental group had an average reading mental age of 8.5 years).

Each subject read 100 words and subsequently their reading mental age was calculated based on their direct scores.

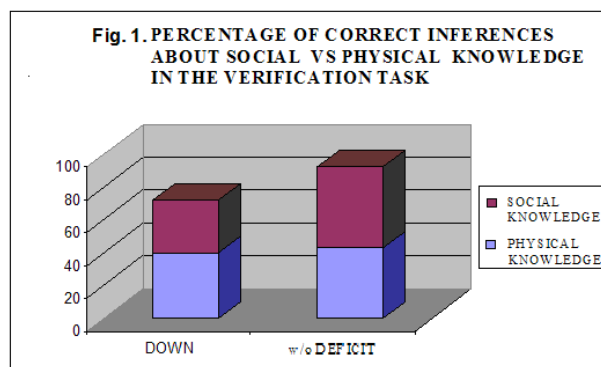
Second, we administered to test subjects make inferences with and without priming effect, along the lines of building the english version of Singer et al. (1992). The test consisted of 16 tasks consist of two sentences and a question: 8 tasks are presented with priming effect, and of these four were related to issues of physical knowledge and the remaining 4 relating to social knowledge; 8 remaining tasks no priming effect is exhibited even with the same characteristics as those mentioned above. Subjects had to read on a computer screen the two sentences and answer YES or NO to the question posed. With this work we intend to verify that subjects made significantly more inferences about social knowledge, as the reader generates comprehensive process from prior knowledge performed better than from

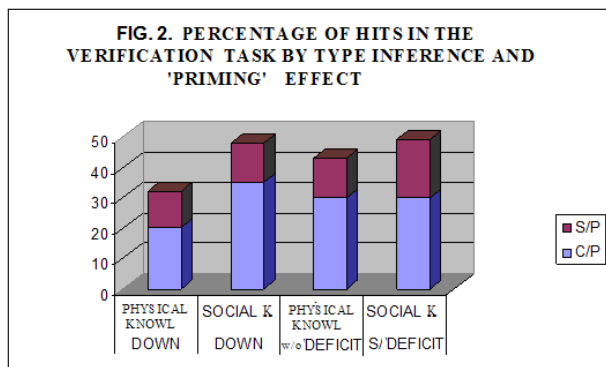
physical cooking, regardless of the priming effect. Furthermore, we also wanted to test whether subjects with cognitive benefit of this facilitation effect.

Results

Verification task results

Percentages obtained by the subjects in the verification work of total inferences vs subjects without deficits. Down subjects showed similar percentages, although most subjects made no deficit (76% vs Down. 89% in subjects with no deficit). Considered scores according to the type of knowledge involved in performing inference (social / physical) we did not find differences between the type of inferences (social vs. physical knowledge). However, no deficit children performed a greater number of inferences regarding the physical social knowledge. As for the effect of priming subjects without deficits benefited from this assistance, regardless of whether the inferences relating to physical or social awareness against Down subjects who benefited only in inferences regarding social knowledge.





In order to check the statistical significance of the contrast medium in the verification test, we conducted the T-Student test for independent groups between the experimental and control groups, and for related groups within the experimental group.

A significance level of $p = .05$ results did not show significant difference in scores of Down subjects and subjects without deficits ($p = .127$).

Results, in Down without priming showed no significant differences between inferences about social and physical knowledge ($p = .244$), as to the priming effect, it significantly benefited generating inferences about social knowledge ($p = .047$), but not the physical knowledge ($p = 0.266$).

Control group showed significant differences between inferences about physical and social knowledge ($p = .018$). In turn, the priming effect facilitated both types of inferences: physical knowledge ($p = 0.023$) and social ($p = .043$).

Results in reaction times (RT)

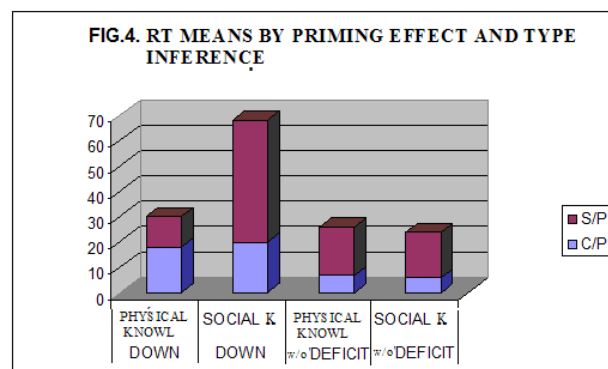
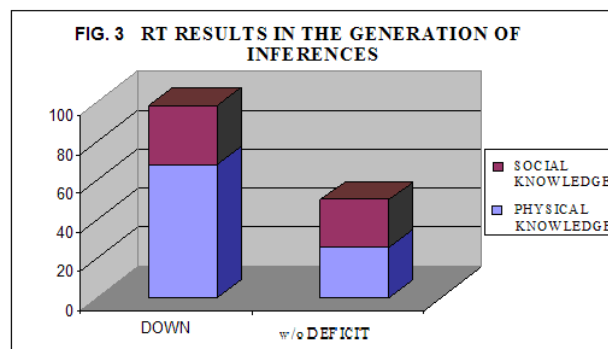
Percentages of RT social vs physical inference generation showed that subjects Down are slower to recover the relevant information, the differences being most pronounced at the time of activation of physical knowledge.

As regards the priming effect data showed that only the Down population benefits from this aid in faster access to social knowledge.

Reaction Times were similar in control group, both in the access to physical and social

knowledge. Not seeing it benefited by the priming effect.

We conducted, with the reaction times of correct inferences (measured in seconds) several contrasts for mean (t-test).



Results showed significant differences between the two groups of subjects: Down students take significantly longer to answer the correct inference than subjects without deficits or control group ($p = .000$).

As for the results showed in Down subjects:

- significant differences in RT between physical and social knowledge: took longer activation of physical knowledge ($p = .000$);
- significant differences by priming effect on inferences about social knowledge ($p = .000$), which was facilitated by the aid;
- no significant differences by the priming effect inferences about physical knowledge ($p = .347$).

Results in control group showed:

- a) no significant differences between the activation time of the physical and social inferences ($p = 0.494$);
- b) no significant differences due to the priming effect on RT for inferences about physical knowledge ($p = 0.235$) and social ($p = 0.699$).

Discussion and conclusions

Throughout this work will tried to know the generation of inferences on-line (verification and reaction time) in making inferences derived from the physical and social knowledge, with and without effect "priming" in Down subjects and subjects without cognitive deficits.

Our study is, at certain stages, an adaptation made by Saldana & Frith (2007) in autistic population, based on the methodology of Singer et al. (1992). Its contribution lies in comprehension population results in Down and, above all, in considering on-line through the measurement of reaction times (RT). In this sense, we can say that the most outstanding of the study refer to the time it takes for these subjects in access to relevant information either textual, either prior knowledge, rather than to self-identification of the same.

It is known that people with Down syndrome have difficulty retaining information, both to receive and process limitations (short term memory) and to consolidate and retrieve (long term memory). However, their procedural and working memory is well developed and, therefore, they can accurately perform sequenced. Perhaps, it is the explanation of our results: children with Down syndrome and mild intellectual disabilities have significant gaps in their explicit or declarative memory. Thus they are able to perform complex behaviours that are unable to explain or describe, besides they show difficulties to develop spontaneous strategies to improve their memory capacity, probably due to lack of training (Davis, 2008). However, the experimental situation presented here consists of two affirmative sentences facilitating a cognitive context (access to prior knowledge), even if the processing time is

longer. It can lead to a significant educational implication: be recommended systematic training and short extension to solve the known face memory deficits, so they can respond immediately with a mental operation. For this reason, Cain, Oakhill and Bryant (2004) sensory information may be stored temporarily in short-term memory, but permanent storage in long-term memory requires consolidation.

As for the differential results about the activation of inferences concerning the physical knowledge vs. social results showed no significant difference in Down subjects and in subjects with no deficit, although we appreciate a greater mastery of inferential processes of social character in the population without deficit.

Thus the data are verified study Saldana and Frith (2007) in autistic population, which are coincident with the Down population: difficulties are not differential between these subjects showing ability to access prior knowledge versus building ideas from purely textual knowledge. However, we found significant differences in favour of social knowledge in population without deficit, which can be played by one's cognitive abilities of students in this age, as shown by studies on developing evolutionary inference. A recent study by Ford and Milosky (2008) shows how quickly the emergence of social inferences, they already begin to appear in childhood, which would result in further consolidation of the same at school age.

Regarding the priming effect, subjects without deficits not especially benefit from this assistance in conducting both types of inferences. However, in Down town, this helps improve inferences regarding social knowledge, these data can be interpreted from what previous studies indicate as characteristics of this population where immaturity is not generalized to all kinds of activities but can be more pronounced in some areas than others. They would have more predisposed to social type tasks: their social age is usually higher than the mental. Perhaps for this reason, the student

uses the facilitating effect to demonstrate these abilities.

In conclusion, it does not seem that the semantic difficulties experienced by children with Down syndrome are entirely explained by limitations in inferential processes, although they may find some problems in the texts of social content, while its execution is very slow. These latter results could also influence other processes readers make inferences as reference or attribution of intentions to the author.

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Title / Título	Inferential processes in readers with Down syndrome. [<i>Los procesos inferenciales en lectores con síndrome de Down</i>].
Authors / Autores	Rosende-Vázquez, Marta & Vieiro-Iglesias, Pilar
Review / Revista	RELIEVE (Revista ELectrónica de Investigación y EValuación Educativa), v. 19, n. 1
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Abstract / Resumen	<p><i>The aim of this work is to know if the source of the difficulty in making inferences, readers with Down syndrome, is in access to prior knowledge or constructing ideas from purely textual knowledge (based on Saldaña and Frith, 2002 for autism). Involved a sample of 20 students with Down syndrome and mild mental retardation (mean IQ = 60) and a control group of 20 children without cognitive deficits. They were matched as to their extent read metal age via Prueba de Evaluación del Retraso Lector (average 8 years). We created two experimental situations: a) subjects had to generate inferences based on physical knowledge, b) social inferences about knowledge. The ability to check and reaction times in the activation of inferences about physical and social knowledge. We also analyzed the influence that the effect "priming". Results showed: a) a rate of correct inferences similar verification tasks between the two groups, b) Down subjects take longer to access knowledge that the previous text, c) reaction times used by subjects Down were higher in activating physical inferences, d) there were no significant differences in the population without reaction times gap between physical and social inferences e) subjects without deficits benefited effect "priming" in both types of inferences f) Down subjects only improve reaction time in the inferences of social nature.</i></p> <p>El presente estudio pretende conocer si el origen de la dificultad para realizar inferencias, en lectores con Síndrome de Down, se encuentra en el acceso al conocimiento previo o en la construcción de ideas a partir del conocimiento puramente textual (basándonos en Saldaña y Frith, 2002 para autismo). Participó una muestra de 20 alumnos con Síndrome de Down y discapacidad mental leve (media de C.I.= 60) y un grupo control de 20 alumnos sin déficit cognitivo. Ambos fueron igualados en cuanto a su edad mental lectora medida a través de la Prueba de Evaluación del Retraso Lector (media 8 años). Creamos dos situaciones experimentales: a) los sujetos tenían que generar inferencias basadas en el conocimiento físico; b) inferencias acerca del conocimiento social. Se evaluó la capacidad de verificación y tiempos de reacción en la activación de inferencias sobre conocimiento físico y social. También se analizó la influencia que el efecto "priming" sobre ambas situaciones experimentales. Los resultados mostraron: a) una tasa de inferencias correctas similar en las tareas de verificación entre ambos grupos; b) los sujetos con Síndrome de Down tardan más en acceder al conocimiento textual que al previo; c) los tiempos de reacción empleados por los sujetos con Síndrome de Down fueron mayores en la activación de inferencias de carácter físico; d) no se encontraron diferencias significativas en los TR en la población sin déficit entre inferencias físicas y sociales; e) los sujetos sin déficit se beneficiaron del efecto "priming" en ambos tipos de inferencias; f) los sujetos con Síndrome de Down sólo mejoran el tiempo de reacción en las inferencias de naturaleza social.</p>
Keywords / Descriptores	<i>Inference; Down syndrome; reading comprehension; prior knowledge.</i> Inferencias; síndrome de Down; comprensión lectora; conocimiento previo.
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