

Gender and Attention Development in Children in Play Situations in Abidjan/Côte d'Ivoire



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ABSTRACT: The presence of play in life raises questions about its relationship with human development, behavioral functions, particularly physical, social-emotional and cognitive. Since attention is one of the cognitive functions that regulate human functioning, the study of its development led us to analyze its relationship with gender in children in play situations. To do this, we selected 144 children aged 7 to 11 years, 72 of whom were girls and 72 boys from disadvantaged socioeconomic backgrounds in Abidjan. These subjects were selected on the basis of a questionnaire and trained to play "4-cross" (traditional game) and video rally (electronic game). These participants were evaluated by the Double Barrage Test (T-2-B) of Zazzo (1969) and the Continuous Performance Test of Rosvold et al. (1956) adapted (WinCPT). The results of these tests do not show a significant difference between the performance of girls and boys. However, a qualitative analysis shows a tendency to differences in the strategies used by girls and boys in the execution of attention tasks. Boys tend to use visual and spatial strategies more often. They are faster in certain spatial-visual tasks and use more autonomous strategies, which are better adapted to new situations. On the other hand, girls tend to be faster in processing certain types of information: in perceptual speed and inaccuracy. These results, which do not confirm the hypothesis, converge with some previous work.

KEYWORDS: development, attention, gender, play, types of play, age.

I. INTRODUCTION

The human being is capable of activities and behavioral reactions in relation to the physical and social environment that surrounds him. This functioning concerns the physiological, conative, social, affective and cognitive aspects of the individual. Among these aspects, cognition is an important term that refers to a complex system that generates, transforms and processes information related to the different aspects of life. It involves various mental processes that play a role in many psychological functions such as learning, memory, intelligence, perception and attention. The latter, which underlies and is almost indispensable to all cognitive activities, seems to be one of the most important (N'dri, 2015).

Indeed, attention is a common notion that does not have unanimous agreement on its definition and its model of functioning. However, for Camus (1996, p. 24) : « attention is a psychic activity by which a subject increases his or her efficiency with regard to learning, perception, intellection and memory by orienting, controlling and selecting one or more activities during a limited period of time with the inhibition of competing activities ». Attention is therefore a psychic function that regulates, maximizes or not the effect of the information processing functions. Psychic activity is then the coordination of the relatively stable level of certain cognitive functions and the fluctuating level of attention (N'dri, 2009). Consequently, the level of attention can vary from one individual to another or from one moment to another or from one activity to another (Janvier & Testu, 2005 ; Méité, 2009 ; Testu, 2000). Thus, when changes occur with age over the course of evolution then the developmental aspect of attention is highlighted.

The development of attention is characterized by a growth in the ability to selectively reach the target information, to ignore the context, and to be able to maintain this ability for a relatively sustained period of time in a problem-solving operation (N'dri, 2015). Thus, the development of attention spans from childhood to adolescence (Camus, 1996 ; Capponi, 1997 ; Lussier & Flessas, 2003 ; N'douba, 2002 ; 2011). It is an intermittent, irregular development of attention in three phases : the first phase would be marked by the period from birth to 6-7 years of age; the second phase would begin at 6 years of age, with a sharper developmental pacing, and end around 10-11 years of age; and the beginning of the third phase would be at 11/12 years of age and end shortly before the end of adolescence (N'dri, 2009 ; 2015). The second phase (6-12 years) experiences a more significant development of attention, thus providing more interesting opportunities for study. This attentional development would be governed by genetically predetermined factors, experiential and environmental influences (Gazzaniga, 1995 ; Lussier & Flessas, 2003). It is therefore possible to highlight the characteristics of the environment that are related to the development of attention. And, of all the environmental factors considered to achieve attention development, play appears to be an essential activity for the child (Piaget, 1945 ; Romano, 2012).

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Gambling is a complex and difficult concept to define. However, from a cognitivist perspective, Tano sees « games in their relation to the capture, processing, acquisition, and consolidation of knowledge necessary for the adaptation of the subject to the immediate and future environment » (Tano, 1985, p. 5-6). The game is thus a freely exercised activity, almost spontaneously, pleasant, often exciting, organized or not by a system of rules ; a virtual reality allowing the consolidation of the knowledge necessary for the adaptation of the subject to the immediate and future environment ; a purpose of which the player, the child, is not at all aware (N'dri, 2009 ; 2015). Thus, play represents a kind of experience of the child in a dynamic relationship with attention through its exercise. This dynamism may be contingent on the individual characteristics of the child.

One of these characteristics is the sex which is the result of a biological, social and psychological construction. It is determined by a pair of heterochromosomes (XY for male sex and XX for female sex) that makes the human being male or female at birth (Baudelot & Establet, 2007 ; Money & Ehrhardt, 1972). In addition, it refers to the attributes in social relations, the partition and hierarchy between women and men (Deaux & Major, 1987; Maccoby, 1990). It also refers to the gender roles and responsibilities that society constructs. These roles are influenced by perceptions and expectations derived from cultural, economic, social, and religious factors, as well as individual or institutional biases (Rouyer, Mieyaa & Le Blanc, 2014). This differentiated biological, social and psychological construction of gender could therefore be a factor in variation in this attentional development.

Thus, the development of attention in children is a reality that would feed with play activities and individual characteristics, including gender. However, most of the studies conducted from this perspective have not shown any gender related difference (Carbonneau, 2019 ; Chevalier, 2010 ; Duval, Bouchard & Pagé, 2016 ; Gershon, 2002 ; Hasson & Fine, 2012). Better yet, although gender is not a primary variable, one study showed that no significant difference in attention level development was found as a function of gender among children from privileged backgrounds in Abidjan (N'dri, 2009). Given that advantaged socio-economic backgrounds have different characteristics than disadvantaged socio-economic backgrounds, would it not be appropriate to examine gender in relation to the development of attention in disadvantaged children in play situations ? In other words, would children in low-income settings develop attention differently as a function of gender during play ?

Answering such a question could help confirm or not that play activities are involved in the development of children's attentional behavior. It would also provide an opportunity to examine the attentional abilities of girls and boys in low socioeconomic settings. From a practical perspective, this study could provide educators and pedagogues with an awareness of the value of girls and boys in order to guide them according to their ability. This would, for example, guide parenting and teaching practices and improve the academic performance and education of elementary school children through appropriate selection of educational activities.

Therefore, we will examine the relationship between gender and the development of attention in children from disadvantaged backgrounds. This objective gives rise to the following hypothesis : when trained to play games, the levels of attention obtained by girls on the various tests are lower than those of boys from a disadvantaged environment.

II. METHODOLOGY

Testing the hypothesis of the present work requires an adequate practical procedure that examines, among other things, the description of the variables, the sample, the research instruments, the experiment and the test-taking procedure.

A. Description of the Variables

The variables to be examined are the game, the sex and the development of attention. Several games are likely to require attention, but for this work, we adopt two types of games : the traditional or ordinary games and the modern or electronic games. The traditional game exploited here is the game of "four crosses" which is practiced by two people, opponents, on squared paper. Each player has a pen of a different color than the one of his opponent. Each player must alternately place a cross at one of the intersections of the straight lines that have been used to draw the grid (see Figure 1a). Each player must form a square or a segment, depending on the variant chosen by the players, with four (4) crosses without skipping any intersections between these marked crosses. These four (4) crosses are immediately connected to materialize the square or the segment which constitutes a gain, one (1) point.



Figure 1. Four cross game and video rally game

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The electronic game examined here is the video rally game "grand prix circuit" which consists in simulating a car race where the competitors must reach a certain place. The circuit has left and right turns, road signs and competitors. You have to accelerate to get there first and be careful not to go off the track or collide with other drivers. This situation requires some acceleration to finish the race in good conditions. To achieve this goal, the player must be focused at the start in order to start promptly. He has to keep an eye on his two mirrors and the general layout of the circuit displayed in the upper left corner of the screen (see Figure 1b), all of which require a wide field of concentration. The merit of these games for the occasion is that they require more concentration than strategy.

Sex is the result of a biological, social and psychological construction that presents two different components : the male and female sex. This difference in appearance gives rise to two types of education : the female sex is morphologically more fragile and weak. The woman is educated to love, sensitivity, submission, expression of emotions, relational life, detail. In other words, she would be kind, generous, empathetic, calm and gentle. While the male sex would be morphologically more solid and considered as the strong sex. The man is educated to be rigorous, to fight, to keep his emotions in check, to challenge, to be general. He would be courageous, energetic, independent, confident and strong. These morpho- physiological and educational differences could generate differences in the development of attention with the practice of the game.

The development of attention represents the dependent variable of this work. It is the manifestation of attention in its quest for greater efficiency in solving everyday problems. Different forms of attention have been identified and analyzed : joint, selective, divided or shared, and sustained or maintained attention (Lieury & al., 1996). It has been shown that only sustained attention has a more general, cognitive, developmental and synthetic character than the other forms of attention (Camus, 1996 ; 2003 ; Garnier, 2003 ; Lieury & al., 1996 ; Lussier & Flessas, 2003). Thus, the development of sustained attention, which depends on the subject's level of maturation and environmental conditions, can be observed through training in the video rally game and the "four crosses" game, which is a continuous quantitative variable that could vary according to the sex of the participants.

B. Participants

The population concerned by this study is all children aged 7 to 11 years from disadvantaged backgrounds in the District of Abidjan. From this population, a sample of 144 subjects, including 72 girls and 72 boys, was selected using a non- probability or empirical sampling technique, namely purposive sampling. These subjects belong to the disadvantaged socio- economic environment of the commune of Yopougon (in the Gesco and Wassakara sub-districts). The sample consisted of three (3) levels of school children aged 7, 9 and 11 years old of equal numbers (48 subjects). They are respectively from the classes of CP₂, CE₂ and CM₂. These different age levels of subjects are each composed of 24 girls and 24 boys. This distribution is summarized in the table below.

Participant Distribution Table

	Girls	Boys	Total
Level CP ₂ (7 years)	24	24	48
Level CE ₂ (9 years)	24	24	48
Level CM ₂ (11 years)	24	24	48
Total	72	72	144

The different groups and subgroups in this table allow us to make the different comparisons of attention development levels. And, these comparisons would only be possible through the measurement instruments and the experimental procedure used to coordinate them in a synergistic action perspective.

C. Material and Experimental Procedure

A questionnaire elaborated on the basis of factors such as age, sex, family situation and games played was necessary for the selection of subjects. In addition, the Double Barrage Test (T-2-B) of Zazzo (1969) and the Continuous Performance Test (CPT) of Rosvold, Mirsky, Sarandon, Brandsome and Beck (1956) adapted (WinCPT) by N'dri (2009), respecting the parameters and conforming to the original proportions, are the two psychological tests that we use in this work. The T-2-B assesses sustained attention according to several indices, but for the purpose of this work, we use here those that are related to age and development. These are speed (V), efficiency (R) and inaccuracy (In). Unlike the original CPT, which uses numbers (6432) as the stimulus, the WinCPT uses letters (bpdq), which are different in appearance but identically formed. It evaluates sustained attention according to two main parameters : the Absolute Percent Correct (P_{CA}) and the Relative Percent Correct (P_{CR}). These tests commonly used to evaluate sustained attention allow us to evaluate the attentional performance of the subjects in order to make a synthesis.

The subjects are subjected to an experimental procedure including two (2) experimental situations which are : the play-tutoring situation (3 groups of two sub-groups each, i.e. 6 sub-groups in total, trained in the game of "four (4) cross" for some (3 subgroups) and video rally for others (3 subgroups). Thus, after having undergone treatment for 5 hours and 50 minutes, or 350 minutes in 14 sessions of 25 minutes, depending on the group to which the subject belongs, all groups undergo the same psychological tests again

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(posttest). These psychological tests are administered in a specific order in order to randomize the effects of the order in which the subjects, testers and tests are administered (the counterbalancing technique). Since this posttest is composed of the same tests as the pretest, we can assess the difference between the two levels of testing (pretest and posttest) without major methodological bias. If this exists, we would conclude that there are inter-group and intra-group differences. These differences are analyzed with the Mann-Whitney (Z) statistical test.

III. RESULTS

Examining the level of attention of children from low socioeconomic backgrounds as a function of gender leads us to the presentation of their performance on the T-2-B and the WinCPT in order to test the hypothesis put forward.

A. Comparisons of Girls and Boys at T-2-B

In the comparison between girls and boys of different ages (7 years, 9 years and 11 years), we present the attentional performance scores obtained by the subjects trained in the 4-cross and video rally games. With the T-2-B, comparisons are based on speed, efficiency and inaccuracy (see Figures 2, 3 and 4).

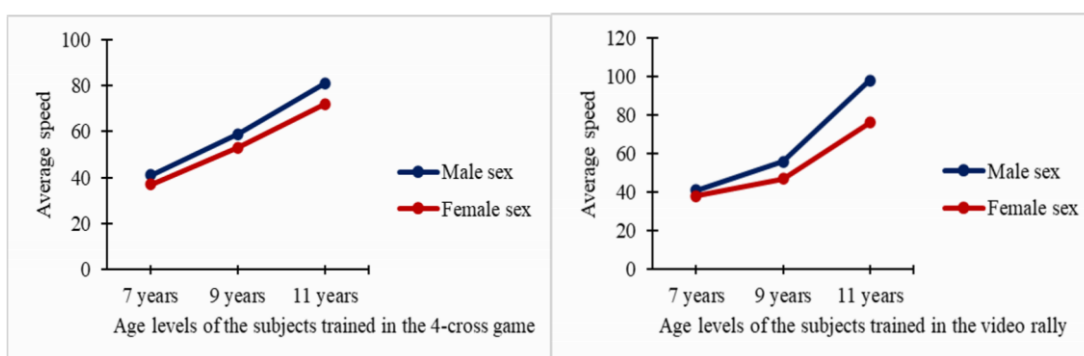


Figure 2 . Attentional performance curves of subjects at speed

Figure 2 shows that there was no significant difference in speed between girls and boys in the "4-cross" trained subjects ($Z(24) = -0.17, P > .05$; $Z(24) = -0.37, P > .05$; $Z(24) = -0.67, P > .05$) and in the 7-year-old and 9-year-old subjects trained in the rally-video game ($Z(24) = -0.13, P > .05$; $Z(24) = -0.73, P > .05$). The only significant difference between girls and boys was observed in the 11-year-old subjects trained in the rally video game ($Z(24) = -3.76, P < .05$). Thus, boys perform significantly better than 11-year-old girls. However, even if this conclusion does not confirm the hypothesis, it should be noted that the curves show in every respect that boys have an advantage over girls.

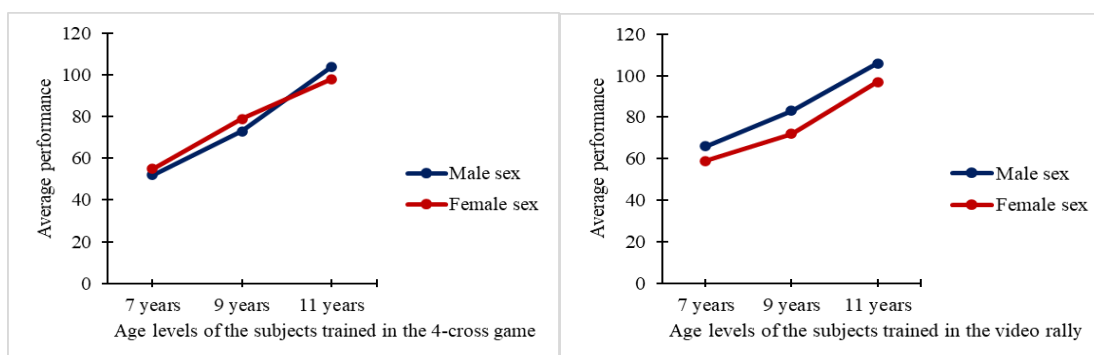


Figure 3 . Attentional performance curves of subjects at performance

The observation in Figure 3 shows that at performance the subjects trained in the "4-cross" game as well as in video rally do not differ significantly by gender ($Z(24) = -0.21, P > .05$; $Z(24) = -0.28, P > .05$; $Z(24) = -0.19, P > .05$; $Z(24) = -1.01, P > .05$; $Z(24) = -1.21, P > .05$; $Z(24) = -1.14, P > .05$). In other words, any difference found between girls and boys would be due to random variation. The hypothesis is therefore not confirmed. However, in general, we observe that boys perform better than girls in terms of performance.

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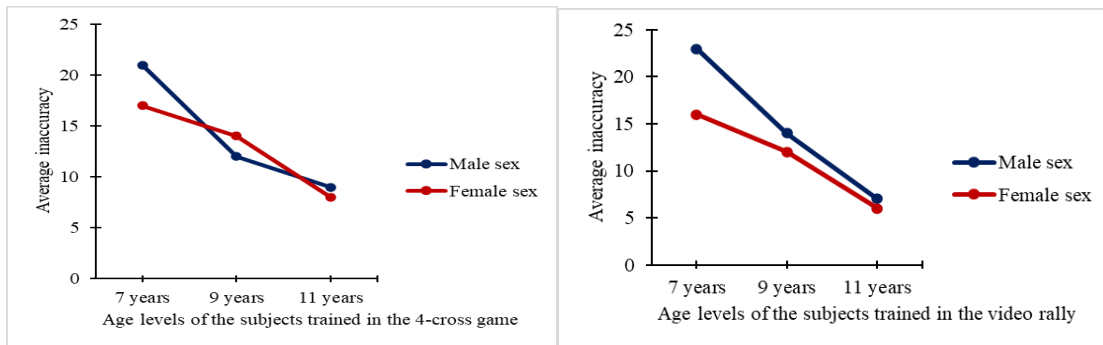


Figure 4 . Attentional performance curves of subjects at inaccuracy

Figure 4 allows us to note that at inaccuracy no significant difference is observed between 9-year-old and 11-year-old girls and boys ($Z(24) = 0.63, P > .05$; $Z(24) = 0.76, P > .05$; $Z(24) = 0.83, P > .05$; $Z(24) = 0.56, P > .05$). While in the 7-year-old subjects the performance of boys differed significantly from that of girls ($Z(24) = 2.75, P < .05$; $Z(24) = 2.97, P < .05$). In other words, girls perform better than boys. This goes in the opposite direction of the hypothesis. Unlike the other parameters analyzed which increase with age, inaccuracy decreases with age. These differences in performance are also attributable to the particularity of the inaccuracy parameter which depends on the strategy (speed and/or accuracy) adopted by the subjects and which is part of the interpretation indices of the T-2-B which are not very age related.

B. Comparisons of Girls and Boys in WINCPT

In the comparison between girls and boys of different ages (7 years, 9 years and 11 years), we present the attentional performance scores obtained by the subjects trained in "4-cross" and video rally games. With the WinCPT, comparisons are based on the absolute percent correct (P_{CA}) and relative percent correct (P_{CR}) obtained by the subjects (see Figures 5 and 6).

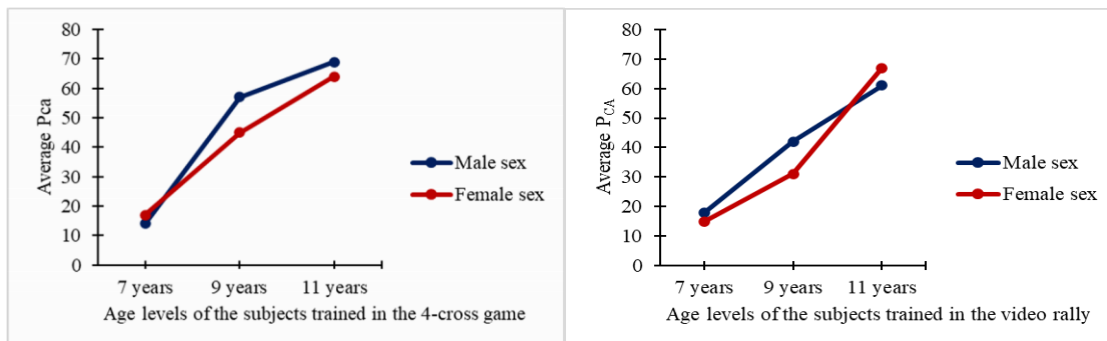


Figure 5 . Attentional performance curve of subjects at P_{CA}

Analysis of the data in Figure 5 shows that at the absolute correct percentage (P_{CA}), girls' performance is not significantly different from boys' in the majority of cases ($Z(24) = -1.67, P > .05$; $Z(24) = -1.76, P > .05$; $Z(24) = -1.72, P > .05$; $Z(24) = -1.86, P > .05$). The only exception was the 9-year-old subjects trained in the "4-cross" game and video rally, showing that boys performed significantly better than girls ($Z(24) = -2.11, P < .05$; $Z(24) = -2.37, P < .05$). In conclusion, it can be said that girls do not differ significantly from boys at P_{CA} . Thus, the hypothesis is not supported at the absolute correct percentage.



Figure 6. Attentional performance curve of subjects at P_{CR}

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Analysis of the data in Figure 6 shows us that at the relative correct percentage (P_{CR}) the performance of girls is not significantly different from that of boys in all cases ($Z(24) = -1.84, P > .05$; $Z(24) = -1.74, P > .05$; $Z(24) = -1.42, P > .05$; $Z(24) = -1.34, P > .05$; $Z(24) = -1.25, P > .05$; $Z(24) = -1.12, P > .05$). In other words, any variation the difference in performance on the P_{CR} between girls and boys is due to the fact that they are late. The hypothesis is therefore not confirmed.

In sum, the analyses carried out with the T-2-B and the WinCPT on the relationship between gender and the development of attention show in general that the level of sustained attention does not differ significantly between girls and boys in game situations, regardless of the type of game. However, we observe that out of five (5) situations of comparison where we note a significant difference between girls and boys, the latter are superior in three (3) situations, obtained in the two tests, against two (2) for girls, obtained in only one test, the T-2-B and in only one parameter, the inaccuracy. Moreover, we observe that 18/30 situations of comparison, that is to say 60%, are to the advantage of the boys. Thus, although the statistical analysis does not confirm the hypothesis previously put forward and does not allow us to affirm that there is a difference in attention between girls and boys, the observation shows us a superior tendency of boys over girls, which goes in the direction of the hypothesis. This result could, at least, reflect a tendency to use different strategies in solving the problems posed in the tasks carried out. This difference in strategies in the treatment of attentional tasks would be proof of a qualitative difference between girls and boys in attention. On the other hand, the results obtained confirm in all respects that attention develops as a function of the amount of practice and the quality of the game played by children from disadvantaged backgrounds.

IV. DISCUSSION

The cognitive function is one of the most important drivers of human behavior. The understanding of its functioning requires the knowledge, identification and understanding of the elements that compose it. It is in this perspective that attention is studied. This study examined the type of relationship that could exist between the development of attention and gender in children from a disadvantaged socioeconomic background in a play situation.

The answers to this question suggest that the development of attention is not a function of gender for children in low socioeconomic play. In other words, girls' attentional performance does not differ significantly from that of boys in low socioeconomic play. However, a qualitative analysis would reveal a difference, particularly in terms of the strategies used in solving attentional tasks, between girls and boys from low socioeconomic backgrounds in a gaming situation. The psychological explanation of such results requires theoretical contributions such as Piaget's (1967) constructive theory and Camus' (1996) model of attentional processes.

According to Camus' (1996) model of attentional processes, the functioning of attention takes into account two key concepts, namely attentional process and cognitive representation, the explanation of which is based on two other concepts, namely magnification and attenuation. Attentional control is therefore the constant search for a balance between magnification and attenuation. This evaluation accounts for the balance between inhibition and salience of the information to be processed. The achievement of such a balance is more efficient as the maturational structures offer more possibilities. These are offered by the experiences through the exercises of the tasks concerned. Thus, when subjects train for the "4-cross" game and the video game with several distractors related to mobility and/or game accessories, the subject strives, on the one hand, to inhibit or ignore these and, on the other hand, to increase salience or to devote himself to the tasks directly involved in achieving the game objective. This increasing capacity of attention is realized without distinction of sex as soon as the subjects are subjected to the same tasks, except in the strategy of execution of these tasks in relation to the specificity of each sex. For example, boys tend to use visual and spatial strategies more often. They would be faster in certain visual-spatial tasks and use more autonomous strategies that make them more comfortable in novel situations (Kimball, 1989 ; Fagley & Miller, 1990). On the other hand, girls tend to be faster in processing certain types of information perhaps because they do better than boys in perceptual speed and accuracy tests (Antill & Cunningham, 1982).

These explanations are also supported by Piaget's (1967) constructive theory according to which the acquisition of knowledge is only a construction ; it does not therefore give rise to significant differentiation according to gender. This explains the lack of quantitative differentiation in performance between girls and boys. However, since girls and boys are different in nature, their processing strategies may vary. This is why a difference in strategies is apparent between girls and boys in attentional performance. These results were compared with those of previous studies carried out in this field. From this comparison, we find some results in agreement and others in disagreement with those of the present work.

Convergences are observed with the work of Duval, Bouchard and Pagé (2016) who show that gender does not influence the development of executive functioning. For Chevalier (2010), this lack of link between gender and executive functions could be explained by the small actual difference between the sexes, and by the difficulty in detecting these using the tests that are commonly used to assess executive functions. If there are similarities in the general objective, there are also differences in the specific objectives and in the approach of the present study. This work assessed the development of executive functions, a set of cognitive functions of which attention is a part. Therefore, the results of that work less closely reflect those of the present study devoted to the development of attention.

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The absence of gender differences in attention is also consistent with the work of Carbonneau (2019), Gershon (2002) and Hasson & Fine (2012) who found no difference between boys and girls in sustained attention. However, for these authors, the clinician's judgment (qualitative analysis), as well as the use of cognitive tests, are essential to highlight certain difficulties in girls. For example, the cognitive evaluation of these girls shows average intellectual functioning with a relative weakness in working memory. Standardized tests also show difficulties in inhibition, planning and sustained attention. According to these authors, it seems that the girl has several cognitive difficulties recognized as deficits in young people. Thus, relying solely on quantitative analysis could lead to minimizing or erroneously dismissing even small differences observed with qualitative analysis between girls and boys in the assessment of attention. These results, although they present similarities, leave some discrepancies insofar as they focused on Attention Deficit Disorder with or without Hyperactivity (ADHD) in contrast to ours, which focused on the development of attention in children without attention deficit in a play situation.

Thus, from the perspective of work carried out on the development of attention in children in play situations, similarities are observed with the results of the work of N'dri (2009). Indeed, this previous work carried out to relate play activities to the development of attention showed that gender is not a differentiating factor in the development of attention through the experience of training in games in subjects of the same age and this was true for three age groups (7 years, 9 years and 11 years). However, even though the age groups and game situations are similar, there are still discrepancies. This is because the previous work (N'dri, 2009) was carried out on subjects from an advantaged socioeconomic background and was limited mainly to a quantitative analysis, whereas this one was carried out on subjects from a disadvantaged socioeconomic background and showed in a qualitative analysis, in addition to the quantitative analysis, a difference in task processing strategies according to gender. In other words, boys would have more effective strategies than girls in solving attention problems. This discrepancy would be consistent with the work of Duval, Bouchardand & Pagé (2017) and Wiebe, Epsyand Charak (2008) for whom gender would influence the development of executive functioning. Indeed, these neuroimaging studies have shown that the maturation of the prefrontal regions of the brain would show differences in boys and girls, such that girls would have higher executive function skills than boys at preschool age (Wiebe, Epsy & Charak, 2008). This difference would be accentuated by the tendency for differential education of girls and boys especially in low socioeconomic settings.

V. CONCLUSION

Prompted by the limitations of a previous study conducted in 2009 in an advantaged socioeconomic environment, the present study implemented the same methodological approaches in terms of types of games, criteria for selecting subjects, their training procedure, and assessment. Thus, this relative replication of the previous study related gender and attention development in children from disadvantaged socioeconomic backgrounds in a gaming situation.

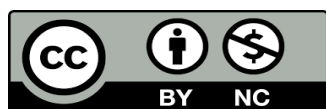
The results of the quantitative analysis show that there is no significant difference between girls and boys in their ability to solve problems requiring attention. In other words, for this analysis, any differences found between girls and boys in the amount of attention would be due to random fluctuations. However, these results point to differences between girls and boys in the quality of attentional problem solving. The boys would have more elaborate strategies than the girls in the processing of attentional tasks. This difference would be the result of a difference in both nature and fact. In other words, it would be the fact of the biological constitution and the education received by the girls and the boys marked of differentiation.

These results can guide the understanding of the relationship between girls and boys by showing that, although girls are biologically different from boys in many skills, they often compete and have similar skills with boys. This can provide opportunities for girls and boys to be oriented to different areas of work that require cognitive skills without excluding them on the basis of gender. These results also call on parents and educators to avoid being too different in the content of the education given to children according to gender. Despite its qualities, this study is hampered by the weakness of its sample and therefore does not claim to close the debate on the understanding of cognitive abilities, particularly the attention of girls and boys; but it should remain rather as a contribution to the revival of this debate which tends, at times, to enter into hibernation.

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