# Numerical Magnitude Processing in Children with Mild Intellectual Disabilities

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RESEARCH HIGHLIGHTS

- Magnitude comparison is impaired in mild intellectual disability (MID)
- Children with MID show a delay accessing numerical magnitudes from symbols

ABSTRACT

The present study investigated numerical magnitude processing in children with mild intellectual disabilities (MID) and examined whether these children have difficulties in the ability to represent numerical magnitudes and/or difficulties in the ability to access numerical magnitudes from formal symbols. We compared the performance of 26 children with MID on a symbolic (numbers) and a non-symbolic (dot-arrays) comparison task with the performance of two control groups of typically developing children: one group matched on chronological age and one group matched on mathematical ability level. Findings revealed that children with MID performed more poorly than their typically developing chronological age-matched peers on both the symbolic and non-symbolic comparison tasks, while their performance did not substantially differ from the ability-matched control group. These findings suggest that the development of numerical magnitude representation in children with MID is marked by a delay. This performance pattern was observed for both symbolic and non-symbolic comparison tasks, although difficulties on the former task were more prominent. Interventions in children with MID should therefore foster both the development of magnitude representations and the connection between symbols and the magnitudes they represent.

## 1. Introduction

Mathematical abilities are crucial in modern Western societies, for example when taking medical and other social decisions (Reyna & Brainerd, 2007), and they are associated with greater labour market success (Chiswick, Lee, & Miller, 2003). Children with below-average intellectual abilities (IQ < 85) are known to have difficulties with the development of mathematical skills (Hoard, Geary, & Hamson, 1999), but little is known about the cognitive deficits that underlie their poor achievement in mathematics. Such information is important in order to devise appropriate interventions for these children. It has been suggested that the ability to represent numerical magnitudes plays a crucial role in the development of mathematical skills (e.g., Butterworth, 2005a; Gersten, Jordan, & Flojo, 2005). The present study therefore aims to investigate numerical magnitude processing skills in children with mild intellectual disabilities (MID).

Infants (Xu & Spelke, 2000) and kindergarteners (Barth, Beckmann, & Spelke, 2008) are able to understand and process numerical magnitude information by means of non-symbolic representations: They are able to compare and add sets of dots or objects. It is assumed that this ability is innate and independent of language and education (Dehaene, 1997) as uneducated adults (Pica, Lemer, Izard, & Dehaene, 2004) and even non-human animals (Brannon & Terrace, 1998; Brannon, 2006) are able to make such comparisons. Over the course of development, children learn to link these non-symbolic representations with symbols or numbers (Griffin, 2003). Both cross-sectional (Holloway & Ansari, 2009) and longitudinal studies (De Smedt, Verschaffel, & Ghesquière, 2009; Halberda, Mazzocco, & Feigenson, 2008) with typically developing children showed that the ability to represent numerical magnitudes is related to mathematics achievement.

A classic task to measure numerical magnitude representation is the numerical magnitude comparison task (Sekuler & Mierciewicz, 1977). In this task, children have to indicate the numerically larger of two presented numerical magnitudes. These magnitudes can be presented both in a symbolic and a non-symbolic format (e.g., De Smedt et al., 2009; De Smedt & Gilmore, 2011; Halberda et al., 2008; Holoway & Ansari, 2009). When people are comparing two numerical magnitudes, the distance effect occurs (Moyer & Landauer, 1967): people are faster and more accurate at making responses when the numerical distance between the two magnitudes is relatively large (e.g., 2 vs. 9) than when it is small (e.g., 7 vs. 9). This effect is assumed to arise from overlapping internal representations of numerical magnitudes: Magnitudes that are closer to each other have more representational overlap and are more difficult to discriminate than magnitudes that are further apart (for a review, see Noël, Rousselle, & Mussolin, 2005). This distance effect decreases with increasing age (Sekuler & Mierciewicz, 1977), indicating that these magnitude representations become more precise and show less overlap throughout development. Moreover, the size of the distance effect predicts later individual differences in mathematics achievement. For example, De Smedt et al. (2009) showed that children with a smaller distance effect at the start of formal schooling had higher mathematics achievement levels in second grade.

Several studies have demonstrated that children with mathematical difficulties have difficulties with magnitude comparison (De Smedt & Gilmore, 2011; Landerl, Bevan, & Butterworth, 2004; Landerl, Fussenegger, Moll, & Willburger, 2009; Mussolin et al., 2010; Rousselle & Noël, 2007). Two explanations for difficulties in magnitude comparison have been put forward. According to the *defective number module hypothesis* (Butterworth, 2005b), these difficulties originate from a specific deficit in the innate ability to understand and represent numerical magnitudes. In contrast, the *access deficit hypothesis* (Rousselle & Noël, 2007) proposes that these difficulties originate from impairments in accessing numerical meaning from symbols, rather than from difficulties in processing magnitude per se. To disentangle between both hypotheses, one needs to compare performance on a symbolic and a non-symbolic task. If children with mathematical difficulties perform more poorly on both types of tasks, this supports the defective number module hypothesis. If children with mathematical difficulties perform more poorly on the symbolic, but not on the non-symbolic task, this favours the access deficit hypothesis.

Because children with MID are expected to have difficulties in acquiring mathematical skills, it is important to find out whether they mainly have problems with the representation of magnitude per se (defective number module) or with accessing numerical information from symbols (access deficit). To the best of our knowledge, only one study examined numerical magnitude comparison in children with below-average intellectual abilities (Hoard et al., 1999). This study revealed that children with a below-average IQ ($M$ = 78) were less accurate in comparing digits than their typically developing peers. However, it remains unclear whether children with MID participated in this study. Furthermore, these authors only examined accuracy but not the speed with which the digits were compared, and it has been argued in research on numerical magnitude processing in children that reaction time might reveal subtle yet important differences that cannot be uncovered by looking at accuracy alone (Berch, 2005). The comparison of non-symbolic magnitudes was also not included in the study of Hoard et al. (1999), which makes it impossible to determine whether the children in this study had difficulties with representing numerosity per se (number module) or whether they had only difficulties in accessing numerical information from symbolic digits (access deficit).

The present study tried to address these issues by systematically investigating numerical magnitude comparison in children with MID. In order to contrast the defective number module hypothesis and the access deficit hypothesis, we focused both on symbolic and non-symbolic magnitude comparison tasks. If children with MID have problems with the representation of numerical magnitudes per se, they should perform more poorly on both the symbolic and the non-symbolic comparison tasks. If children with MID have mainly difficulties in accessing magnitude information from symbols, they should perform more poorly on the symbolic but not on the non-symbolic comparison task.

We also wanted to examine whether the difficulties with magnitude representation in children with MID are marked by a delay or a deficit. According to the *delay* model, children with MID follow the same overall pattern of development as typically developing individuals, but they progress at a slower rate and ultimately attain a lower asymptote of cognitive functioning. In contrast, the *deficit* model states that the difficulties of children with MID are the result of deficits in specific cognitive processes, which makes the general principles of development not applicable (Bennett-Gates & Zigler, 1998). This research question was addressed by using a chronological-age/ability-level-match design. This design involves the selection of two control groups of typically developing children: one control group of children matched on chronological age to the group of children with MID and one control group of children matched on arithmetic achievement level to the children with MID. If the performance of children with MID differs from the performance of their chronological age matched peers, but not from the performance of younger children with the same arithmetic achievement level, then the development of children with MID is marked by a delay. If, by contrast, the performance of children with MID differs from the performance of both control groups, then their development can be characterized by a deficit.

It should be noted that children's performance on the symbolic magnitude comparison task might be influenced by their knowledge of the digits that are used in this task. In order to control for this factor, we administered a digit identification task to find out whether group differences are due to differences in symbolic knowledge rather than to differences in accessing magnitude information from symbols.

## 2. Method

### 2.1 Participants

Participants with MID were recruited from five special education schools for children with MID. Control children were selected from five mainstream primary schools. Parental consent was obtained for 255 children (130 boys, 125 girls), who all completed a standardized arithmetic test (de Vos, 1992) to determine their mathematics achievement level. All children also completed the Raven's Standard Progressive Matrices (Raven, Court, & Raven, 1992) as a measure of intellectual ability. Against the background of DSM-IV-TR criteria for defining mild intellectual disabilities (APA, 2000), only children with an IQ between 50 and 70 were included in the group of children with MID.

Control children had a normal IQ, i.e. between 85 and 115. None of them had a developmental disorder and none of them had repeated grade. Two control groups were selected: one group matched on chronological age (CA-group) to the children with MID and one group matched on arithmetic achievement level (AL-group) to the children with MID.

The final sample consisted of 26 children with MID, 26 CA-matched controls and 26 AL-matched controls. Table 1 shows the descriptive statistics of these three groups. The groups did not differ in the number of boys and girls, $\chi^2(2, N = 78) = 1.24$, $p = .54$. The three groups differed, as expected, in chronological age, $F(2,75) = 207.78$, $p < .01$, $\eta_p^2 = .85$: AL-matched children were significantly younger than CA-matched children ($p < .01$, $d = -5.42$) and children with MID ($p < .01$, $d = -5.65$), who in turn did not differ from each other, $p = .94$. Groups differed, logically, in intellectual ability, $F(2,75) = 378.95$, $p < .01$, $\eta_p^2 = .91$: children with MID had a significantly lower intellectual ability than the children from the AL-matched ($p < .01$, $d = -6.74$) and CA-matched ($p < .01$, $d = -7.56$) control groups, who did not differ from each other, $p = .76$. The groups differed in their performance on the arithmetic achievement test, $F(2,75) = 116.60$, $p < .01$, $\eta_p^2 = .76$: CA-matched children performed significantly better than children with MID ($p < .01$, $d = 3.97$) and AL-matched children ($p < .01$, $d = 3.45$), who in turn did not differ, $p = .41$. These findings indicate that the three groups were successfully matched.

## 2.2 Procedure

All participants were tested at their own school during regular school hours. Children first completed the group-administered intellectual ability and mathematical achievement tests. After that, the experimental tasks were administered individually in a quiet room.

## 2.3 Measures

### 2.3.1 Group administered tasks

#### 2.3.1.1 Intellectual ability

Raven's Standard Progressive Matrices (Raven et al., 1992) was used as a measure of intellectual ability. For each child, a standardized score ($M = 100$; $SD = 15$) was calculated.

#### 2.3.1.2 Arithmetical ability

Arithmetical ability was assessed using a standardized paper-and-pencil achievement test for arithmetic, Tempo Test Arithmetic (de Vos, 1992). In this test, children are asked to solve basic arithmetic problems as accurately and quickly as possible (e.g., 5 + 3 = ). For each operation, 40 problems of increasing difficulty are presented and children are required to solve as many problems as possible within a one-minute period. In this study, only the addition and subtraction problems were presented, as the children with MID did not yet receive instruction in multiplication and division. The score on this test is the number of correctly solved problems within the time-limit (maximum = 80).

### 2.3.2 Experimental tasks

All experimental tasks were presented using the E-prime 1.0 software (Schneider, Eschmann, & Zuccolotto, 2002). They were all administered using a 17-inch notebook. Children were always instructed to perform both accurately and quickly. Stimuli occurred in white on a black background in Arial font (size 72). The experimenter initiated each trial by means of a control key. Each trial started with a 250-ms fixation cross in the centre of the computer screen accompanied by a beep of 440 Hz. After 1000 ms the stimulus appeared and remained on the screen until response, except for the non-symbolic numerical magnitude comparison task where the stimulus disappeared after 840ms, in order to avoid counting. In the numerical magnitude comparison tasks, participants had to respond by pressing a key on a computer keyboard that was put in front of the notebook and was connected to it. The left response key, labeled with a blue sticker, was 'd'; the right response key, labeled with a yellow sticker, was 'k'. Each task was preceded by three practice trials to familiarize the child with the key assignments. Answers and reaction times were recorded by the notebook. In digit identification, responses were verbal. When the child responded, the experimenter, who was seated next to the child, immediately pressed the spacebar of the external keyboard that was connected to the notebook, to register reaction time. After the registration of the reaction time, the child's answer was entered on the keyboard by the experimenter. Two practice trials were included to make children familiar with the task administration.

#### 2.3.2.1 Numerical Magnitude Comparison

##### 2.3.2.1.1 Symbolic comparison

A classic numerical magnitude comparison task (Sekuler & Mierciewicz, 1977) was administered. In this task, children indicated the numerically larger of two simultaneously presented numbers, one displayed on the left and one displayed on the right side of the computer screen. Stimuli involved all combinations of the numbers 1 to 9, yielding 72 trials. Children were required to select the larger number by pressing the response key on the side of the larger number. The position of the largest number was counterbalanced.

#### 2.3.2.1.2 Non-symbolic comparison

Children indicated the larger of two simultaneously presented arrays of dots – one displayed on the left, one displayed on the right side of the computer screen. Stimuli comprised the same numerosities as in the symbolic comparison task, yielding 72 trials. The stimuli were generated by means of the MATLAB script provided by Piazza, Izard, Pinel, Le Bihan and Dehaene (2004) and were controlled for non-numerical parameters, i.e. individual dot size, total occupied area, and density. This was done to ensure that children could not reliably use these non-numerical cues or perceptual features to make a correct decision. Similar to the symbolic comparison task, children were required to select the larger numerosity by pressing the response key on the side of the larger numerosity. The position of the largest numerosity was counterbalanced.

### 2.3.2.2 Control task: Speed of digit identification

Each of the digits 1 to 9 was successively presented on the computer screen and the child was asked to name each digit as fast as possible. Each digit was presented twice, which yielded 18 trials.

## 3. Results

### 3.1 Control task

Before we turn to the numerical magnitude comparison tasks, performance on the digit identification task is discussed. All participants performed with 100% accuracy on this control task, which indicates that they were all able to recognize the numbers presented in this study. There were group differences in the speed of digit identification, $F(2,75) = 9.12$, $p < .01$, $\eta_p^2 = .20$: CA-matched children ($M = 733.04$ ms, $SD = 73.99$) were significantly faster than children with MID ($M = 840.09$ ms, $SD = 106.18$; $p < .01$, $d = -1.19$) and AL-matched children ($M = 803.72$ ms, $SD = 92.63$; $p < .01$, $d = -0.86$), whereas the latter two groups did not differ from each other, $p = .33$. These differences are considered in subsequent analyses.

### 3.2 Numerical Magnitude Comparison

The mean reaction time and accuracy on the numerical magnitude comparison tasks are displayed in Figures 1 and 2. The mean reaction times were based on correct responses only. Group differences on this task were evaluated by means of a repeated measures ANOVA with task (symbolic vs. non-symbolic) as within-subject factor and group as between-subjects factor on children's reaction time and accuracy. Post-hoc *t*-tests were corrected for multiple comparisons by using Tukey-Kramer adjustments. Partial eta-squared was computed as a measure of effect size.

With regard to reaction time, there was a main effect of group, $F(2,75) = 15.46$, $p < .01$, $\eta_p^2 = .29$: CA-matched children were significantly faster than children with MID ($p < .01$, $d = -1.49$) and AL-matched children ($p < .01$, $d = -1.48$), but the latter two groups did not differ from each other ($p = .27$). There was also a significant group × task interaction, $F(2,75) = 4.43$, $p = .02$, $\eta_p^2 = .11$, indicating that these group differences were more prominent on the symbolic than on the non-symbolic task (Figure 1). The main effect of task was not significant, $F(1,75) = 2.56$, $p = .11$, $\eta_p^2 = .03$. To evaluate whether these findings could be explained by individual differences in speed of digit identification, we repeated the analysis with this variable as a covariate. After controlling for this variable, the main effect of group remained, $F(2,74) = 7.88$, $p < .01$, $\eta_p^2 = .18$.

We also evaluated whether the group differences on the symbolic magnitude comparison task could be explained by performance on the non-symbolic magnitude comparison task, and vice versa. Therefore, we examined whether the group differences on the symbolic task remained when non-symbolic performance was controlled for and whether group differences on the non-symbolic task remained when symbolic performance was additionally accounted for. Findings revealed that the group differences on symbolic numerical magnitude comparison remained when non-symbolic numerical magnitude comparison was additionally controlled for, $F(2,74) = 9.30$, $p < .01$, $\eta_p^2 = .20$. By contrast, group differences in non-symbolic magnitude comparison disappeared when symbolic magnitude comparison speed was additionally controlled for, $F(2,74) = 0.72$, $p = .49$, $\eta_p^2 = .02$. This suggests that the access to representations of magnitude from symbolic numbers rather than the representation of magnitude per se is impaired in children with MID, as the group differences on the non-symbolic comparison task can be explained by performance on the symbolic comparison task.

For each child, we additionally determined the size of the distance effect for both the symbolic and non-symbolic comparison tasks. This was done by calculating for each child and for each task the slope of the linear regression in which reaction time on the comparison task was predicted by distance, i.e. the numerical difference between the to be compared numerosities. The size of this slope reflects the effect of distance on reaction time, with steeper slopes representing larger distance effects (De Smedt et al., 2009). This slope should be negative because the distance effect predicts a negative relationship between distance and reaction time. The average slopes are displayed for each group and task in Table 2. As expected, all slopes were negative; they all were significantly different from 0 (*t*s > -7.75, *p*s < .01). These slopes were subjected to a repeated measures ANOVA with task (symbolic vs. non-symbolic) as within-subject factor and group as between-subjects factor. There was a main effect of task, $F(1,75) = 7.36$, $p < .01$, $\eta_p^2 = .09$, indicating that the distance effect for the non-symbolic comparison task was significantly larger than the distance effect for the symbolic comparison task. The main effect of group ($F(2,75) = 6.82$, $p < .01$, $\eta_p^2 = .15$) and the group × task interaction, $F(2,75) = 4.50$, $p = .01$, $\eta_p^2 = .11$ were significant. Post-hoc *t*-tests revealed that on the symbolic task, children with MID had a significantly steeper slope than AL-matched children ($p = .03$, $d = -0.62$), who in turn had a significantly steeper slope than CA-matched children ($p = .01$, $d = -1.00$). In other words, children with MID had a larger distance effect than AL-matched children, who showed a larger distance effect than CA-children. There were no group differences ($t < 1$) for the slopes on the non-symbolic task.

The overall accuracy on the numerical magnitude comparison task was high (Figure 2). There was only a main effect of group, $F(2,75) = 4.92$, $p = .01$, $\eta_p^2 = .12$, indicating that CA-matched children performed more accurately than children with MID ($p = .02$, $d = 0.70$), and AL-matched children ($p = .02$, $d = 0.84$), who in turn did not differ, $p = .99$. There was no main effect of task, $F(1,75) = 0.36$, $p = 0.55$, $\eta_p^2 < 0.01$, nor a significant group × task interaction, $F(2,75) = 2.97$, $p = .06$, $\eta_p^2 = .07$. Because the overall accuracy in the comparison tasks was very high, it was not possible to reliably calculate the effect of distance on children's accuracy.

## 4. Discussion

Understanding the cognitive determinants of mathematical difficulties is necessary in order to design appropriate interventions. Children with mild intellectual disabilities have problems with the development of mathematical abilities, yet research that focuses on possible cognitive determinants of these difficulties in mathematics is scarce. We tried to extend the existing body of data by systematically investigating numerical magnitude comparison in children with MID.

Our results indicate that children with MID have particular problems on tasks that measure numerical magnitude representations. This is consistent with Hoard et al. (1999), who demonstrated that children with a below-average IQ perform more poorly on digit comparison than their peers with an average intelligence. Our study extends the findings of Hoard et al. (1999) by showing that, in comparison with a chronological age-matched group, children with MID perform poorly on numerical magnitude comparison tasks in both symbolic and non-symbolic formats.

Two accounts for impairments in numerical magnitude representations have been put forward (Butterworth, 2005b; Rousselle & Noël, 2007). These difficulties could be due to a specific deficit in the ability to represent and understand numerical magnitudes (defective number module). On the other hand, these difficulties may originate from problems in accessing numerical meaning from symbols (access deficit). To determine which of these two explanations applies for the difficulties in numerical magnitude processing in children with MID, we investigated their performance on a symbolic and a non-symbolic comparison task.

Children with MID performed more poorly on both symbolic and non-symbolic comparison tasks, consistent with the defective number module hypothesis. A more detailed analysis of the data revealed that the group differences were most prominent on the symbolic task. For example, group differences in the distance effect were only observed in the symbolic but not in the non-symbolic task. Also, group differences in symbolic comparison remained when differences in non-symbolic comparison were accounted for, whereas group differences in non-symbolic comparison disappeared when performance on the symbolic task was taken into account. This all suggests that children with MID have particular problems in accessing numerical meaning from symbols.

We also investigated by means of a chronological-age/ability-level-match design whether the development of magnitude representation in children with MID is marked by a delay or by a deficit. Our data indicate that children with MID performed more poorly than their CA-matched peers, yet there were no group differences between children with MID and AL-matched children. This all suggests that the development of magnitude representations in children with MID is delayed, but not fundamentally different.

The current study examined only one potential domain-specific source of difficulties in mathematics achievement, i.e. the ability to represent numerical magnitudes. However, it has been proposed that also domain-general factors, such as working-memory and other executive functions (e.g., De Smedt et al., 2009; Hecht, Torgesen, Wagner, & Rashotte, 2001; Swanson & Kim, 2007) contribute to (difficulties in) mathematics development. Because children with intellectual disabilities are known to have problems in working memory (e.g., Schuchardt, Gebhardt, & Mäehler, 2010; Van der Molen, Van Luit, Jongmans, & Van der Molen, 2007), future studies should examine to which extend mathematical difficulties in children with MID are explained by domain-general factors, such as working memory and executive functions.

Future studies should also investigate whether our findings can be replicated when other magnitude representation tasks are used, such as number line estimation (Booth & Siegler, 2008) or approximate addition and subtraction (Gilmore, McCarthy, & Spelke, 2007). The advantage of these types of tasks is that they include larger (i.e. multi-digit) numerosities than numerical magnitude comparison tasks. Moreover, they focus more on the accuracy with which numerical magnitude representations are available, while we mainly focused on reaction time.

Finally, it might be interesting to examine the mathematical difficulties of children with MID at a neurobiological level. Several cognitive neuroimaging studies have shown that children with difficulties in mathematics have structural and functional abnormalities in those areas of the brain that are involved in numerical magnitude processing, i.e. the intraparietal sulcus (e.g., Mussolin et al., 2010; Rotzer, Kucian, Martin, von Aster, Klaver, & Loenneker, 2008). This brain area is consistently active during mathematical tasks (Rivera, Reiss, Eckert, & Menon, 2005) and future studies are required to examine to which extent the mathematical difficulties of children with MID are associated with structural and/or functional abnormalities in these brain regions.

The current findings have important implications for the teaching and remediation of children with MID. Because children with MID have problems with both the development of magnitude representations and with the connections between symbols and the magnitudes they represent, intervention should focus on both aspects. One way of dealing with this is via the use of (linear) numerical board games. Ramani and Siegler (2008) demonstrated that playing these types of games enhances children's numerical knowledge because these games provide multiple cues to the connection between symbols and their quantities. For example, the larger the number on the dice, the larger the number of movements the child has to make with the token, the larger the number of number names the child has spoken or heard and the larger the distance the child has moved the token (Siegler, 2009). Future research should examine the effect of interventions using board games on the development of mathematics in children with MID.

## 5. Acknowledgements

We would like to thank all participating children, parents and teachers. Special thanks are due to Tina Jacobs for her assistance with data collection. This study was supported by the Marguerite-Marie Delacroix Support Fund.

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Table 1

*Descriptive Statistics of the Sample*

| Group | *n* | Sex | Age in years | Math ability[a] | IQ[b] |
|---|---|---|---|---|---|
| MID | 26 | 10 boys, 16 girls | 10.79 (0.75) | 27.38 (6.22) | 62.08 (4.87) |
| AL | 26 | 12 boys, 14 girls | 7.57 (0.34) | 29.73 (6.83) | 103.88 (7.49) |
| CA | 26 | 14 boys, 12 girls | 10.86 (0.81) | 52.73 (6.77) | 105.15 (6.61) |

*Note.* [a] Number of correctly solved problems on Tempo Test Arithmetic. [b] IQ-score on Raven's Standard Progressive Matrices. MID = Mild Intellectual Disabilities; AL = Ability Level matched control group; CA = Chronological Age matched control group. Standard deviations are presented in parentheses.

Table 2

*Average slopes and standard deviations for each group and task*

| Group | Symbolic comparison | | Non-symbolic comparison | |
|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* |
| MID | -38.42 | 20.21 | -36.93 | 24.28 |
| AL | -27.26 | 16.45 | -32.90 | 19.69 |
| CA | -14.39 | 8.43 | -33.91 | 17.69 |

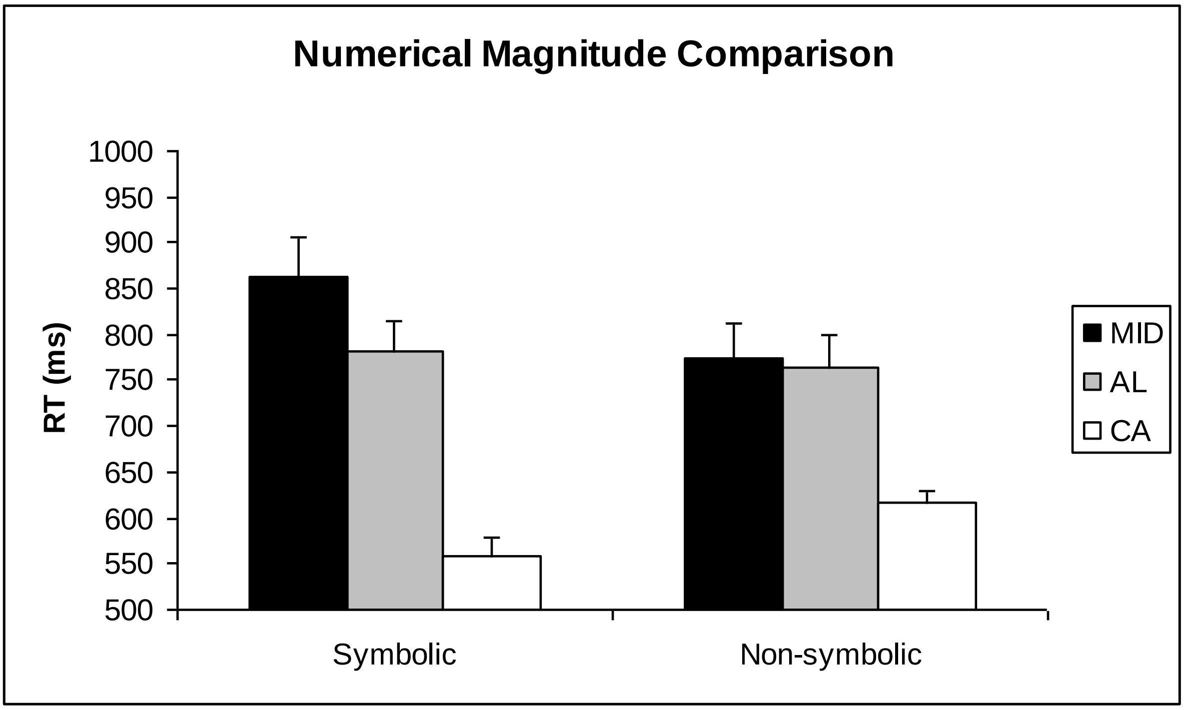
*Note*. MID = Mild Intellectual Disabilities; AL = Ability Level matched control group; CA = Chronological Age matched control group.

Figure Captions

*Figure 1.* Mean reaction time (based on correct responses only) on the numerical magnitude comparison tasks as a function of group. MID = Mild Intellectual Disabilities; AL = Ability Level matched control group; CA = Chronological Age matched control group. Error bars depict 1*SE* of the mean.

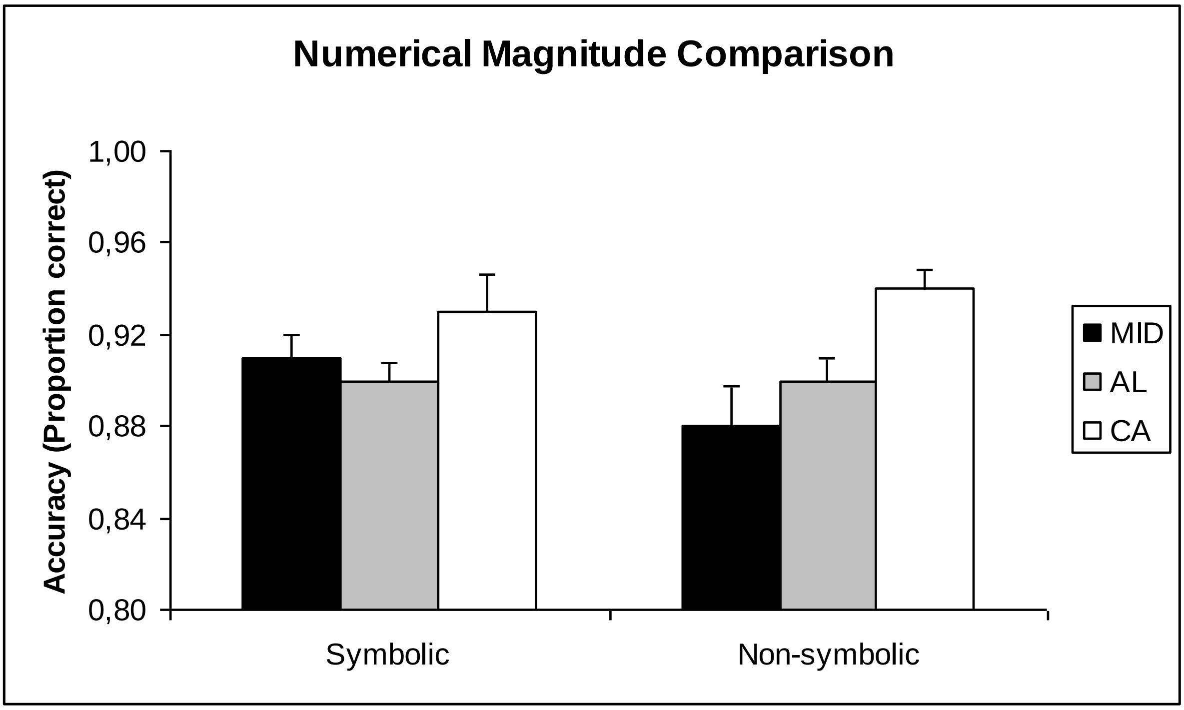
*Figure 2.* Mean accuracy on the numerical magnitude comparison tasks as a function of group. MID = Mild Intellectual Disabilities; AL = Ability Level matched control group; CA = Chronological Age matched control group. Error bars depict 1*SE* of the mean.

Figure 1



Numerical Magnitude Comparison
RT (ms)
1000
950
900
850
800
750
700
650
600
550
500
Symbolic
Non-symbolic
MID
AL
CA

Figure 2


Numerical Magnitude Comparison
Accuracy (Proportion correct)
1,00
0,96
0,92
0,88
0,84
0,80
Symbolic
Non-symbolic
MID
AL
CA