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Running head: Collaborative Memory with Assistants

The More You Remember the More You Decide –

Collaborative Memory in Adolescents with Intellectual Disability and their Assistants

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Abstract

The aim of the present study was to investigate collaborative memory in adolescents with intellectual disabilities when collaborating with an assistant, and also the extent to which decisiveness is related to individual memory performance.

Nineteen students with intellectual disabilities (mean age = 18.5, SD = 0.9) each collaborated with a teaching assistant (mean age 40.3, SD = 12.1) familiar from everyday work in school. Pictures were presented individually. Recognition was performed in two parts; first individually and thereafter collaboratively. The design involved 2 settings, one natural (with equal encoding time) and one with equal individual memory performance (assistants had shorter encoding time than the students). Results showed collaborative inhibition in this previously uninvestigated collaboration setting with adolescents with intellectual disabilities and their assistants. The assistants both performed higher and decided more than the students with intellectual disabilities in the natural setting, but not in the equated performance setting. Inhibition was larger in the equated setting. The assistants' decisiveness was moderately correlated with individual memory performance. Implications for everyday life are discussed.

Keywords: Collaborative memory, Intellectual disabilities, Assistant, Decisiveness

Collaborative Memory in Adolescents with Intellectual Disability and their Assistants

1. Introduction

Children and adolescents with intellectual disabilities (ID) need to collaborate in order to handle everyday situations and relate upon others to a higher degree than persons without ID. Their collaboration partners could, for example, be their parents, a personal assistant or a teaching assistant at school. The task of an assistant is to help the person with ID, in both situations at hand and the long term, by supporting enhanced learning to improve quality of life. Children and adolescents with ID often have less knowledge about the topic of collaboration than their partner, due to both lower cognitive ability and less experience. One example could be a visit to an art museum with school where the teaching assistant knows more about arts in general. Afterwards, when they tell others about the visit, the accuracy of the detail given by the adolescent with ID may be dependent on the collaborative input of the teaching assistant. At the same time, it should still be the story of the adolescent and not the story of the assistant. Little is known about the collaboration between adolescences with ID and their assistants, especially in relation to cognitive aspects. Such knowledge could, in the long run, be used to design educational approaches for assistants to improve the quality of life for adolescences with ID. The aim of this study is to investigate collaborative memory in adolescents with ID and their assistants and to assess to which extent they let each other decide.

When two individuals collaborate in a memory task, following the Andersson and Rönnerberg (1996) method, whereby individual recall without collaboration precedes collaborative recall, there are three common measures: sum of individual score, nominal score and collaborative score (Andersson & Rönnerberg, 1996; Weldon,

2000). Individual score is the sum of the two persons' score at the individual recall without collaboration. Nominal score is the non redundant sum of individual score. Collaborative score is their score at collaboration. For example, assume that John and Sue are to remember names of fruits. John remembers apple, orange, and pear and Sue remembers apple, peach and melon at individual recall without collaboration. Together they recall apple, orange, peach and melon at collaborative recall. The individual score would then be 6 (3+3), the nominal score 5 (apple, orange, pear, peach and melon; apple is recalled by both persons, but is only counted once) and collaborative score 4. The literature on collaborative memory consistently reports that nominal recall is higher than collaborative recall that is higher than individual recall (Andersson, 2001). Depending on type of task, the collaborative score is approximately 90-93% of the nominal score (Andersson, Helstrup & Rönnerberg, 2007). It should be noted, though, that the collaborative score is higher than one person's individual score, so it is still better to collaborate than not to.

The negative effect of collaboration is called collaborative inhibition. It has been found on a variety of explicit cognitive tasks (Andersson & Rönnerberg, 1997; Diehl & Stroebe, 1991), but not on semantic memory or implicit memory tasks (Andersson & Rönnerberg, 1996; Johansson, Andersson & Rönnerberg, 2000). The phenomenon has been demonstrated in groups consisting of two (e.g. Andersson & Rönnerberg, 1996) to four individuals (e.g. Basden, Basden & Henry, 2000). It has also been shown for children (e.g. Andersson, 2001), adults (e.g. Meade & Roediger, 2009), and elderly people (e.g. Ross, Spencer, Linardator, Lam & Perunovic, 2004). The effect has also been observed for a variety of materials like pictures (Finlay et al., 2000; Weldon & Bellinger, 1997), a movie clip (Ekeocha & Brennan, 2008), stories (Andersson &

Rönnberg, 1995; Takahashi & Saito, 2004; Weldon & Bellinger, 1997), and related words (Basden, Basden, Bryner, & Thomas III, 1997).

The negative collaboration effect is smaller if the collaborators are friends (Andersson, Helstrup, & Rönnberg, 2007) and can even disappear among elderly couples who have lived together for many years (Johansson, Andersson & Rönnberg, 2005). Motivation has little or no influence on the negative collaboration effect (Weldon, 2000).

Collaborators have problems with absorbing unique information from others (Gigone & Hastie, 1997; Stasser & Titus, 1985). For example, people tend to talk about and listen to things which they already have in common (Wittenbaum, Hubbell & Zuckerman, 1999). One of the explanations of the negative collaboration effect is that retrieval strategies are disrupted when individuals collaborate (Dahlström, Danielsson, Emilsson & Andersson, 2011). The idea is that every person has an optimal order in which to recall, in relation to the strategy used, and that order is individual. In collaboration, collaborators have different optimal recall order and at least one person is forced to change order (Basden et al., 1997).

Persons with ID exhibit lower performance than age-matched controls on many explicit cognitive tasks (Bray, Fletcher & Turner; 1997). These encompass working memory (e.g. Henry & Winfield, 2010; Levén, Lyxell, Andersson, Danielsson & Rönnberg, 2008) executive functions (e.g. Danielsson, Henry, Rönnberg & Nilsson, 2010; Van der Molen, Van Luit, Jongmans & Van der Molen, 2007) and picture recognition (Danielsson, Rönnberg & Andersson, 2006; Danielsson, Rönnberg, Levén, Andersson, Andersson & Lyxell, 2006). Although the effect of expertise has been investigated (Meade, Nokes, & Morrow; 2009), this has involved participants with the same level of expertise within each dyad. To the best of our knowledge, there

are no studies which have examined collaborative memory in settings where the collaborators are expected to have different performance levels. This makes it theoretically interesting to study collaborative memory in adolescents with ID when they collaborate with their assistant. This will be investigated in the present study.

The research questions in the present article were:

- 1) Is there a negative effect of collaboration in adolescents with ID and their assistants in a collaborative recognition task?
- 2) Who decides most in collaboration when adolescents with ID and their assistants collaborate, and how does that depend on individual memory performances?

The hypothesis for the first research question is that there will be a negative effect of collaboration. For the second research question there are three different hypotheses. The first hypothesis is that each individual contributes equally to decision-making processes, as in previous studies on collaborative memory. The second hypothesis is that the person with best performance decides more since it makes the collaboration score higher, i.e. persons' individual decisiveness is related to individual memory performances. The third hypothesis is that the assistants decide more as a result of a power imbalance between them and the adolescent with ID. The power imbalance could e.g. be due to the fact that assistants are employed to help, or that the assistants simply expect to know better.

To investigate who decides in the collaboration, a manipulation was introduced. Persons collaborating were presented with different sets of pictures at encoding where some pictures were presented for both persons and some only by one of them. Investigation of pictures presented only to one person revealed indications of different decisiveness between participants. Another manipulation was introduced to be able to separate the second and third hypothesis of the second research question. In one

condition, both persons had the same encoding time and it was assumed that the assistants would generate higher individual scores. In another condition the assistants had shorter encoding time than the adolescents with ID and the assumption was that this would decrease the scores of the assistants to the same level as the adolescents with ID. If such a manipulation also eliminates differences in decisiveness it can be concluded that decisiveness is related to individual memory performance. If manipulation only eliminate the overall memory performance but not the decisiveness difference, the remaining differences in decisiveness is probably due to the power imbalance.

Collaborative memory has been investigated in both between subject (e.g. Meade & Roediger, 2009) and within subject designs (e.g. Andersson & Rönnerberg, 1995; Dahlström et al., 2011). The advantage of a within subject design is that it gives better experimental control of individual differences and also allows analyses where performance at individual recall is related to performance at collaborative recall on an individual level. The disadvantage is that consecutive recall attempts introduce a possible reminiscence effect. Andersson and Rönnerberg (1995) showed that the reminiscence effect existed but was small. However, if the reminiscence effect affected the obtained results in the present study, it would have reduced the amount of collaborative inhibition. In relation to the present study's research question, the advantages with a within subject design weight up the disadvantages and therefore, a within subject design is chosen.

2. Material and methods

2.1. Participants

Nineteen pairs of students with intellectual disabilities (mean age = 18.5, SD = 0.9) were recruited from upper secondary education (special schools for adolescents

with intellectual disabilities) together with one teaching assistant (mean age 40.3, SD = 12.1) each that they used to work with in school. Of the ten male students, five cooperated with a male assistant and five cooperated with a female assistant. Of the nine female students, three cooperated with a male assistant and six cooperated with a female assistant.

2.2. Tasks and Material

The task was a picture recognition task where pictures were first presented individually, then recognized individually and finally recognized collaboratively. The encoding pictures consisted of 56 black-and-white line drawings of common objects. Of the 56 pictures, 20 pictures were in common and presented to both participants, 10 pictures were uniquely presented to the students, 10 other pictures were uniquely presented to the assistants, and 26 pictures were filler pictures that were not presented at recognition or analyzed. The pictures were presented in the same order for all participants. The order of the different picture types was balanced and the first three and last three pictures were filler pictures, in order to minimize the influence of primacy and recency effects. For recognition, 50 pictures were used for recognition: The 20 pictures that were in common, the 10+10 pictures that were uniquely presented and 10 new pictures. Two sets of stimuli were used to minimize the influence of material effects. For recognition, two-columned A4 answering sheets of paper were used. These had 50 numbered lines where participants could mark one out of three alternatives: recognized the picture, did not recognize the picture, or not sure.

2.3. Procedure

In many studies of people with ID, a mental age comparison group is used. That would not be a good method in the collaborative setting since children without ID do not have teaching assistants in the same way as children with ID. That would mean

that they should collaborate with someone with whom they are not used to collaborating; this would make it hard to discern whether any group difference observed was due to intellectual disability or familiarity among collaborators. Therefore, we used another design with one condition where both collaborators had the same encoding time (2 seconds for each picture) and one where the assistant was given a much shorter encoding time (0.3 seconds for each picture). This manipulation was intended to equalize the individual memory performance between collaborators. This procedure helps establish whether results were dependent on different memory abilities (different inhibition in both settings) or the fact that one was the authority (similar inhibition in both settings).

Both conditions of the test involved the same procedure, with exception of the different encoding times. First, the student and the assistant were placed on chairs with their backs facing each other so that they could not see each other. Then, the 56 encoding pictures were sequentially presented on two computer screens (one each). In the following individual recognition phase, the student and the assistant were individually presented with one of the recognition sets and were asked to, individually and at their own pace, mark on the answering sheet whether they recognized the picture from the stimuli-list. In the following collaborative recognition phase, the assistant moved to the student's computer screen and they were collaboratively presented with another recognition set and asked to, collaboratively and at their own pace, mark on the answering sheet whether they recognized the picture from the stimuli-list. The order of settings, the stimuli and the recognition sets were all counter-balanced among dyads. Participants were not told that they were presented with different pictures.

2.4. Measures and Scoring

The number of correctly recognized pictures was calculated for each individual recognition phase, resulting in an individual score. The nominal score was defined as the sum of non-redundant individual scores and collaborative score was defined as the number of correctly recognized pictures during collaboration, following the Andersson et al. (Andersson & Rönnerberg, 1996) procedure. Collaborative inhibition can be defined in two different ways following Dahlström et al. (2011). General collaborative inhibition is the nominal score minus the collaborative score. Specific collaborative inhibition is similar to general collaborative inhibition but only considers items correctly recognized in individual recognitions. In general collaborative inhibition the collaborative performance is based upon the original stimuli, whereas in specific collaborative inhibition the collaborative performance is based upon the set of pictures recognized at individual recall. In the present study, only specific collaborative inhibition is presented, but general collaborative inhibition gave the same general pattern of results.

A measure of individual decisiveness was calculated. The pictures that were recognized at both individual and collaborative recognition, of the ones uniquely presented to each participant, was divided by the number of correctly recognized pictures during individual recognition for each collaborator. This score was calculated for the assistant and the adolescent with ID separately. Thus: Assistant's decisiveness = (recognized unique pictures for assistant)/(individual score for assistant) and Student's decisiveness = (recognized unique pictures for student)/(individual score for student).

2.5. Design

The experimental design was a 2×2 within-subjects factor design. The first factor referred to the type of recognition (nominal versus collaborative); the second

factor referred to the setting (natural versus equated performance). The dependent measure was number of correctly recognized pictures hits in the first analysis. In the present design, a main effect of type of recognition should be interpreted as a significant collaborative inhibition. To make sure that the results in the first ANOVA was not confounded with different decision criteria for saying that a picture has been seen, a second analysis was conducted. It used the same design as the first analysis, but false alarms was used as dependent measure. All statistics were performed using the Statistical Package for the Social Sciences (SPSS) for Windows version 18.

3. Results and Discussion

3.1. Manipulation Check

First, some analyses were made to make sure that the manipulation worked as intended. In the natural setting, assistants performed better than students at individual recognition, $t(36) = 2.30, p < .05, r = .36$. In the equated performance setting, no statistically significant difference in individual recognition between the adolescents with ID and their assistants was found, $t(36) = 0.27, p > .05$. There were no significant difference between the students performance individually at the equated performance setting compared to the natural setting, $t(19) = 1.69, p > .05$.

To summarize, there was initially a difference between performance for students and assistants at individual recognition and the manipulation eliminated that difference as intended.

3.2. Collaborative Inhibition

Means and standard deviations for the different types of recognition are presented in Table 1. The mean number of correctly recognized items nominally and collaboratively in natural, as well as equated, performance settings, were examined using ANOVAs. There was a main effect of recognition indicating specific

collaborative inhibition, $F(1, 18) = 63.37, p < .001, r = .88$. This means that participants were inhibited by the collaboration and that their collaborative performance did not reach the potential as indicated by nominal recognition.

There was also a main effect of setting, $F(1, 18) = 18.30, p < .001, r = .71$, showing a performance that overall was better in the natural setting. That is expected since that was what the manipulation was aimed for. There was a significant interaction between recognition and setting, $F(1, 18) = 6.10, p < .05, r = .50$, which is presented in Figure 1. Even though the nominal score was smaller in the equated performance setting, the inhibition was larger, compared to the natural setting. The interpretation is that when the assistants' individual performances are reduced to the performances of the students, collaboration is more inhibiting. A possible reason is that collaboration under more uncertain conditions might include more extraneous communication that contributes to inhibition of original memories.

Insert Table 1 and Table 2 about here

To get a broader picture of the collaboration, false alarms (pictures that had not been presented before, but participants said that they had seen) were analyzed with an ANOVA. There was a main effect of setting, $F(1, 18) = 6.26, p < .05, r = .51$, indicating more false alarms during collaboration than in nominal recognition. No main effect of type of recognition and no interaction between setting and type of recognition were found. This indicates that the false alarm rate is fairly independent of type of recognition, as opposed to correctly recognized pictures that were dependent on type of recognition.

3.3. *Decisiveness*

Means and standard deviations for individual recognition of the pictures that were unique for each collaborator and the pictures that were in common are presented

in Table 2, together with how many of those pictures were also recognized at collaboration. From this, the individual decisiveness was calculated as described in the method section and an ANOVA was performed. There was a main effect of setting, $F(1, 36) = 4.38, p < .05, r = .33$, as well as a significant interaction between setting and person, $F(1, 36) = 10.83, p < .01, r = .48$. The decisiveness was on average higher in the natural setting. Examination of simple main effects showed that the decisiveness of the assistants were significantly lower in the equated setting compared to the natural setting, $F(1, 36) = 14.49, p < .001, r = .54$, and compared to the students' decisiveness in the equated setting, $F(1, 72) = 4.52, p < .05, r = .20$. In the natural setting, the assistants' decisiveness was higher compared to the students' decisiveness, although this difference was only almost significant, $F(1, 72) = 3.21, p = .08, r = .21$. The students' decisiveness increased slightly from the natural to the equated setting. To summarize, the manipulation made the decisiveness of the assistants weaker while the decisiveness of the students were marginally stronger.

Another way to investigate this phenomenon is the correlation between decisiveness and individual memory performance. There was a significant correlation in the natural setting, $r = .38, p = .02$, but not in the equated setting, $r = .17, p = .30$. Focusing on assistants there were no significant correlations between decisiveness and individual performance; neither in the natural setting, $r = .34, p = .15$, nor in the equated setting, $r = .33, p = .17$. The students had the same nonsignificant results, $r = .22, p = .35$ (natural setting) and, $r = -.12, p = .63$ (equated memory performance).

To summarize, the effect of collaborative inhibition was confirmed in the setting of an image recognition task with dyads consisting of students with intellectual disabilities and their assistants. There was a significant difference in decisiveness between the groups in the natural setting, but not in the equated performance setting,

suggesting that decisiveness is dependent on individual memory performance.

Correlations did confirm this picture with regard to the natural setting, but not the equated memory performance setting.

4. General Discussion

The first research question in the present study was whether there would be a negative effect of collaboration in adolescents with ID, and their assistants, in a collaborative recognition task. The results confirm the negative effect of collaboration in this setting. This was expected, as this effect has been found in many other settings. On the other hand, the effect has been shown to be reduced by friendship and even disappear among old couples living together for a long time. Adolescents with ID and their assistants have a relationship where they collaborate rather intensely for sustained periods. The length of time is not comparable with the time old couples have lived together, but this could still potentially have reduced the negative collaboration effect.

The second research question concerned who decides most in the collaboration, and how this may be mediated by individual memory performance. Results showed that assistants decide more than students in the natural setting. Amount of decisiveness was positively correlated with individual memory performance, i.e. the more you remember, the more you decide. When differences in individual memory performances were equated by the manipulation, there was no significant difference in decisiveness between the groups. The correlation between decisiveness and individual memory performance was still positive, but not significant.

The first hypothesis about equal decisiveness within the dyad is falsified. The results favor the second hypothesis; that there is a relationship between decisiveness and individual memory performance. One aspect of the assistant's job is to influence

the student to take better decisions. In many situations the assistants have greater knowledge and are thereby able to judge if a decision is good or bad. Both the adolescents with ID and the assistants might have learnt how the other person acts and therefore developed a collaboration style that is adapted to respective individual memory performance. The third hypothesis about power imbalance could not be confirmed. In the equated performance setting, there was no significant difference in decisiveness, which means that when the difference in individual memory performance was adjusted for, there was no significant effect of power imbalance. This picture was also supported by the correlation patterns. It is good for the students and a good work of the assistants that collaboration effects of power cannot be found.

Overall correlations between decisiveness and individual memory performance were positive but only significant in the natural setting and not the equated memory performance setting. Looking at only the assistants, the correlations were moderate and explained 11% of the variance (R^2). This means that decisiveness is related to individual memory performance to some extent, but there are also other factors that have to be taken into account. The present design does not address these factors, but level of familiarity between collaborators, as well as personality factors, are implicated.

In an everyday situation, the assistant should thus adjust his or her decisiveness depending on the goal of the collaboration. In some situations, the goal is that the dyadic collaboration should achieve optimum results. . In other situations, such as school, the goal is that the student should learn as much as possible in a certain area, such as decision making. In this context, the student should try to decide almost everything, with the assistant giving feedback on whether the decision was correct or not. Another way to see it is that the first type of situation concerns performance now,

while the second type facilitates future performance. In reality, most situations arguably incorporate both of these concerns, albeit to differing extents.

5. Conclusion

On collaborate memory tasks, it has typically been found that the non-redundant sum of the individuals score is higher than the collaborative score. This means that the individual's potential is not reached at collaboration. This is called collaborative inhibition. It should be noted, though, that the collaborative score is higher than one person's individual score, so it is still better to collaborate than not to. Collaborative inhibition has been shown on a variety of tasks, materials and groups before. The present article is the first to show collaborative inhibition in a setting of students with intellectual disabilities and their assistants. Two settings were used, one with equal encoding time (natural setting) and one where the assistants had shorter encoding time to get equal memory performance (equated setting). The assistants recognized more pictures and were more decisive than the students with intellectual disabilities in the natural setting. Inhibition was larger in the equated setting. The assistants' decisiveness within the dyad was moderately correlated with individual memory performance. The results did not indicate that the power imbalance within the dyad affected the decisiveness within the dyad. Instead, level of familiarity between collaborators and personality factors are suggested for further research. The results are valid for the investigated setting, but is also interesting for the broader memory literature since this is the first time collaborative memory have been investigated in a setting where the collaborators had different memory ability.

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Table 1. Means and standard deviations for individual recognition, nominal recognition, collaborative recognition and collaborative inhibition.

Variable	<i>N</i>	Natural setting		Equated setting	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Individual recognition	38	26.11	3.13	22.66	5.33
Nominal recognition	19	33.58	3.92	28.42	7.04
Collaborative recognition	19	27.63	5.54	20.05	6.71
Collaborative inhibition	19	5.95	4.58	8.37	4.35

Table 2. Means and standard deviations for individual recognition of the pictures that were unique for each collaborator and the pictures that were in common together with how many of those pictures that were also recognized at collaboration.

	Natural setting				Equated setting			
	Student		Assistant		Student		Assistant	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Unique	6.37	2.06	8.58	1.12	6.00	2.89	5.53	2.78
Unique left	4.37	2.52	7.16	2.19	4.42	2.61	3.32	2.50
Common	12.74	4.39	17.37	2.48	13.05	4.71	12.05	4.12
Common left	11.26	4.60	15.16	3.44	10.16	4.84	8.95	4.22

Figure Caption

Figure 1. Nominal and collaboration recognition performance in the natural and equated performance setting with 95% confidence intervals on the error bars.

Figure 2. Decisiveness for the assistants and the students with ID in the natural and equated performance setting with 95% confidence intervals on the error bars.