Remembering and Knowing Faces

Based upon

Primitive Processes of Cognition

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Abstract

Recent recognition studies have shown that systematic variation in experiences of remembering and knowing can be obtained by varying encoding tasks. However, the interactions of underlying processes that support the production of remember and know judgments are not easily discerned. One promising explanation of remembering and knowing is based upon two primitive processes of cognition, Item-Specific Processing (ISP) and Relational Processing (RP), working together in support of memory . In order to more clearly define the roles of these two primitive processes of cognition, we examined two encoding tasks, a distinctiveness rating task (assumed to enhance ISP) and a category sorting task (assumed to enhance RP). At low levels of learning (one encoding trial) we replicated an earlier face recognition study by Mäntylä (1997). With sufficient learning (three encoding trials) we reversed these findings and showed that ISP produces a predominance of know judgments and RP produces a predominance of remember judgments.

Introduction

In 1985, Tulving introduced a distinction between two subjective states of awareness that has yet to be fully explained. In this study we focused on the subjective judgments associated with these two states of awareness and the cognitive processes that support their development. Subjective judgments of knowing indicate the first state of awareness. To know is to recognize or recall a studied item without conscious awareness of the original stimulus presentation. In contrast, recollection with conscious recollection of the learning sequence is termed remembering. Remembering entails the bringing to mind a particular association, image or something about the studied items appearance or position in the presentation sequence (Tulving, 1985; Gardiner, 1988).

The most promising explanation of remember and know judgments is a dual processing account based upon Item-Specific Processing (ISP) and Relational Processing (RP).

Item-Specific Processing (ISP) focuses attention on an individual item. An individual item can be a facial feature such as the eyes, hair, or mouth. ISP develops distinctiveness for individual items in memory.

Relational Processing (RP) focuses attention on the relationship between two or more items.

Through within-item relational processing facial features are bound together into a whole face. Relational processing can be used to combine facial features into a whole or to sort faces into several categories.

In this way item-specific processing and relational processing work together to form a complete representation of an individual face.

The level of RP is directly related to the amount of detail that is processed in a given stimulus presentation. Sorting faces along one dimension, such as face distinctiveness, should require less RP than sorting faces between six different categories.

Encoding tasks are not process pure (Jacoby, 1991). All encoding tasks contain a mixture of ISP and RP. In order to understand the production of remember and know judgments from a dual processing perspective, the nature of the interaction between the two processes must be considered. According to Hunt and colleagues ISP and RP are complementary processes (Einstein & Hunt, 1980; Hunt & Einstein, 1981; Hunt, 1995; Hunt & McDaniel, 1993). This means that ISP provides some information that RP cannot provide and vice versa. Because these processes are complementary, it is reasonable to assume that if information is provided in the stimulus that would otherwise be obtained through ISP then the complementary process (RP) would be engaged.

Repetition of encoding trials will produce changes in the pattern of remember and know judgments (Gardiner, Kaminska, Dixon, & Java, 1995; Conway, Gardiner, Perfect, Anderson, & Cohen, 1997; Gardiner & Radomski, 1999).

Assumptions:

1. Item-Specific Processing (ISP) promotes distinctiveness in memory (Hunt & McDaniel, 1993).

2. Distinctive items are better retained in memory (Ellis & Hunt, 1989).

3. Items encoded with a predominantly ISP encoding task will be better retained than items encoded with a predominantly relational encoding task (Epling, 1997).

4. Items that are recognized based upon knowing are better retained than items recognized based upon remembering (Gardiner & Java, 1991).

5. ISP and RP are complementary processes (Einstein & Hunt, 1980; Hunt & Einstein, 1981; Hunt, 1995; Hunt & McDaniel, 1993).

Expectations:

1. With sufficient learning, ISP will produce a predominance of know judgments based upon assumptions 1, 2, 3, and 4.

2. With sufficient learning, RP will produce a predominance of remember judgments.

3. If a face appears to be distinctive then RP will be preferentially engaged for the distinctive face based upon assumptions 1 and 5.

4. If a face does not appear to be distinctive then ISP will be preferentially engaged, in order to develop distinctiveness for the face in memory based upon assumption 1.

Method

Participants. Sixty-four University of Texas at Dallas undergraduate students participated in partial fulfillment of a course requirement. Subjects were randomly assigned to one of the four study groups based upon order of arrival at the laboratory.

Design and Materials. The experiment employed a 2 (Distinctiveness Rating versus Category Sorting) x 2 (one versus three) x 2 (homogeneous versus heterogeneous) design. Encoding task and the number of encoding trials were varied between subjects. List structure was varied within subjects. All subjects encoded one homogeneous and one heterogeneous study list. Study lists were varied in order to extend findings related to organization from he verbal literature to the domain of face recognition.

The stimuli were portrait style images, which were edited to show just the head and part of the neck. Faces were rendered in 256 shades of gray on index card stock measuring four and a quarter by five and a half inches. Faces were about three and one-half inches tall, subtending a nine degree visual angle at twenty-two inches.

All participants studied one 36-item homogeneous list and one 36-item heterogeneous list of faces. The order of list presentation was counterbalanced, such that half of the subjects saw a homogenous study list first and half saw a heterogeneous list first.

Procedure. Subjects were assigned to one of four encoding conditions upon arrival at the lab and each subject was tested individually. Subjects performed either one or three encoding trials with either a relational encoding task or a distinctiveness encoding task. In the relational encoding conditions, faces were sorted into six stacks based upon similarity. It was suggested that faces might be considered to be similar based upon resemblance, personality, expression, or any criteria that the subject cared to choose. In the distinctiveness encoding conditions, faces were sorted into six different stacks based upon perceived distinctiveness of the individual faces. The scale for distinctiveness ranged from very typical to very distinctive. Participants were allowed to proceed at their own pace. The encoding instructions in all conditions stated that there would be a recognition test after the encoding task.

During the testing phase, subjects were asked to determine if a given face was a studied item or if it was a new item. If the face was a studied item, then the subject was to determine the basis of recognition. Test responses were made by placing faces onto one of four stacks. The stacks were identified by place cards labeled “New”, “Know”, “Remember”, and “Guess” (Gardiner, Richardson-Klavehn, & Ramponi, 1997). All of the studied faces plus an equivalent number of new faces were randomly intermingled for presentation at test. Eight people were dropped from the study without examining their responses. Two of these subjects could not sort the faces in the required time. The remaining six subjects failed to follow instructions.

Results

Remember Judgments. The pattern of results for correct remember judgments, shown in Figure 1, was supported with a three-way ANOVA modeling the factors of encoding task, study list, and number of encoding trials. Category sorting produced more remember judgments than distinctiveness rating (.48 versus .37), [$F(1,60) = 9.17$, $p < .005$, MSE = .042]. This effect was qualified by an interaction between encoding task and the number of encoding trials. The effect observed with one encoding trial was reversed with three encoding trials.

Follow-up analyses showed that the effect due to encoding task was significant after one encoding trial [$F(1,30) = 5.49$, $p < .05$, MSE = .051] and again after three encoding trials [$F(1,30) = 59.22$, $p < .0001$, MSE = .033]. Notably, the magnitude of the effect was much greater after three encoding trials than after just one encoding trial as measured by η^2 (.66 versus .15).

Know Judgments. The pattern of results for correct know judgments, shown in Figure 2, was supported with a three-way ANOVA. There was a main effect for encoding task. Distinctiveness rating produced more know judgments than category sorting (.38 versus .28), [$F(1,60) = 8.75$, $p < .005$, MSE = .035]. The effect of encoding task was qualified by an interaction with the number of encoding trials. The effect observed with one encoding trial was reversed with three encoding trials.

Follow-up analyses showed that with one encoding trial, the category sorting task produced higher levels of know judgments than the distinctiveness rating task (.37 versus .23), [$F(1,30) = 7.71$, $p < .01$, MSE = .040]. With three encoding trials, the distinctiveness rating task produced higher levels of know judgments than the category sorting task (.53 versus .19) [$F(1,30) = 61.12$, $p < .0001$, MSE = .029]. Again, the magnitude of the effect was greater after three encoding trials than after just one encoding trial as measured by η^2 (.67 versus .20).

What about Distinctive Faces versus Less Distinctive Faces?

Remember Judgments. Analysis of correct remember judgments showed an effect for distinctiveness [$\underline{F}(1,120) = 59.96$, $\underline{p} < .0001$, MSE = .017]. More correct remember responses were given for distinctive faces than for typical faces (.25 versus .18). This result was replicated with H-FA scores for remember judgments [$\underline{F}(1,120) = 45.54$, $\underline{p} < .0001$, MSE = .015].

Know Judgments. Distinctiveness was a significant factor in the production of correct know judgments [$\underline{F}(1,120) = 12.08$, $\underline{p} < .001$, MSE = .005]. More correct know responses were given for typical faces than for distinctive faces (.18 versus .15). However, this effect was not replicated with H-FA scores for know judgments.

Conclusion

With sufficient learning (three encoding trials):

- Relational Processing supports the production of remember judgments. Category sorting produced more remember judgments than distinctiveness rating.
- Item-Specific Processing supports the production of know judgments. Distinctiveness rating produced more know judgments than category sorting.
- The magnitude of the effect of encoding task on the production of remember and know judgments was substantial, .66 and .67 respectively, as measured by η^2.

Discussion

The results observed with one encoding trial replicate Mäntylä (1997) while the results obtained with three encoding trials reverse the previous findings. Mäntylä suggested that ISP facilitates the production of remember judgments with one encoding trial and Rajaram (1999) suggested that fluency of processing mediates the production of know judgments. We suggest that RP is the underlying process that produces remember judgments and that ISP is the underlying process that produces know judgments.

The remember-to-know shift observed with ISP between one and three encoding trials is consistent with a similar pattern of results obtained by Conway, Gardiner, Perfect, Anderson, & Cohen (1997). However, the know-to-remember shift observed with RP between one and three encoding trials is,to the best of our knowledge, entirely new.

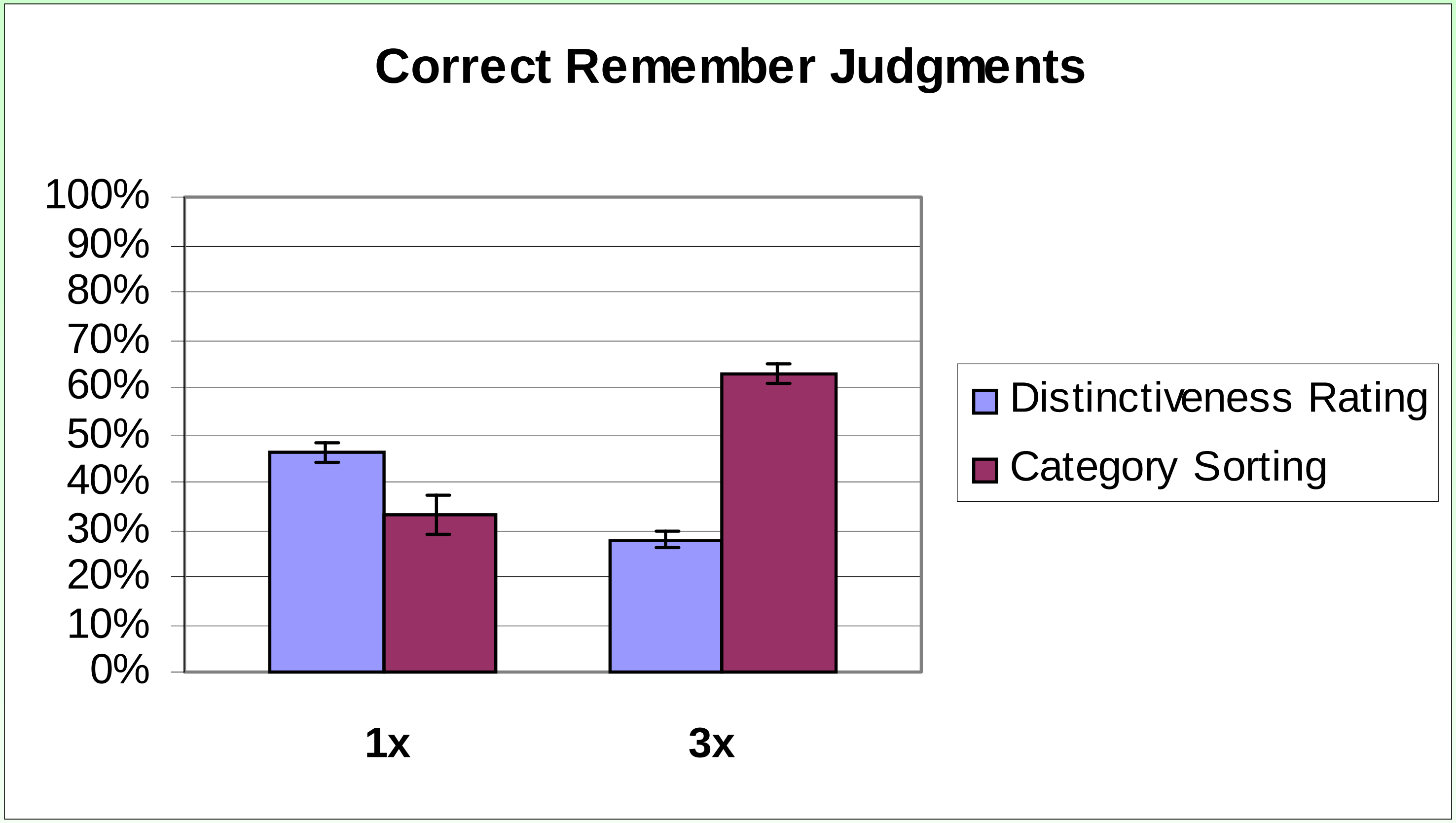

Figure 1. Correct remember judgments of studied items by number of encoding trials and encoding task. Vertical lines depict standard errors of the means.

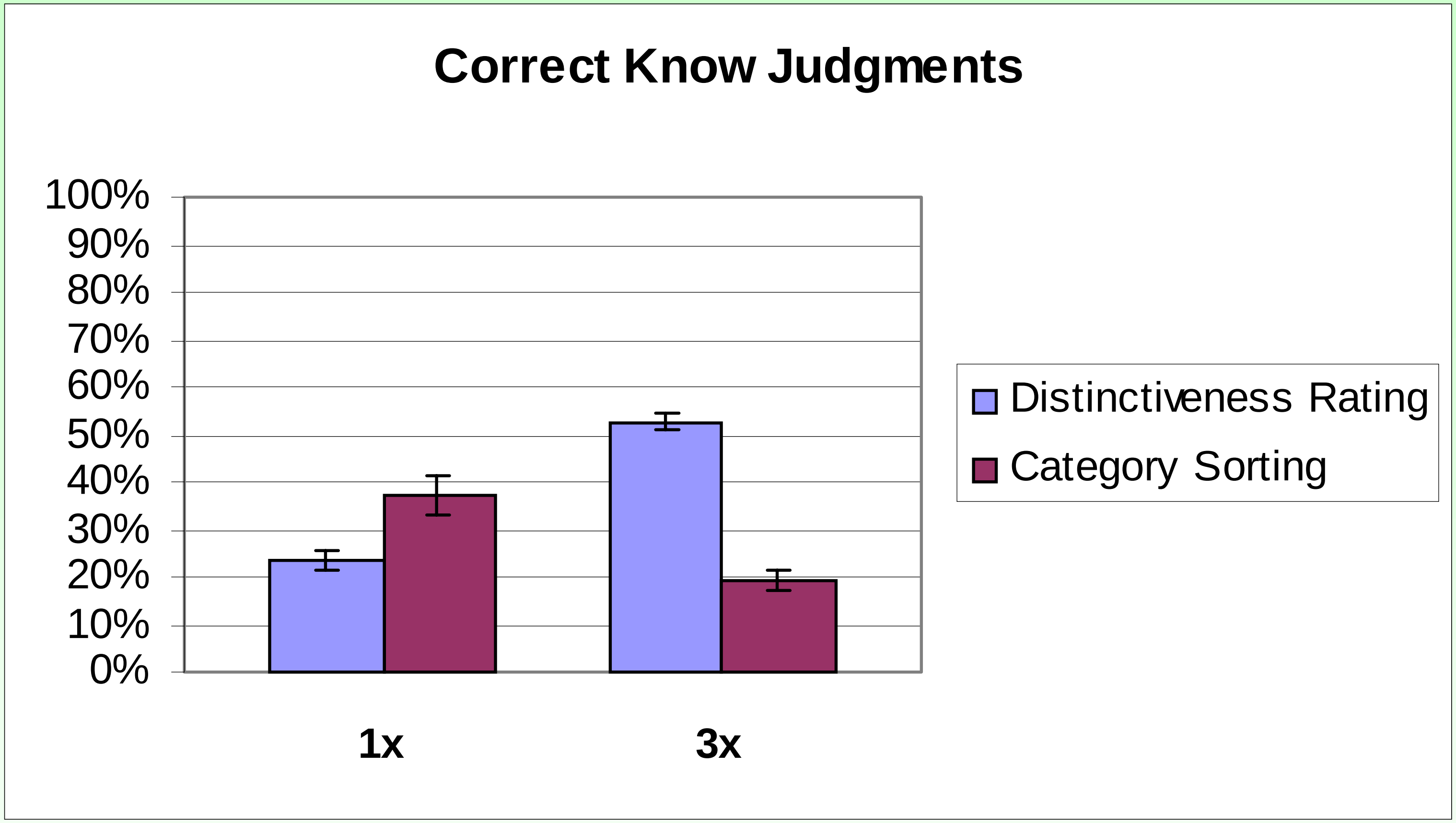

Figure 2. Correct know judgments of studied items by number of encoding trials and encoding task. Vertical lines depict standard errors of the means.

Comparison of Mäntylä's (1997) Results to the Current Study

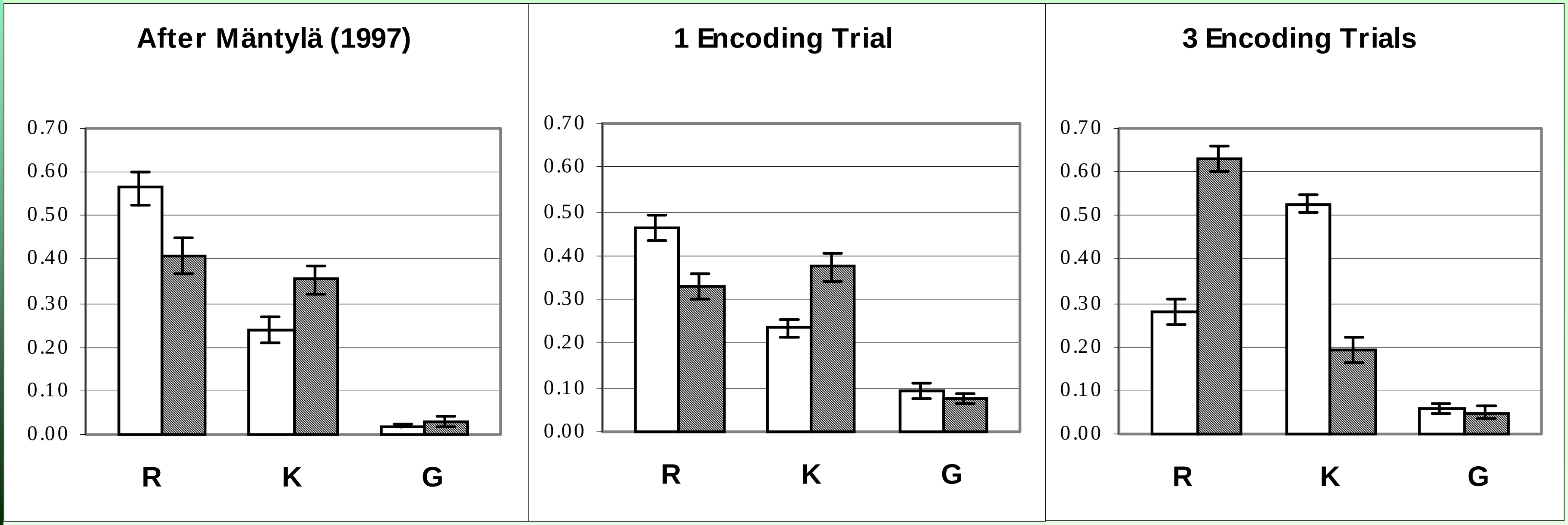

Figure 3. Proportions of correct Remember (R), Know (K), and Guess (G) responses by encoding task. The distinctiveness rating task is represented in white the bars. The category sorting task is represented in the shaded bars. Mäntylä's (1997: experiment 4) results are shown in the first panel. The one presentation and three presentation conditions of the current experiment are shown in panels 2 and 3, respectively. Vertical bars indicate standard errors of the means.

References

Conway, M.A., Gardiner, J.M., Perfect, T.J., Anderson, S.J., & Cohen, G.M. (1997) Changes in Memory Awareness During Learning: The Acquisition of Knowledge by Psychology Undergraduates. *Journal of Experimental Psychology: General*, 126, 393-413.

Einstein G.O. & Hunt R.R. (1980). Levels of Processing and Organization: Additive Effects of Individual-Item and Relational Processing. *Journal of Experimental Psychology: Human Learning and Memory*, 6(5) 588-598.

Ellis, H.C. & Hunt, R.R. (1989). *Fundamentals of Human Memory and Cognition*, *Fourth Edition.* 302. Dubuque, Iowa: Wm. C. Brown Publishers.

Epling, G.A. (1997, May). Hypermnesia and Primitive processes of Cognition. Poster session presented at the annual meeting of the Association for Research in Memory, Attention, Decision-making, Intelligence, Language, Learning, and Organization Richardson, Texas.

Gardiner, J.M. (1988) Functional aspects of recollective experience. *Memory & Cognition,* 16, 309-313.

Gardiner, J.M. Kaminska, Z., Dixon, M., & Java, R.I. (1996). Repetition of previously novel melodies sometimes increases both remember and know responses in recognition memory. *Psychonomic Bulletin & Review*, 3 (3), 366-371.

Gardiner, J.M. & Radomski, E. (1999). Awareness of Recognition Memory for Polish and English Folk Songs in Polish and English Folk. *Memory*, 7 (4), 461-470.

Hunt, R.R. (1995). The subtlety of distinctiveness: What von Restorff really did. *Psychonomic Bulletin & Review*, 2 (1), 105-112.

Hunt, R.R. & Einstein, G.O. (1981). Relational and Item-Specific Information in Memory, *Journal of Verbal Learning and Verbal Behavior*, 20, 497-514.

Hunt, R.R. & McDaniel, M.A. (1993). The Enigma of Organization and Distinctiveness. *Journal of Memory and Language*, 32 (4), 421-445.

Jacoby, L.L. (1991). A process dissociation framework: Separating automatic from intentional uses of memory. *Journal of Memory and Language*, 30, 513-541.

Mäntylä, T. (1997). Recollections of Faces: Remembering Differences and Knowing Similarities. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 23, 1203-1216.

Rajaram, S. (1999). Assessing the nature of retrieval experience. In B.H. Challis, & B.M. Velichkovsky [Eds.] *Stratification in Cognition and Consciousness* (255-275). Philadelphia, PA: John Benjamins Publishing Co.

Tulving, E. (1985). Memory and Consciousness. *Canadian Psychology*, 26, 1-12.