Addendum to "Remembering operations"*

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An error in analysis of data presented in the earlier paper is corrected here.

An error in computation, recently discovered, modifies one result reported in *Remembering Operations* (Kolars, 1973). The main conclusion, that typography can affect and be represented in memory for sentences, and the theoretical arguments based on that conclusion still stand; the modification concerns the estimate of the graphemic component called d' (old) in the paper. In addition to correcting the computations previously described, this note also supplies the proportion of responses underlying the calculation of d' . Recapitulation of the main findings will clarify the relations in the data.

Table 1 shows, averaged across Ss, the proportion of responses made to each of the six kinds of sentences in the recognition deck in Experiment I. Rows are response categories, sentences classified as appearing in the same form in the recognition deck as in the read deck, sentences classified as appearing in different form (the alternate typography), or sentences thought to be appearing for the first time (new). The values shown in the table are for sentences read correctly on both trials and, therefore, are a few percent lower than the raw values reported in the Results section of the original paper.

The table is made up of two parts, the four leftmost columns, which show how Ss sorted reread sentences (those from the recognition deck that had earlier appeared in the read deck), and the two rightmost columns, which show how they sorted new sentences (those that appeared only in the recognition deck). In two applications the d' statistic related the proportions in the rightmost columns to the proportions in the leftmost columns, the former as false alarms, the latter as hits, separately for each S. In one of those two, d' (sem), hits were the sum of responses in the upper two rows of the table in each of the four columns for reread sentences and false alarms were the corresponding sums in the two columns for new sentences. This computation evaluates recognition of old sentences as *statements* having occurred before, without regard to their typography on the two occasions. In the second of the two computations, d' (new), only exactly correct

Table 1
Averaged Proportion of Responses

Classification	Kind of Sentence					
	NN	NI	IN	II	WN	WI
Same Form	.49	.14	.08	.77	.03	.07
Different Form	.18	.54	.89	.20	.10	.10
New	.33	.32	.04	.03	.87	.83

placements were taken as hits, the same form sentences of NN and II, the different form sentences of IN and NI, and the WI and WN sentences in the corresponding rows as false alarms. This computation evaluates recognition of sentences in respect to their typography.

A third calculation, called d' (old), restricted attention to the four leftmost columns of the upper two rows only, taking as hits the exactly correct responses and as false alarms the other old, but misplaced, sentences: for NN as hit, IN in the same form category as false alarm; for II as hit, NI in the same form category as false alarm. This computation also evaluates recognition of sentences in respect to their typography, but conditionalized on their correct recognition as old. An error was made in the conduct of this last calculation. Examination of Table 1 shows that only two values of d' can be calculated here, called N. and I.; when the error is corrected, the results reveal no reliable difference between the two values of d' (old).

Table 2 shows the corrected values of d' for Experiment I, in the order of decreasing semantic generality just described. Sentences that were initially read in inverted form (II and IN sentences) have higher values in d' (sem) and d' (new) than sentences initially read in normal form (NN and NI sentences), but the difference disappears in the computation of d' (old). ANOVA on these results yielded $F(3,33) = 20.40$ for the difference between sentence pairs in d' (sem), $F(3,33) =$

Table 2
Values of d' for Different False Alarms

	Pairing				SE _{DM} *
	NN	NI	IN	II	
d' (sem)	1.78	1.95	3.29	3.48	.28
d' (new)	1.78	1.49	2.83	2.51	.30
d' (old)	2.36**		2.00†		.25

*I am obliged to Howard Kaplan, who detected the computational error, and C. D. Creelman for their helpful discussion of TSD, and David Ostry for programming. This work was assisted under Grant 382 of the Ontario Mental Health Foundation, and by the National Research Council of Canada (A 7665).

*Standard error of the difference between means
**N. †I.

Table 3
Proportions of Responses and Values of d'

	Pairing						SE_{DM}^*
	NN	NI	IN	II	WN	WI	
Same Form	.36	.17	.24	.77	.03	.03	
Different Form	.24	.36	.73	.18	.06	.07	
New	.40	.47	.03	.04	.90	.90	
d' (sem)	1.64	1.48	3.17	3.12			.28
d' (new)	1.45	1.20	2.20	2.69			.31
d' (old)	1.03**		1.52†				.43

*Standard error of the difference between means

**N. †I.

8.86 for the difference in d' (new) (both $ps < .01$ and $F(1,11) = 2.03$, $ps > .05$ for d' (old)).¹

Orthogonal contrasts yielded the following results. For the comparison of same form vs different form (NN + II vs NI + IN), $t(33) < 1$ in both d' (sem) and d' (new). For the test of the significance of the first letter (NN + NI vs II + IN), $t(33) = 5.51$ in d' (sem) and $t(33) = 3.48$ in d' (new), both $ps < .01$. For the test of the significance of the last letter upon encoding (NN + IN vs II + NI), $t(33) < 1$ in d' (sem) and $t(33) = 1.05$ in d' (new), both $ps > .05$. As there was no main effect for the difference between N. and I. in d' (old), none of these tests was made on those data.

Table 3 summarizes the proportion of responses and the associated values of d' for Experiment II. Again, many more sentences initially read inverted were recognized correctly. ANOVA on sentence pairing yielded $F(3,15) = 22.18$ for d' (sem), $F(3,15) = 9.88$ for d' (new) (both $ps < .01$), and $F(1,5) = 1.27$ for d' (old), $p > .05$.

Orthogonal contrasts for Experiment II yielded the following results. For the comparisons of NN + II vs NI + IN, $t(15) < 1$ in d' (sem) and $t(15) = 1.19$ in d' (new), both $ps > .05$. For the assessment of initial encoding, NN + NI vs II + IN, $t(15) = 5.76$ in d' (sem) and $t(15) = 3.64$ in d' (new), both $ps < .01$. For the assessment of final encoding, NN + IN vs II + NI, $t(15) < 1$ in both d' (sem) and in d' (new).

Finally, Table 4 shows the proportions correct and the associated values of d' for the silent reading of

Table 4
Proportion of Responses and Values of d'

	Pairing						SE_{DM}^*
	NN	NI	IN	II	WN	WI	
Same Form	.48	.15	.06	.77	.03	.09	
Different Form	.21	.40	.85	.10	.10	.09	
New	.31	.44	.09	.12	.87	.82	
d' (sem)	1.81	1.19	2.73	2.37			.21
d' (new)	1.80	1.17	2.56	2.38			.24
d' (old)	2.26**		2.17†				.36

*Standard error of the difference between means

**N. †I.

Experiment III. ANOVA on sentence pairs yielded $F(3,33) = 19.85$ for d' (sem) and $F(3,33) = 13.21$ for d' (new), both $ps < .01$, and $F(1,11) < 1$ for d' (old).

Orthogonal contrasts for Experiment III found the difference for NN + II vs NI + IN yielded $t(33) < 1$ in d' (sem) and d' (new). The test for initial encoding, NN + NI vs II + IN, yielded $t(33) = 4.91$ in d' (sem) and $t(33) = 4.02$ in d' (new), both $ps < .01$. The test for final encoding, NN + IN vs II + NI, yielded $t(33) = 2.33$ in d' (sem), $p < .05$, and $t(33) = 1.64$, $p > .05$ in d' (new).

The main finding, that more is remembered of a sentence than its semantic content, remains as previously demonstrated; and the conjectures regarding the role of graphemic pattern analysis in the perception and memory of sentences remain as stated. Their actual role in perception and memory is still under study; the annoyance that the computational error may have caused readers of the earlier paper is regretted.

REFERENCE

Kolers, P. A. Remembering operations. *Memory & Cognition*, 1973, 1, 347-355.

NOTE

1. In the original report, sex was an independent variable in the 2 (sex) by 4 (sentence pairing) by 6 (Ss) ANOVA. It proved to be an unstable variable in these tests, however. In the present analyses, the data have been collapsed across sex to make a 4 (sentence pairing) by 12 (Ss) ANOVA. Consequently, there are differences in the two reports in the degrees of freedom associated with F tests.