judgment procedures and conducting a number of additional experiments. There were two subsamples in the most Westernized Fore; one subsample performed the judgment task by using Pidgin translations of the affect terms, and the other subsample used the affect terms of their own Fore language.

The Borneo sample was the Sadong, a Bidayuh-speaking group of Hill Dyaks in southwest Sarawak. These people still lived in their traditional long houses and maintained their traditional agrarian way of life. Only one man spoke English, most men spoke some Malay, and many had seen a few movies in a commercial center located about a day's walk from their village.

The distribution of six responses to each category (affect) of photographs was tallied, and the most frequent judgment response for each affect category was converted into a percentage of the total responses to the stimuli which represented that category (Table 1). The data from the three literate samples support our contention of a pan-cultural element in facial affect display. Agreement and accuracy were far higher in each group than had been reported for recognition of emotions within cultures, and the same affect term was the most frequent response in the United States and Brazil for all of the stimuli and for 29 out of the 30 stimuli when Japan is compared. Three literate cultures are not a sufficient sample to proclaim universality; however, Izard (*9*), who worked independently at the same time as we, but with his own set of facial photographs obtained results for eight other literate cultures that are substantially the same as ours.

When exposure to common visual input is controlled (to answer the argument that such similarities among literate cultures only reflect learned recognitions from mass media) the agreement and accuracy were lower in the preliterate cultures than in the literate ones. We believe that this is because of the enormous obstacles imposed by language barriers and task unfamiliarity in preliterate cultures (even with the more Westernized observers). Despite such handicaps, there were similar recognitions of happiness, anger, and fear in all samples, and for disgust, surprise, and sadness in two out of three samples (Table 1). An affect category was never misidentified by the majority of observers in more than one of the preliterate samples. Our studies of other much less Westernized Fore observers yielded similar results, with the exception of the sadness category, and we also obtained additional support in studies in progress on how these affects are expressed in the Fore. The possibility that the data on the preliterate samples might have been biased by the use of Caucasoid faces as stimuli was negated by additional studies in which Melanesian (South Fore) faces were shown to the South Fore observers and results similar to those reported here were obtained. The proposition that there are pan-cultural elements in human affect displays appears to be largely supported, both in the literate cultures that we and Izard have studied, and for the most part in the preliterate cultures that we have investigated. Those who deem it important to have maximum control for shared visual input to limit the opportunity to learn common affect recognitions might still want the further evidence on the less Westernized samples of Fore to be reported later.

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Retrograde Amnesia in Free Recall

Abstract. *Supervention of high-priority events in a series of events constituting a free-recall task interferes with postexposure processing of mnemonic information about immediately preceding events, with the result that recall of these preceding events is impaired. Recall of immediately following events is not affected. This retrograde interference is time dependent.*

Retrograde amnesia refers to selective impairment of memory for events preceding a critical "amnestic" event. The magnitude or the extent of such impairment varies directly with the temporal proximity between the amnestic event and the events whose retention is measured. Known and putative amnestic events or treatments include concussion, electroconvulsive shock, local brain stimulation, anesthesia, anoxia, and administration of various drugs (*1*). The action of amnestic events is usually interpreted in terms of the disruption of consolidation of the engrams or memory traces of events preceding the amnestic event, but alternative interpretations have also been offered (*2*).

Understandng of retrograde amnesia is of considerable theoretical importance. The advancement of such understanding depends on availability of appropriate methods for the production of retrograde amnesia under the laboratory conditions and for accurate specification of its characteristics. I describe here two experiments with use of a new method of demonstrating a phenomenon that resembles retrograde amnesia. The method has certain advantages over the existing ones (*3*), although its applicability is limited to human subjects.

In the experiments, the events to be remembered were common words presented to the subjects sequentially, one word at a time, with the instructions to remember as many of the words in a given list as possible and to recall them at the end of the presentation of the list in any expedient order. Thus the basic experimental paradigm was that of single-trial free recall (*4*). It is convenient to think of the words in a free-recall list as a succession of events, and of the subject's task as one of processing mnemonic event information. Hence "word" and "event" in this context are to be treated as synonyms.

The amnestic events were names of famous people (for example, Columbus, Freud, Aristotle) that occurred in some lists and that were to be treated as high-priority events by subjects. Subjects were instructed that whenever a name of a famous person appeared in the list, he was to make sure that he remembered that name. He also had to recall the name first, before proceeding to recall other items (common words) from the list.

Two kinds of lists were used: standard lists, each containing 15 common words, and high-priority lists, each containing 14 common words and the name of one famous person (the high-priority event). The high-priority event in a given list occurred in input position 2, 8, or 14 (high-priority lists 2, 8, and 14). The subjects knew before the experiment that some lists would contain high-priority events, but they did not know before presentation of any particular list whether or not it would contain a high-priority event.

In the first experiment, each of 40 subjects (summer school students at the University of Toronto) was tested with 20 standard-test and 30 high-priority lists, ten of each of three types, the 50 lists occurring in a scrambled order. List items were presented visually on a television screen at the rate of 1 second per word. After seeing a list, subjects had 30 seconds to write down as many items as they remembered from the list. Different sets of computer-generated lists were used with different small groups of subjects, so that the findings are based on a wide sampling of relevant materials.

The second experiment was essentially a replication of the first, except that two rates of presentation were used—0.5 second per word and 2 seconds per word. Each of 20 subjects (senior high school students) was tested with 100 lists in two separate experimental sessions. One-half of the lists were seen by each subject under the fast rate and the other half under the slow rate of presentation. Lists and rate of presentation were counterbalanced across subjects and sessions.

The primary data from the experiments are provided by probabilities of recall of items from each of 15 input positions in a list (Table 1).

The data of interest concern the probabilities of recall of words from input positions immediately preceding and immediately following the high-priority events in the high-priority lists. To assess the effects of the high-priority events the data for any given high-priority list are to be compared with recall probabilities of words from corresponding input positions in standard-test lists presented at the same rate (numbers in parentheses, Table 1).

With faster rate of presentation (1 sec/word in the first experiment and 0.5 sec/word in the second experiment), the presence of the high-priority event appears to depress the recall of the immediately preceding words, particularly in high-priority lists 8 and 14. Recall of words from input positions 7 and 13 is approximately twice as high in standard-test lists as it is in high-priority lists 8 and 14, respectively. Thus, the supervention of a high-priority event produces a sizable decrement in recall of at least one immediately preceding event. There is also a suggestion that in high-priority lists 8 and 14 (0.5-second rate), recall of two immediately preceding words is affected.

The presence of the high-priority events in any of these lists, however, does not seem to have affected the recall of words from input positions immediately following the high-priority events, at least not to the extent anywhere near that shown for immediately preceding words. The amnestic effect of such an event thus appears to be asymmetrical: High rates of recall of high-priority events are accompanied by lowered recall of immediately preceding events without showing similar effects on the recall of immediately following events.

This phenomenon, of retrograde amnesia in free recall, depends on the rate of presentation of the words. The amnesia all but disappeared with the rate of 2 seconds per word in the second experiment. The difference in the recall of words from input position 13 between the standard test list and the high-priority list 14 (0.60 compared to

Table 1. Probabilities of recall of items from 15 input positions in different lists in experiments 1 and 2. Decimal points are omitted. *N*, number of observations (No. of subjects times No. of lists) on which probabilities in a row are based; ST, standard test; HPE, high-priority event; numbers in parentheses, data from high-priority lists compared with recall probabilities of words from corresponding input positions in standard-test lists presented at same rate; numbers in square brackets refer to high-priority events.

List	*N*	Input position														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Experiment 1—1 second per item																
ST	800	(37)	22	(18)	17	15	15	(20)	20	(22)	24	30	35	(53)	69	(79)
HPE 2	400	(28)	[83]	(18)	15	14	14	18	16	20	18	22	29	44	57	66
HPE 8	400	31	24	16	20	13	12	(09)	[79]	(20)	18	26	31	46	57	63
HPE 14	400	32	22	18	17	14	18	17	20	18	28	22	30	(28)	[96]	(81)
Experiment 2—0.5 second per item																
ST	400	(26)	19	(13)	14	11	15	(16)	18	(19)	22	26	42	(55)	72	(74)
HPE 2	200	(16)	[82]	(10)	09	12	12	12	16	16	22	24	34	50	55	62
HPE 8	200	22	18	14	08	12	09	(08)	[92]	(17)	17	28	35	44	60	62
HPE 14	200	27	23	16	14	10	17	15	20	26	22	28	32	(28)	[99]	(80)
Experiment 2—2 seconds per item																
ST	400	(43)	33	(31)	27	28	29	(29)	30	(31)	35	42	51	(60)	78	(84)
HPE 2	200	(40)	[88]	(28)	24	33	26	28	25	28	38	42	50	60	64	65
HPE 8	200	38	32	29	26	32	28	(26)	[92]	(38)	30	40	54	54	74	68
HPE 14	200	36	32	34	32	34	32	28	36	39	46	45	51	(49)	[100]	(81)

0.49) is barely significant at $P = .05$ level (on the basis of the t test) but it is considerably attenuated in comparison with corresponding differences observed with faster rates of presentation. High-priority lists 2 and 8 show no evidence of retrograde amnesia in free recall at the rate of 2 seconds per word.

The most promising explanation of retrograde amnesia in free recall appears to be some version of the consolidation hypothesis. The asymmetry of the amnestic effects of the high-priority event as well as the apparent rate-sensitivity of the phenomenon rule out a number of otherwise plausible interpretations. My data suggest that the initial registration or the encoding phase of the act of remembering sometimes extends beyond the temporal interval during which the event to be remembered is physically present in the subject's field of view. It is this processing, after exposure, of rapidly occurring events that seems to be interfered with by the supervention of another event which is afforded high-priority treatment by the system.

Consolidation-like processes have frequently been postulated in theoretical accounts of human memory. Peterson (*5*), for instance, assumed that consolidation of one component of the memory trace accounted for the paradoxical observation that a verbal item presented twice in the input series was recalled best when it was partially forgotten before its second presentation.

The method described here may have some value in probing the consolidation process. It may also lead to other insights into the nature of memory.

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Linguistic Structure and Transposition

Abstract. *Transfer of a learned discrimination along the size dimension was studied in groups of American and African tribal children. The language spoken by the African children contains an asymmetry in the expression of size comparisons that is not present in English. Contrary to theories of linguistic mediation of choice behavior, transfer choices were not related to the differing linguistic patterns; however, initial choices and post-test descriptions of choices were so related.*

The most familiar version of the hypothesis that performance of nonverbal tasks is mediated by linguistic competence (*1*) is that thought is formed and channeled by the semantic and syntactic capacities of one's language. Despite difficulties, certain formulations (*2*) of this hypothesis have been subjected to experimental evaluation (*3, 4*).

The study of transposition of discrimination in children has often been used for analyzing presumed linguistic mediation (*5*). In the transposition experiment, the task is to discriminate between related stimuli at two points on the dimension defined by that relation. In the United States it is generally found that older children transpose across a wider range of stimuli than younger children do (*5, 6*). This is often but not always (*7*) taken as evidence that linguistic competence favors certain forms of choice behavior.

Our study is based on an asymmetry in verbal comparison discovered in the course of an investigation of the relation between culture and learning (*8*). The Kpelle of north-central Liberia habitually put the member with the higher value first in the comparison of two objects. This same asymmetry is not present in standard American English. For example, the Kpelle normally would say, "John's house is big past (bigger than) Flumo's house," but only rarely would say "Flumo's house is small past (smaller than) John's house." In American English, both comparisons occur with equal frequency.

The presence in the Kpelle language of an asymmetry not found in English suggested a study of Kpelle and American children learning to transpose a size comparison from one pair of stimuli to another similar pair. Strong forms of the theories of linguistic mediation lead to the hypothesis that rate of learning and amount of transposition would be biased in the direction predicted from our observations of the linguistic asymmetry in making size comparisons.

The African subjects were 160 Kpelle children, divided into three groups as follows: group 1, illiterates 4 to 5 years old; group 2, illiterates 6 to 8 years old; and group 3, first-graders 6 to 8 years old who attended government schools. Groups 1 and 2 spoke little or no English and had not attended any form of Western school. The children in group 3 were functionally illiterate and spoke only a limited amount of pidgin English but had been exposed to the school environment for at least 6 months. The American subjects (group 4) were 72 nursery school children, 3 to 5 years old (average age of 4 years, 2 months).

The stimulus materials consisted of ten opaque white plexiglass squares. The smallest square had an area of 12.2 cm^2, and the area of each successive square was larger than that of its neighbor in the ratio of 1.4:1.

The experimenter and subject sat across a table from each other with a small barrier between them so that the experimenter had a place to write responses and arrange stimuli beyond the view of the subject. The subject was read the following instructions (in his native language): "I will show you two things. Each time I show you these things you must tell me which one I am thinking of. If you are correct, I will say yes. If you are wrong, I will say no. Try to be correct every time." After each correct response, the experimenter said, "Yes, very good" or some equivalent words of encouragement. After each incorrect response the subject was told, "No."

Training was carried out on the middle blocks in the series, blocks 5 and 6. For half of the subjects the smaller block was always correct and for the remainder the larger block was correct. Trials were presented until a criterion of nine consecutive correct