THE EFFECTS OF INTERACTIVE IMAGES ON LANGUAGE ACQUISITION FOR ADULTS

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Abstract: An interactive mnemonic strategy known as progression (which previously has been shown to be useful in recognition memory in adults) was used in this study involving foreign language vocabulary acquisition. Progression uses a series of five panels: the first displays the stimulus item (a foreign Word), the last displays the response item (a picture of the referent), and the intermediate panels represent a gradua1 visual metamorphosis (change in shape) from the first item to the last. Adults viewed either the five pane1 progressive illustrations or one of two non-interactive conditions: the first and last pane1 only (word + picture) or the written foreign word and its written English equivalent (word + word) Recall of the meanings of foreign words was significantly better for the adults viewing progressive displays than for those viewing non-interactive stimuli.

Résumé: Une stratégie mnémonique interactive connue sous le terme progression a été utilisée dans cette étude portant sur 'acquisition de vocabulaire dans une langue étrangère. La progression utilise une séries de cinq étapes: la première montre le stimulus (un mot étranger), la dernière présente un item réponse (une image du référant) et l'intermédiaire représente une métamorphose visuelle graduelle (changement dans la forme) du premier item au dernier. Les adultes ont soit vu les cinq étapes d'illustration progressive ou une de ces deux conditions non-interactives: 1) la première et la dernière panels seulement (mot et image) ou 2) le mot étranger écrit avec son équivalent écrit en anglais (mot et mot). Le rappel de la signification des mots étrangers était plus élevé chez les adultes a qui on avait présenté les illustrations progressives que chez ceux à qui on avait présenté des stimuli non-interactifs.

In a number of studies interactive illustrations have been shown to be effective in facilitating memory. These illustrations vary widely and are used for avariety of purposes, but all fall under the "interactive" category by virtue of the fact that the symbols depicted in the illustration in some way interact with each other. Hence their common denominator is the visual link or association show in the picture. Several types will be discussed.

In the 1970s researchers began exploring the possibility of using interactive pictures to facilitate the association of word pairs. Studies overwhelmingly demonstrated the efficacy ofthese illustrations as opposed to separate pictures (e.g., Emmerich & Ackerman, 1976; Lippman & Shanahan, 1973; Lutx & Lutz, 1977). Usually the two items are shown in a syntactic relationship, either active or spatial (e.g., a *monkey* smoking a *cigar* or a wagon on a *roof* SO that a visual link in the illustration directly corresponds to the items to be remembered. The mental

association of the two items is required so that the presentation of the stimulus item elicits the interactive scene, which in turn allows retrieval of the response item.

A more complex version of this type of interactive illustration is used by Levin, Anglin, and Carney (1987). They describe transformational pictures which aid in the recall of prose information. These pictures rely on the interactive relationship of items to be remembered. For example, a transformational picture intended to convey the information *Karl Jansky invented an antennafor improving the quality of telecommunications* recodes the name *Jansky* into the acoustically similar but more concrete form *jam,* and depicts children eating jam and talking on phones with antennas on top. As with paired associates, a simple interactive relationship is used in which key symbols are displayed in an active or spatial relationship. In this case children are depicted interacting with the symbols, *jam, antenna,* and *telephone.* Just as described with paired associates, the visual link in the illustration corresponds to the items to be remembered. However, in transformational pictures there are the initial acoustic link (to make the target information concrete) and a final step of decoding the symbols into the proper form expressing the intended information (a semantic link).

Illustrations have also been used in conjunction with the much-studied keyword method, developed by Atkinson (1975) and Raugh & Atkinson (1975) as a mnemonic device for foreign language vocabulary learning. The method utilizes two steps: first, an acoustically similar English word (keyword) is found for the foreign word, and second, the keyword is imagined in an interactive scene with the foreign word's meaning. For example,pato, a Spanish word meaning *duck,* sounds like the Englishpot. The learner might imagine a duck with a pot on its head. This mental image would assist the learner in remembering that *pato* means *duck.* Keyword researchers conducted a number of studies, including generating keyword sentences rather than mental images for young children (Pressley, Levin, & McCormick, 1980), experimenter-provided rather than subject-generated images (Pressley & Levin, 1978), and keyword effects on concrete and abstract words (Pressley, Levin & Miller, 198 1). Of particular interest is the work of Morrison and Levin (1987), who studied the effects of mnemonic strategies on the recall of mineral names and attributes by eighth grade students. The investigators taught subjects under three conditions to use a keyword strategy whereby the mineral name was associated with an acoustically similar keyword (i.e., *wolframite-wolf).* Likewise, attributes were characterized by symbols (i.e., *hard vs. soft* were represented by a man or a baby, respectively). In the illustration condition both keywords and attributes were depicted interactively; in the imagery condition subjects were instructed to experimenter-generated keywords and attribute symbols to create their own interactive image; in the unstructured condition subjects were instructed to generate their own keywords and images integrating those keywords with experimenter-generated attribute symbols. In the control condition subjects were encouraged to use their own strategies for remembering the mineral names and attributes. Results indicated that the illustration condition produced significantly

better retention of facts than the other conditions. Similar benefits from interactive illustrations have been demonstrated by Scruggs, Mastropieri, McLoone, Levin, & Morrison (1987). Like transformational pictures, these utilize an acoustic link, a visual link, and a semantic link for their mnemonic success.

What is it about these illustrations that accounts for their mnemonic effect? The answer lies in their ability to use interaction to evoke memorable associations. Cohen (1987), referring to keyword studies on second-language acquisition, has discussed this technique of recording material as the creation of a cognitive link, and the interactive pictures serve as cognitive mediators for reconnecting the link in the mind of the learner.

Another type of illustration that differs from the simple interactive pictures is the complex interactive illustration. These do not depict a simple active or spatial relationship between two objects (i.e., the wagon on the roof) that directly corresponds to the message (pair wagon and roof). Instead they depict symbols that represent ideas to be associated rather than objects. These symbols do not immediately convey the message, engaging the learner in visual problem-solving to discover the deeper meaning of the illustration.

Two studies have investigated the effects of such visuals on recognition memory. In one study Abed (1994) used visual puns, illustrations that associate two ideas or concepts to create a new meaning, often using a distinctive reference as a verbal pun. For instance, one visual pun contained the text Let my people go with the g in go formed by adjoining a hammer and sickle (see Figure 1). In this example the idea of freedom is associated with that of the former Soviet Union as an oppressive state. The interaction among the pictorial and textual units is immediately obvious, but comprehension of the visual pun takes place only after some reflection on the connection between the two ideas being symbolized. These visuals, then, engage the viewer in increased cognitive activity. They employ a visual link which evokes a deeper semantic link.

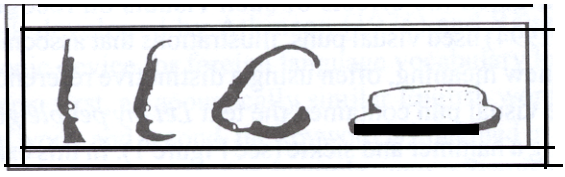
Figure 1.

Adult subjects in the study were shown either visual puns or non-interactive illustrations with equivalent messages. During presentation of the illustrations these were mixed with non-interativedistractor visuals. In Experiment 1 distractors were pictures of common objects (non-meaningful messages), while Experiment 2 used distractors with meaningful messages (i.e., a campaign poster). Both immediate and

delayed recognition tests demonstrated that the interactive visual puns facilitated recognition memory significantly more than non-interactive illustrations. The distractors, however, affected how long the memory trace remained. Long-term recognition remained high for visual puns when they were intermixed with non-meaningful distractors, but some decay over time was evident when meaningful distractors were used.

Abed (1992) also used complex interactive visuals, progressive visuals consisting of four, the first and last of which were easily recognizable items. The two intermediate panels represented the progressive change from the first item to the last; that is, they were identifiable amorphous shapes (see Figure 2). While encoding of the first and last panels could be both visual and verbal, encoding of the intermediate panels could be visual only due to the difficulty of naming these panels. Verbal encoding might occur at different levels as well. For example, the progression from the gun to the slice of bread could be verbally encoded simply by labelling the first and last panels, *gun* and *bread,* or by engaging in deeper cognitive analysis to comprehend the visual as a representation ofmilitary vs. humanitarian aid. As with visual puns, a visual link evokes a deeper semantic link.

Figure 2:



In this investigation subjects (college students) viewed one of three conditions: two interactive conditions under which they saw progressive illustrations with all four panels or only three panels (Panels 1,2, and 4), and one non-interactive (control) condition under which they saw only the first and last panels. Subjects were tested for recognition of the first and last panels only. Both interactive conditions yielded significantly higher scores than the non-interactive condition on a delayed test. No significant difference was found between the conditions for immediate testing.

The key to the success of complex interactive illustrations is derived from the fact that they do not expose their messages completely through a visual link, but instead require the learner to take another step by making a semantic link to understand the message behind the association of the two ideas. This concept can best be explained through the theory presented by Lockhart & Craik (1990). They differentiate between depth of processing, a reference to qualitatively different levels of analysis (e.g., sensory, semantic), and elaboration, or the richness of the processing within a given level. More extensive elaboration, within a level should lead to a stronger memory trace. This theory has generated a number of studies in diverse fields, but only those mentioned above have dealt with complex interactive illustrations, a relatively new and little-explored area of illustration research.

With regard to complex interactive illustrations, they demand processing first at the sensory level (visual) and then at the semantic level, with elaboration being

extensive on both levels. That is, the viewer first process the interaction between the pictorial and/or textual features, followed by elaboration on the semantic level involving the relationship between the symbols, how these symbols relate to viewer's past experience and general world knowledge, etc. The elaboration required to perceive the intended message will serve to facilitate the retention of that message. It is possible, though, that the visual link without the underlying association of concepts is enough to ensure benefits for retention?

The present study uses progressive illustrations to test their potential as facilitators in the retention of factual information, namely foreign language vocabulary. Foreign language words are visually linked with pictures of referents in a progressive format. The message to the viewer, therefore, is similar to that of the paired associates research discussed above: associate the two items. Understanding the message does not require the intense cognitive activity of either the visual puns or the progressive illustrations used in previous studies. However, it is possible that progressive illustrations will still be effective due to their visual link. Several studies have noted that subjects will use spontaneous, self-generated elaboration strategies (Belleza, 198 1; Hall, Wilson, & Patterson, 198 1; Ott, Butler, Blake, & Ball, 1973), and the visual link of progression may encourage this type of elaboration, which in turn will strengthen the memory trace. Given that progressive illustrations have in the past facilitated memory, the present study seeks to answer the following research question: will interactive progressive illustration facilitate foreign language vocabulary acquisition among adults? This study will explore the following hypothesis:

Interactive progressive illustration will facilitate recall of foreign vocabulary items to a greater degree than noninteractive paired associates (word-word and word-picture) due to the elaboration produced by the progression.

Methodology:

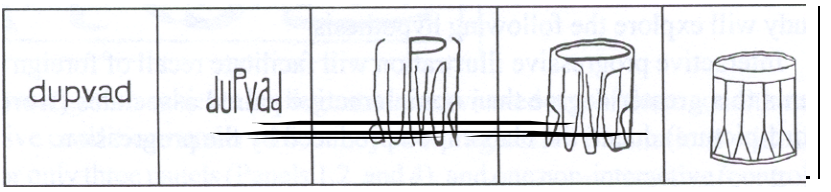
Subjects. Adults subjects were chosen to be consistent with the age range of participants in previous complex interactive illustration studies. Sixty adults were randomly assigned to one of three treatment groups. In the first group (identified hereafter as PROG) subjects viewed progressive illustrations in which a written foreign word progressively changed to a picture of its meaning. In the second group (WP) subjects saw the written foreign word paired with a picture of that word. Finally, the last group (WW) saw the written foreign word and its written English equivalent. Subjects were presented with visual stimuli and tested for recall on an individual basis.

Materials. Because adults subjects were likely to have had some exposure to a variety of foreign languages even if they had no formal training in a specific language, nonsense words were considered a practical alternative to choosing a foreign language. Accordingly, 50 words were created following the pattern CVCCVC, and these words were paired with meanings. Although research indicates a pronounced advantage to using pictures as stimulus items rather than response items (Paivio, 1971, p. 255; Postman, 1978), it was decided to use the foreign

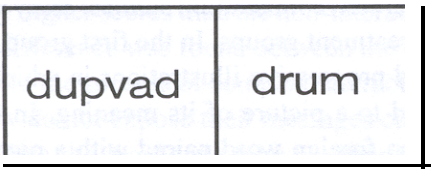
word as stimulus and the picture as response, thereby leading from the unfamiliar to the familiar, or from problem to solution as is typical in a learning environment. This strategy offers a discovery approach that encourages the learner to find out more about the foreign word. Progressive illustrations and other complex illustrations rely on the curiosity factor that stimulates the learner to link the unknown to the known. Progressive illustrations (11" x 14") were drawn depicting a written foreign word in the first panel, followed by three panels of progressive change, and ending with a picture. These 50 stimuli were tested using three criteria: smoothness of progression/lack of "jump cuts", ease of picture identification, and ease of pronunciation of foreign words. Of the original 50,23 were chosen for use in the study (see word list in Appendix A) as well as two additional items to be used as examples. For the WP group, the first and last panels of each stimulus item were used. For the WW group, the English equivalent was printed on an 11" x 14" panel and paired with the first panel. Legibility factors such as size, typeface, and spacingwere considered in printing all text items. The foreign word panel was used for testing. Samples of progressive stimulus items are shown in Figure 3.

Figure 3: Samples of Stimulus

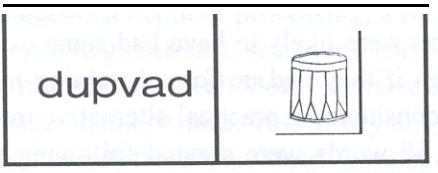
Example of Progression Stimuli



Example of Word-word Stimuli



Example of Word-Picture Stimuli



Procedure. Prior to the experiment, a random order was determined both for presentation and for testing of each subject. Thus subjects saw a different order of stimuli for presentation and for testing, and a different random order was used for each subject. Each subject saw 23 stimuli appropriate to the treatment condition.

Subjects were tested individually. Prior to the presentation phase, subjects from the PROG group were shown two examples of progression. The investigator explained how the word changes to the picture, and that the two are equivalent. Subjects were told that they must try to remember the foreign word and its translation because they would be asked to recall them later. Presentation of the stimuli then proceeded, with the investigator showing one stimulus item at a time on an easel. Subjects determined the length of viewing time, which ranged from 15 to 27 seconds. When all 23 stimuli were seen, subjects were asked to count backwards from ten. Again they were told that they would see a foreign word and needed to provide its meaning. Testing then proceeded, with presentation pace determined again by the subject. Subjects verbally gave their responses, and these were recorded by the investigator. One point was awarded for each correct response, with a possible maximum score of 23 points. Responses were judged to be correct if they labelled the picture with an appropriate name. For instance, either *bucket* or *pail* was an acceptable response for *sunmig.* The procedure for the other two treatment groups was the same, though the examples and testing stimuli given represented the appropriate condition (word and picture for the WP group, and foreign and English word for the WW group).

Results. The data were analysed using a single factor ANOVA, the results of which indicated a significant difference between means [$F(2, 57)) = 29.437$, $p < .0001$]. Using Tukey's HSD statistic for multiple comparison of means, a critical value of 2.127 was determined at the 0.1 level of significance. The test revealed a significant difference between the progression and word-picture treatment groups (mean difference = 4.6) as well as between the progression and word-word treatment groups (mean difference = 5.8). Means and standard deviations are shown in Table 1.

Table 1: Means and Standard Deviations For Recall Test

	Means	**SD**	**N**
PROG	15.1	2.673	20
WP	10.5	2.800	20
w w	9.3	2.029	20

Discussion. Progressive illustrations proved to be superior to the other two conditions in enhancing memory under the present circumstances. This fits in with past research given that interactive illustrations have a history of superiority over non-interactive illustrations. Interactive pictures as well as interactive mental images rely on a visual link (whether real or imaged) which is reinforced by another link, be it syntactic, semantic, acoustic, or some combination of these. In the present study the visual link is presented. What is occurring at the semantic level that

accounts for the results?

With complex interactive illustrations (visual puns and progressive illustrations such as gun changing to bread), the indirectness of the visual message stimulates greater cognitive activity in order to discern the deeper message. This, according to Lockhart & Craik (1990), leads to a stronger memory trace. It is presumed that this elaboration occurred with progressive illustrations. Viewers were likely to look for some deeper conceptual association that corresponds to the visual connection between guns and *bread* rather than looking at them as a simple word pair. When a foreign word progressively changes to a picture, what type of processing is occurring? First, the visual (sensory) processing is likely to be elaborate due to the time and attention given to viewing the progressive change itself. Perhaps the visual link is stimulating some intense cognitive activity at the semantic level as viewers try to make meaning out of it, this time in the form of word association (i.e., *valbil* means flower). Viewers might also be engaging in spontaneous elaboration activities, especially given the instructions to try and remember the word pairs. The visual link, though, seems to be the necessary factor since subjects in other treatment groups were also given instructions to try to remember the pairs but did not score as well.

The present study suggests the possibility of using progressive illustrations to aid in foreign vocabulary acquisition, at least with concrete referents that are easily drawn. The advantage of progression lies in the ability to visually link the two items without having to contrive an interactive scene using a keyword. It should be cautioned, however, that progressive illustrations should be well designed to ensure quality (possibly by using computer software that can easily generate progressive illustrations). Future studies should explore a number of questions. First, the possibility of generalizing the results from nonsense words to actual foreign language learning should be explored as well as the viability of long-term retention. Questionnaires should be designed to compare subjects' elaboration strategies used with progressive illustrations and other treatment conditions in order to determine how it is that progression stimulates the viewer to retain information. It would also be interesting to use progressive illustrations in conjunction with keyword imaging instructions to see if the combination would produce better results than either method alone. Further, it would be interesting to see the impact of progressive illustrations on retention of factual information in children. Finally, an investigation of how viewers process complex interactive illustrations at the semantic level would shed some light on their success as memory enhancers

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Appendix A: Stimulus and Response Items

1. Dupvad - Drum
2. Fanpol - Television
3. Boktin - Fork
4. Sunmig - Bucket
5. Ribset - Truck
6. Potmer - Typewriter
7. Valbil - Flower
8. Mufpan - Pencil
9. Milper - Wrench
10. Hodbel - Hat
11. Dontel - Telephone
12. Radpik - Airplane
13. Tupsin - House
14. Pedlid - Glasses
15. Zimtuk - Racket
16. Lotkam - Axe
17. Tugpan - Broom
18. Wepgof - Shoe
19. Kuzpid - Ball
20. Fenmop -Bird
21. Pogmel - Camera
22. Nuztup - Hammer
23. Supkon - Fish

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