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ABSTRACT

Visual processing of televised information was compared among 85 Japanese and 111 American boys and girls at the kindergarten and 4th-grade levels. The literatures on cognition and learning indicate that language and child rearing factors are more conducive to the development of iconic processing skills in Japanese children than in American children, a phenomenon which increases with age. The reverse pattern is found for verbal processing skills. It was predicted that after viewing a television program without narration or dialogue, Japanese children's amount and concentration of visual attention and comprehension would be higher than that of American children, particularly at the 4th-grade level. Results confirmed the predictions for visual attention, suggesting that different television processing strategies were employed. Contrary to the predictions, American children scored higher than Japanese children on the comprehension test, perhaps because of the cultural differences in expectations about the testing procedure. The results are discussed in the context of processing differences. Alternative explanations for the findings are explored, and directions for future research are suggested. Appended are seven pages of references, seven tables and two figures. (Author/RH)

Visual Processing of Televised Information by Japanese and American Children

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Abstract

Visual processing of televised information was compared for 85 Japanese and 111 American boys and girls at the kindergarten and fourth-grade levels. The cognitive and learning literatures indicate that language and child-rearing factors are more conducive to the development of iconic processing skills in Japanese children than in American children, a phenomenon which increases with age, while the reverse pattern is found for verbal processing skills. It was predicted that in a television program without narration or dialogue, Japanese children's amount and concentration of visual attention and comprehension would be higher than that of American children, particularly at the fourth-grade level. The results confirmed the predictions for visual attention suggesting that different television processing strategies were employed. Contrary to the predictions, American children scored higher than Japanese children on the comprehension test, perhaps because of the cultural differences in expectations about the testing procedure. The results are discussed in the context of processing differences, and alternative explanations for the findings are discussed. Suggestions for future research are presented.

Visual Processing of Televised Information

by Japanese and American Children

Salomon (1985) states that in cross-cultural television research, merely examining the effects of television is inadequate. Rather, researchers must take into account the cultural context in which children view television, because cultural variables can influence how children process televised information and hence what they attend to and comprehend.

A number of studies, for example, have demonstrated cross-cultural influences on basic cognitive processes. In comparing Japanese and American populations, researchers have found that language processing and child-rearing factors lead to better development of iconic processing skills in Japanese children than in American children. Correspondingly, these factors are said to be more conducive to the development of verbal processing skills in American children than they are in Japanese children. If language and child-rearing factors lead to differential processing of visual and verbal learning and cognitive tasks by Japanese and American children, it is also likely that there are differences in processing the visual and auditory-verbal medium of television.

Processing differences might be exhibited in two ways: (a) Japanese children could utilize the visual component of television to process information to a greater degree than

American children, and/or, (b) American children could employ the auditory verbal component of television more than Japanese children in order to process the information. The present study was designed to examine the first of these two possible outcomes.

Language Differences

Unlike the English writing system, which is essentially a phonetic language, Japanese is both phonetic and visually symbolic. Japanese orthography is unique in that it employs three different writing systems, mostly in combination: hiragana, katakana, and kanji. Hiragana and katakana are phonetic symbols, the former used for some nouns, verbs, and particles as well as adjectival endings, adverbs, and verb tense, while the latter are used generally for foreign loan words (Stevenson, Lee, Stigler, Kitamura, Kimura, & Kato, 1986). Kanji are logographic or ideographic symbols adopted from Chinese.

In Japanese, a single word or morpheme can be represented by different written characters which will vary the meaning, while different words or morphemes with various meanings can share one the same written character. How the word is written or pronounced depends upon the context in which it is used.

Stevenson et al. (1986) note the challenge this distinction poses for young children or novices attempting to learn the Japanese language in addition to having to master three different writing systems: "there are single characters with multiple pronunciations and multiple characters with the same pronunciation. Both increase the difficulty of going from symbol to sound in reading _kanji_, and from sound to symbol in writing _kanji_" (p. 218).

Suzuki (1977) points out that in English, more information is conveyed by sound than in written form. The opposite is true in Japanese where more information is conveyed in its written form than in its spoken form. The reason that Japanese rely heavily on graphic rather than on phonetic differentiation is due to the extreme simplicity of the Japanese phonetic system. The language, Suzuki (1977) notes, has only five vowel sounds and consonant clusters are not permitted to stand at the beginning of syllables. Moreover, all syllables must end in a vowel. As a result, there are 102 syllables in Japanese as compared to nearly 3,500 in English. Thus, there are a large number of homophonous characters which must be differentiated visually.

To use Suzuki's (1977) example, the notions of "private" and "municipal" share the same phonetic representation, _shiritsu_, but are represented by different kanji characters. To distinguish between private and public schools, one cannot rely on the sound alone but rather must rely on the written form of the word or the context to insure the proper meaning. Indeed, Stevenson et al. (1986) note that "the meaning of a word usually can be directly discerned from seeing the characters that constitute it, even though deciding without instruction how the characters should be pronounced might be difficult" (p. 218). Research by Hatano, Kuhara, and Akiyama (1981) suggests that Japanese individuals develop a "mental lexicon of Kanji" stored in memory which can mediate ambiguous phonemes. (For more extensive discussions of the Japanese language, see Kuno, 1986, and Paradis, Hagiwara, & Hildebrandt, 1985).

Some researchers have suggested that the nature of the Japanese language can lead to greater development of iconic or visuo-spatial processing skills among Japanese individuals. Hatano (1978) cites research in which Japanese children who learned many kanji characters in kindergarten could read more characters at first grade than children who had little experience with reading kanji characters in kindergarten. By second grade, these differences in ability to read kanji disappeared. However, at the second-grade level, the early learners performed better on the Embedded Figures Test than did the other children. Hatano suggests that attention to shape through repeated exposure to kanji characters in the early years may facilitate iconic processing skills.

Cross-cultural evidence also reflects greater iconic processing skills among Japanese children than among children from other linguistic backgrounds. Stevenson, Stigler, Lee, Lucker, Kitamura, and Hsu (1985) found, for example, that

Japanese children scored significantly lower than both American and Taiwanese children at the fifth-grade level on tasks of verbal memory (they failed to answer questions of both central and incidental events) and scored lower at both the first- and fifth-grade levels on serial memory for words and numbers. However, the Japanese children also performed better on spatial relations tasks (the children had to draw or identify geometric shapes on the basis of verbal directions). The authors note that this latter performance might be related to the rate by which the children learned kanji characters. Similar results were found by Stevenson, Stigler, Lucker, Lee, Hsu, and Kitamura (1982). It is possible that the Japanese children internalized the visual representations more than the American children due to the better cultivation of iconic processing skills required to disambiguate the spoken word.

Child Rearing Factors

Child-care functions in Japan and the United States traditionally have been and continue to be undertaken by the mother. Thus, most cross-cultural investigations of American and Japanese parent-child interactions center on the mother-child relationship. It has been noted that Japanese mothers tend to employ and encourage more nonverbal forms of communication, emphasizing more physical contact and empathy than do American mothers; American mothers encourage more verbal responsiveness from their children and verbally communicate with them more than do Japanese mothers (Caudill, 1972; Caudill & Weinstein, 1969; Hess, Azuma, Kashiwagi, Dickson, Nagano, Holloway, Miyake, Price, Hatano, & McDevitt, 1986; Miyake, Campos, Kagan, & Bradshaw, 1986; Morikawa, Shand, & Kosawa, 1987; Shand & Kosawa, 1985). Such factors appear to lead to differential processing of visual and verbal information by Japanese and American children. For example, Kashiwagi, Azuma, and Miyake (1982) and Kashiwagi, Azuma, Miyake, Nagano, Hess, and Holloway (1984) reported that in Japan, maternal variables (e.g., child-rearing attitudes, mother-child interaction patterns, communication styles) were more strongly associated with the development of nonverbal skills than with verbal skills in preschool-age children, while the reverse pattern was found in the United States. At age 11, however, Japanese maternal variables became more closely associated with the development of verbal skills. Nonetheless, Japanese children's form recognition reconstruction skills at ages 4 to 6 were highly correlated with their IQ and school achievement scores at age 11 and were more highly correlated with nonverbal measures on the WISC-R in preschool than with any other preschool cognitive measure. When compared to their American counterparts, Japanese preschool children were superior on nonverbal skills as measured by the Spatial-Perception Discrimination Test and the Block Design Test from the WISC-R.

It appears, then, that language and child-care variables are more conducive to the development of iconic processing skills in Japanese children while these same factors are more conducive to the development of verbal processing skills in American children. As Salomon (1979) proposed, these skills tend to generalize to other domains, as demonstrated in the cognitive and learning literatures.

Implications for Television Processing

The differences in American and Japanese children's processing of visual-spatial and verbal skills could have implications for their processing of television. Despite the emphasis on the visual component of television, television is both a visual and an auditory-verbal medium. The degree to which children process a given modality could depend upon the strength of the skills required to process that modality.

It is clear that when American and Japanese children watch television, they attend to that which is interesting or comprehensible and use both sensory modalities to determine comprehensibility (Akiyama & Kodaira, 1987; Lorch, Anderson, & Levin, 1979). Researchers have observed that American children monitor the soundtrack and listen for particular auditory formal features which, they have learned signal informative or comprehensible content (Huston & Wright, 1983, in press; Lorch et al., 1979). When interest is triggered by auditory cues, children visually attend to the screen. When the content is no longer comprehensible or interesting, children resume other activities and return to peripheral auditory monitoring.

Children can also semantically process the verbal auditory component of television (Beagles-Roos & Gat, 1983; Pezdek & Hartman, 1983). Moreover, the presence of linguistically appropriate speech can facilitate Japanese and American children's attention and comprehension (Akiyama & Kodaira, 1987; Rice, 1984; Rice & Haight, 1986; Rolandelli, Wright, & Huston, 1985) while incomprehensible speech can reduce attention and comprehension (Akiyama & Kodaira, 1987; Anderson, Lorch, Field, & Sanders, 1981).

However, if Japanese language and child-care factors are more conducive to the development of iconic processing skills, it could be that Japanese children employ the visual component of television for processing information to a greater degree than American children. American children, for whom language and child-rearing factors are more related to verbal processing skills, could be more likely than Japanese children to rely on the verbal features of dialogue and narration for program comprehension. In the absence of speech, American children's attention and comprehension might be reduced because they would have no semantic cues with which to process important content. Moreover, only nonverbal auditory features (e.g., music, auditory special effects) could be used to determine when to look. Conversely, because of their greater use of visual processing, Japanese children should be less handicapped by the absence of auditory-verbal features. Thus it was hypothesized that in a program without speech Japanese children's amount and concentration of visual attention should be greater than American children's.

Because cultural differences in processing develop progressively, age should interact with culture to determine both processing and performance. Iconic processing skills should develop with age for the Japanese children to a greater extent than they would among American children. Therefore it was predicted that nationality would interact with age to influence visual attention and recall. The expected superiority of Japanese children in processing a nonverbal program should be greater for older children than for younger children.

Finally, it was hypothesized that the Japanese children's comprehension would be greater than that of the American children particularly at older age levels, both for concrete information presented visually and for information which could be inferred but was not explicitly shown. If the older Japanese children visually attend to a nonverbal program more than do American children, they should recall more events in the story and also infer more information, yielding a better understanding of the story plot.

Method

Subjects

Subjects were 85 Japanese and 111 American kindergarten and fourth-grade children. Table 1 shows the ages in months of the subjects. The American kindergarten group was 8 months older on average than the Japanese kindergarten group, while the Japanese fourth-graders were about 2 months older than the American fourth-graders.

Table 1 about here

The children were tested individually at their schools. The Japanese fourth-grade children attended a public elementary school in a city of approximately 400,000 people; the kindergarten children attended a private kindergarten in a city of approximately 120,000 people. Both cities were located in near Tokyo. The American data were collected at two public elementary schools in a Midwestern city of approximately 55,000 people, near a major metropolitan area.

Experimenters

Female undergraduate and graduate psychology students served as experimenters. The experimenters were native to the population of children they tested.

Apparatus

In each Japanese school, the children were tested in one of two rooms. The American children were tested in a mobile research unit. The mobile unit had been parked at the schools previously and was considered a part of the standard environment. In each case, a hidden camera and videocassette recorder were located in an adjacent room (experimenter area) behind glass (in one case through a disguised aperture) for recording of children's looking behavior while viewing the stimulus program.

In the treatment area were a chair and table upon which were placed Lego bricks and coloring material used as distractors. The chair was at a right angle to a color television monitor placed approximately one meter away. In the United States, the videocassette recorder for playback of the stimulus program was located in the experimenter area, while in Japan, it was located next to the monitor in the treatment area.

Stimulus Material

To control for the effects of language, a stimulus containing no speech was required. A 7-minute animated story from the American children's television program Pinwheel was selected. The European-made animation depicted a mole who tries to return a fallen star to the sky. It contained no narration or dialogue but did contain all other auditory features such as music, sound effects, and vocalizations. The stimulus was thus designed to be fully comprehensible without the use of language.

In addition to being language-free, the program needed to be cross-culturally appropriate. There is evidence that the structure of Western stories as described by Mandler and Johnson (1977) differs from that of Japanese stories (Matsuyama, 1983; Morikawa, 1986). It might be that these differences are reflected in the children's programming produced in Japan and the United States. However, the program used in the current study had been aired on both Japanese and American educational television stations and was judged by Japanese and American researchers to be culturally appropriate for both populations.

Comprehension Test

Eight cued recall and recognition test items were employed as the comprehension test measure. The items, originally designed to be used with kindergarten and second-grade children, were adapted from a study by Rolandelli, Wright, and Huston (1985) in which the same program stimulus was used. The items were translated from English into Japanese for use with the Japanese sample. Care was taken that the questions were appropriate for each national group and that no cultural bias was introduced by translation. Four questions measured recall of content that was concretely presented in the visual modality (concrete comprehension) and four items measured content which could be inferred from the visual modality but was not explicitly shown (inferential comprehension). Each item was worth two points if answered correctly. If the child failed to produce a correct answer during cued-recall, a multiple-choice recognition item was administered and was worth one point if answered correctly. Each multiple-choice item contained two wrong choices, one taken from another segment of the story and the other a stereotypic alternative (cf. Collins, 1982). A maximum of 8 points was possible for each of the two content subtests (concrete comprehension and inferential comprehension). A maximum of 16 points was possible for the total comprehension score.

Procedure

The procedure was identical in both countries. Each child was escorted to the treatment room by the experimenter and seated in the chair at the table. The experimenter then explained to the child that he or she could play with the Lego bricks and coloring materials, or look at the cartoon on the television. The experimenter also emphasized that the child did not have to look at the television unless he or she wanted to. The child was asked to remain seated. The experimenter exited to the experimenter area. While the child viewed the program, his or her visual attention (looking or not looking at the monitor) was recorded on videotape. After the child had viewed the stimulus, the experimenter returned to the treatment area and administered the comprehension test. Each item was read aloud to the child in the child's native language. If the child did not provide the correct answer to the recall portion of the item, the recognition form was administered, with order of the multiple-choice answers counterbalanced across subjects. Upon completion of the comprehension test, the experimenter escorted the child back to her or his classroom.

Results

Descriptive analyses revealed that the data were not normally distributed. Therefore, a square root transformation was performed. A constant of 1 was added to the raw means to eliminate zero scores in the raw data which otherwise could not be transformed. The transformed means and standard deviations are found in Table 2. For easier interpretation table 2 also displays the reconverted raw score equivalents which were calculated by squaring the square root mean and subtracting the constant 1. However, only the transformed data were used in the analyses.

Nationality(2) X grade(2) X sex(2) analyses of variance (ANOVA) were conducted. The dependent measures were mean duration <u>of looking</u> (mean percent of time looking), mean duration <u>per look</u> (level of sustained viewing measured in 100ths of a minute), concrete comprehension, inferential comprehension, and total comprehension (the sum of the concrete and inferential comprehension scores). Multiple regression analyses were also conducted to avoid any possible effects of the unequal cell sizes. No significant effects of sex were predicted or found.

Nationality Effects

The Japanese children looked at the screen more than the American children, $F(1,193)=30.51$, $p<.001$, and displayed longer durations per look, $F(1,193)=7.56$, $p<.01$, though this finding is qualified by the interaction described below. (See Figure 1 for pattern of means).

Table 2 and Figure 1 about here

Multiple regression analyses confirmed the ANOVA results for the visual attention measures. As seen in Table 3, nationality was a significant predictor of duration of looking and duration per look, with Japanese children looking more on both measures than the American children.

Table 3 about here

However, the American children outperformed the Japanese children on total comprehension, $F(1,194)=22.22$, $p<.001$, concrete comprehension, $F(1,194)=7.79$, $p<.01$, and inferential comprehension, $F(1,194)=33.20$, $p<.001$. (See Figure 1).

The multiple regression analyses indicated that nationality was a significant predictor of total comprehension, and both concrete and inferential comprehension, with the American children scoring higher than the Japanese children (see Table 3).

Grade Effects

No main effect of grade level was found for the visual attention measures in the ANOVA nor was grade a significant predictor of visual attention in the multiple regression analyses. (See Table 2 and Figure 1).

The fourth-grade children scored higher than the kindergarten children on total comprehension, $F(1,194)=28.84$, $p<.001$, concrete comprehension, $F(1,194)=11.73$, $p<.001$, and inferential comprehension, $F(1,194)=40.84$, $p<.001$. (See Table 2 and Figure 1.)

Grade was a significant predictor of total comprehension, concrete comprehension, and inferential comprehension, with fourth-graders scoring higher than kindergarten children (see Table 3).

Interactions

Significant nationality X grade interactions were found for duration of looking, $F(1,193)=4.01$, $p<.05$, and mean duration per look, $F(1,193)=4.07$, $p<.05$. Subsequent ANOVA revealed that the Japanese fourth-grade children looked more than the Japanese kindergarten children ($F(1,82)=5.71$, $p<.02$) while no significant difference was found between the American kindergarten and fourth-graders on either visual attention measure. (See Table 2 and Figure 1).

Post-hoc Analyses

Recall that the American kindergarten group was nearly eight months older than the Japanese kindergarten group. To test if performances, particularly comprehension, were affected by this discrepancy, two sets of analyses were conducted: (a) an analysis of covariance (ANCOVA) within each grade level, with age in months as the covariate; and (b) ANOVA and multiple regression analyses using age equivalent subsamples at each grade level.

Covariation of age. At the kindergarten level, with age in months covaried, the Japanese children looked significantly more, ($F(1,87)=95.71$, $p<.001$, and displayed longer durations per look, $F(1,87)=87.31$, $p<.001$, than the American children. The American kindergarten children displayed significantly higher scores on total comprehension, $F(1,87)=110.67$, $p<.001$; concrete comprehension, $F(1,87)=110.67$, $p<.001$; and inferential comprehension, $F(1,87)=98.58$, $p<.001$.

At the fourth-grade level, the Japanese children again displayed a greater duration of looking, $F(1,98)=128.25$, $p<.001$, and displayed significantly longer durations per look, $F(1,98)=111.56$, $p<.001$, than their American counterparts. By contrast the American fourth-graders exhibited significantly higher comprehension scores in total comprehension, $F(1,98)=108.11$, $p<.001$; concrete comprehension, $F(1,98)=108.11$, $p<.001$; and inferential comprehension, $F(1,98)=104.57$, $p<.001$. The ANCOVA results indicate that the effects of nation yielded by the ANOVA and multiple regression analyses were not a function of the age discrepancy within grade level between the Japanese and American samples.

ANOVA and regression analyses. A second set of analyses, consisting of ANOVA and multiple regressions, was conducted to examine effects of age. In the original analyses, the Japanese kindergarten children's ages ranged from 59 to 69 months while the ages for the American kindergarten group ranged from 62 to 79 months. The Japanese fourth-grade children's ages ranged from 119 to 130 months while the American fourth-grade children's ages ranged from 105 to 134 months. The overlapping age range at the kindergarten level for both national groups was 62 to 69 months while at the fourth-grade level, the range was from 119 to 130 months. To establish more age-equivalent samples within each grade level, particularly at the kindergarten level, an age-matched subsample was analyzed using only those subjects whose ages fell within the overlapping age range. In the subsample, there were 71 Japanese and 61 American children. Table 4 summarizes the age distribution of the subsample.

Table 4 about here

The Japanese children looked more than the American children, $F(1,129)=19.04$, $p<.001$, and used longer looks, $F(1,129)=7.69$, $p<.01$. (See Table 5 and Figure 2 for means and pattern of means), though this effect is qualified by the nationality X grade interaction discussed below.

Table 5 and Figure 2 about here

Nationality was a significant predictor of mean duration of looking and mean duration per look, with the Japanese children looking more and for longer periods of time (see Table 6).

Table 6 about here

The American children scored higher than the Japanese children on total comprehension, $F(1,131)=14.39$, $p<.001$, concrete comprehension, $F(1,131)=5.40$, $p<.03$, and inferential comprehension, $F(1,131)=20.67$, $p<.001$. (See Figure 2.)

Nationality was a significant predictor of total comprehension, concrete comprehension, and inferential comprehension, with the American children scoring higher than the Japanese children (see Table 6).

No significant main effects of grade were found for the visual attention measures nor was grade a significant predictor of visual attention in the multiple regression analyses. The fourth-grade children performed better than the kindergarten children on total comprehension, $F(1,131)=19.06$, $p<.001$, concrete comprehension, $F(1,131)=10.40$, $p<.003$, and inferential comprehension, $F(1,131)=21.68$, $p<.001$. Grade was a significant predictor of total comprehension, concrete comprehension, and inferential comprehension (see Table 6).

Finally, a significant nationality X grade interaction for duration of looking, $F(1,129)=8.72$, $p<.005$, revealed that no national differences appeared until the fourth-grade. The Japanese fourth-graders' mean duration of looking was higher than for the Japanese kindergarten children ($F(1,68)=6.27$, $p<.02$) while the American children's visual attention did not significantly differ between grade. Contrary to the original analyses, no significant interaction was found for mean duration per look.

With the exception of the nonsignificant nationality X grade interaction for mean duration per look, the post-hoc results are consistent with the initial analyses and indicate that the discrepancy in age occurring within grade level did not affect the overall findings.

Attention and Comprehension

Pearson correlation coefficients were used to assess the relationship between the visual attention and comprehension measures. To control for effects of age differences within each grade level, the age-matched subsample was used in this analysis.

As demonstrated in Table 7, both forms of visual attention generally benefitted comprehension for both national groups. However, for the American children, the amount of viewing, as measured by mean duration of looking, was more strongly related to comprehension than to concentration, as measured by mean duration per look, especially at the fourth-grade level. For the Japanese children, both amount of viewing and concentration were beneficial to comprehension, especially at the fourth-grade level.

Table 7 about here

Comprehension for the older children also benefitted more from amount of viewing than it did for the younger children while the concentration-comprehension correlations were comparable for both grade levels.

Comprehension for the females, especially in Japan, benefitted more from concentration than it did for males while comprehension for both females and males generally benefitted equally from amount of viewing.

Finally, while both measures of looking were related to comprehension, in most cases amount of viewing and concentration were more strongly related to concrete comprehension than to inferential comprehension even though the overall comprehension patterns were similar for both types of comprehension (see Figure 1).

Discussion

The results of the current study lend partial support for the hypotheses. It was predicted that because language and child-rearing factors are more conducive to the use of iconic processing skills by Japanese children than American children, the former would look and concentrate more than the latter when viewing television, particularly at the fourth-grade level. This prediction was confirmed, consistent with the cognitive and learning literatures cited above. The nationality and grade differences indicated that Japanese children employed a more visually-oriented television processing strategy in order to understand the program content compared to their American counterparts. This was particularly evident in the Japanese children's longer mean duration per look, a measure which is considered to reflect depth of processing while viewing television (Anderson, Choi, & Lorch, 1987; Wright, Huston, Ross, Calvert, Rolandelli, Weeks, Raeissi, & Potts, 1984).

As predicted, the American children were less reliant on the visual modality for processing televised information. While it cannot be determined from the current data that American children process the auditory-verbal component of television better than Japanese children, it does appear that the American fourth-graders employed a more selective viewing strategy in that they recalled more information from less total looking and shorter looks. The relatively weak correlation between comprehension and mean duration per look is consistent with a selective viewing strategy; the American children did not need to look very often or for very long but only when they needed to in order to process the program content. It may well be [illegible] that the American youngsters were using the music, sound effects, and nonverbal vocalizations in the soundtrack to tell them when to look--an auditory monitoring strategy that has been noted in previous studies (Huston & Wright, 1983; in press; Lorch et al., 1979; Rolandelli et al., 1985).

Why the American children's performance on the comprehension test was better than the Japanese children's test performance is not clear. Japanese children tend to be more inhibited in novel situations (Caudill & Weinstein, 1969; Miyake et al., 1986) and engage in more group than individual activities (Inagaki, 1986; Stigler & Perry, 1987) compared to American children. In the current study, this difference might have interfered with television processing and comprehension due to anxiety. However, if anxiety were a factor it might have led to more off-task glancing (Nottelman & Hill, 1977) which is not consistent with the looking data. Rather, the Japanese children demonstrated higher levels of concentration and a relatively strong correlation between mean duration per look and comprehension. The Japanese children may have looked more because they expected and perceived the task as a learning occasion, yet were less experienced in situations requiring individual report than the American children. Within the Japanese sample, longer looks yielded better comprehension. For the Americans, it was not length but the apparent selectivity of looks that facilitate comprehension.

It is possible that the comprehension test might have been too verbal a measure. Since American children perform better on verbal tasks compared to Japanese children who perform better on visuo-spatial tasks, the test used in the current study--a highly verbal measure--might have been less sensitive to the Japanese children's understanding of the story. It might have been more difficult for the Japanese children to report visually presented information verbally (cf. Salomon, 1979). Perhaps a combination of comprehension testing procedures, such as verbal measures, picture seriation, or reconstruction techniques, would have maximized chances for expression of both the American and

Japanese children's understanding of program content.

Such cultural differences in task meaning and performance factors have been frequently noted. For example, there is evidence that Japanese children tend to be more "on-task" or attentive and less distracted than are American children (Stevenson, Stigler, Lee, Kitamura, Kimura, & Kato, 1986; Stigler & Perry, 1987) and become more conforming with age (Kashiwagi, 1986). Kashiwagi (1986) and Lewis (1986) have also noted that conformity and on-task behavior might be highly correlated for Japanese children. The older Japanese children might have looked more and processed more deeply, even without instructions to view all the time, due to the perceived demands of the experimental situation rather than to greater need for visual processing.

<u>Recommendations for Future Research</u>

Future research needs to compare children's processing of the auditory-verbal component of television in the two cultures. This comparison can be accomplished in two ways. First, to examine whether Japanese children would have more difficulty processing auditory-verbal information than American children, a "radio" condition could be employed. Such a condition would control for use of visual mediators for processing verbal material. Second, a television program employing both the visual and auditory-verbal component could be used. The investigator could assess comprehension of information presented only visually and only verbally. If, for example, Japanese children attended to and benefitted more from the visual modality than did American children, and if American children benefitted more from the verbal component than Japanese children, then it could be concluded that differential use of visual and verbal processing skills accounted for the present results. Developing a language equivalent test for the program stimuli is difficult. However, techniques exist which can minimize the difficulty of designing a cross-culturally appropriate verbal track (e.g., Triandis & Brislin, 1984). A measure of the children's visuo-spatial and verbal processing skills (e.g. Stevenson et al., 1985) should also be employed in order to accurately assess cognitive processing differences between the two national groups.

References

Akiyama, T. & Kodaira, S. I. (1987). Children and television: A study of new TV programs for children based on the pilot of an animated production. Tokyo: NHK Broadcasting Culture Research Institute.

Anderson, D. R., Choi, H. P., & Lorch, E. P. (1987). Attenional inertia reduces distractibility during young children's TV viewing. Child Development, 58, 798-806.

Anderson, D. R., Lorch, E. P., Field, D. E., & Sanders, J. (1981). The effect of TV program comprehensibility on preschool children's visual attention to television. Child Development, 52, 151-157.

Beagles-Roos, J. & Gat, I. (1983). Specific impact of radio and television on children's story comprehension. Journal of Educational Psychology, 75, 128-137.

Caudill, W. (1972). Tiny dramas: Vocal communication between mother and infant in Japanese and American families. In W. P. Lebra (Ed.), Transcultural research in mental health, Vol. II of mental health research in Asia and the Pacific (pp. 25-48). Honolulu: University of Hawaii Press.

Caudill, W. and Weinstein, H. (1969). Maternal care and infant behavior in Japan and America. Psychiatry, 32, 12-43.

Collins, W. A. (1982). Cognitive processing aspects of television viewing. In D. Pearl, L. Bouthilet, & J. Lazar

(Eds.), Television and behavior: Ten years of scientific progress and implications for the eighties (Vol. 2, pp. 9-23). Washington, D. C.: U. S. Government Printing Office.

Hatano, G. (1978). Broadcasting and learning. In Hoso Bunka Foundation, Symposium on the cultural role of broadcasting, October 3-5, 1978 Tokyo (summary report). Tokyo: Hoso Bunka Foundation.

Hatano, G., Kuhara, K., & Akiyama, M. (1981). Kanji help readers of Japanese infer the meaning of unfamiliar words. The Quarterly Newsletter of the Laboratory of Comparative Human Cognition, 3, 30-33.

Hess, R. D., Azuma, H., Kashiwagi, K., Dickson, W. P., Nagano, S., Holloway, S., Miyake, K., Price, G., Hatano, G., & McDevitt, T. (1986). Family influences on school readiness and achievement in Japan and the United States: An overview of a longitudinal study. In H. Stevenson, H. Azuma, & K. Hakuta (Eds.), Child development and education in Japan (pp. 147-166). New York: W. H. Freeman and Company.

Huston, A. C. & Wright, J. C. (1983). Children's processing of television: The informative function of formal features. In J. Bryant & D. R. Anderson (Eds.), Children's understanding of television: Research on attention and comprehension (pp. 35-68). New York: Academic Press.

Huston, A. C. & Wright, J. C. (in press). The forms of television and the child viewer. In G. A. Comstock (Ed.), Public communication and behavior. Vol 2. New York: Academic Press.

Inagaki, T. (1986). School education: Its history and contemporary status. In H. Stevenson, H. Azuma, & K. Hakuta (Eds.), Child development and education in Japan (pp. 75-92). New York: W. H. Freeman and Company.

Kashiwagi, K. (1986). Peresonality development of adolescents. In H. Stevenson, H. Azuma, & K. Hakuta (Eds.), Child development and education in Japan (pp. 167-185). New York: W. H. Freeman and Company.

Kashiwagi, K., Azuma, H., & Miyake, K. (1982). Early maternal influences upon later cognitive development among Japanese children: A follow-up study. Japanese Psychological Research, 24, 90-100.

Kashiwagi, K., Azuma, H., Miyake, K., Nagano, S., Hess, R. D., & Holloway, S. D. (1984). Japan-US comparative study on early maternal influences upon cognitive development: A follow-up study. Japanese Psychological Research, 26, 82-92.

Kuno, S. (1986). The Japanese language. In H. Stevenson, H. Azuma, & K. Hakuta (Eds.), Child development and education in Japan (pp. 93-119). New York: W. H. Freeman and Company.

Lewis, C. (1986). Children's social development in Japan: Research directions. In H. Stevenson, H. Azuma, & K. Hakuta (Eds.), Child development and education in Japan (pp. 186-200). New York: W. H. Freeman and Company.

Lorch, E. P., Anderson, D. R., & Levin, S. R. (1979). The relationship of visual attention to children's comprehension of television. Child Development, 50, 722-727.

Mandler, J. M. & Johnson, N. S. (1977). Remembrance of things parsed: Story structure and recall. Cognitive Psychology, 9, 111-151.

Matsuyama, U. K. (1983). Can story grammar speak Japanese? The Reading Teacher, 36, 666-669.

Miyake, K., Campos, J. J., Kagan, J., & Bradshaw, D. L. (1986). Issues in socioemotional development. In H. Stevenson, H. Azuma, & K. Hakuta (Eds.), Child development and education in Japan (pp. 239-261). New York: W. H. Freeman and Company.

Morikawa, H. (1986). Social and cultural aspects of language acquisition: Examples from Japanese language. Working Papers in Language Development, 1, 59-76. Lawrence, KS: University of Kansas.

Morikawa, H., Shand, N., & Kosawa, Y. (1987). Maternal speech to prelingual infants in Japan and the United States: Relationships among functions, forms and referents. Working Papers in Language Development, 2(1), 24-51. Lawrence, KS:

University of Kansas.

Nottelmann, E. A. & Hill, K. T. (1977). Test anxiety and off-task behavior in evaluative situations. Child Development, 48, 225-231.

Paradis, M., Hagiwara, H., & Hildebrandt, N. (1985). Neurolinguistic aspects of the Japanese writing system. Orlando: Academic Press.

Pezdek, K, & Hartman, E. F. (1983). Children's television viewing: Attention and comprehension of auditory versus visual information. Child Development, 54, 1015-1023.

Rice, M. L. (1984). The words of children's television. Journal of Broadcasting, 28, 445-461.

Rice, M. L. & Haight, P. I. (1986). "Motherese" of Mr. Rogers: A description of the dialogue of educational television programs. Journal of Speech and Hearing and Hearing Disorders, 51, 282-287.

Rolandelli, D. R., Wright, J. C., & Huston, A. C. (1985, May). Children's auditory and visual processing of narrated and nonnarrated television programming. Paper presented at the annual meeting of the International Communication Association, Honolulu.

Salomon, G. (1979). Interaction of media, cognition, and learning. San Francisco: Jossey-Bass.

Salomon, G. (1985). The study of television in a cross-cultural context. Journal of Cross-Cultural Psychology, 16, 381-387.

Salomon, G. & Leigh, T. (1984). Predisposition about learning from print and television. Journal of Communication, 34(2), 119-135.

Shand, N. & Kosawa, Y. (1985). Culture transmission: Caudill's model and alternative hypotheses. American Anthropologist, 87, 862-871.

Stevenson, H. W., Lee, S., Stigler, J., Kitamura, S., Kimura, S., & Kato, T. (1986). Learning to read Japanese. In H. Stevenson, H. Azuma, & K. Hakuta (Eds.), Child development and education in Japan (pp. 217-235). New York: W. H. Freeman and Company.

Stevenson, H. W., Stigler, J. W., Lee, S., Kitamura, S., Kimura, S., & Kato, T. (1986). Achievement in mathematics. In H. Stevenson, H. Azuma, & K. Hakuta (Eds.), Child development and education in Japan (pp.201-216). New York: W. H. Freeman and Company.

Stevenson, H. W., Stigler, J. W., Lee, S., Lucker, G. W., Kitamura, S., & Hsu, C. (1985). Cognitive performance and academic achievement of Japanese, Chinese, and American children. Child Development, 56, 718-734.

Stevenson, H. W., Stigler, J. W., Lucker, G. W., Lee, S., Hsu, C., & Kitamura, S. (1982). Reading disabilities: The case of Chinese, Japanese, and English. Child Development, 53, 1164-1181.

Stigler, J. W. & Perry, M. (1987, March). Cross-cultural studies of mathematics teaching and learning: Recent findings and new directions. Paper presented at the NSF-NCTM Research Agenda Conference on Effective Mathematics Teaching, Columbia, Missouri.

Suzuki, T. (1977). Writing is not language, or is it? Journal of Pragmatics, 1, 407-420.

Triandis, H. C. & Brislin, R. W. (1984). Cross-cultural psychology. American Psychologist, 39, 1006-1016.

Wright, J. C., Huston, A. C., Ross, R. P., Calvert, S. L., Rolandelli, D., Weeks, L. A., Raeissi, P., & Potts, R. (1984). Pace and continuity of television programs: Effects on children's attention and comprehension. Developmental Psychology, 20, 653-666.

Table 1

Age on Months

	Mean	SD	N
	JAPAN (N=85)		
Kindergarten	63.0	3.0	38
Male	63.7	3.1	16
Female	62.3	2.9	22
Fourth-grade	123.5	3.6	47
Male	124.2	3.8	20
Female	122.8	3.4	27
	USA (N=111)		
	Mean	SD	N
Kindergarten	71.0	5.4	52
Male	71.4	6.4	21
Female	70.6	4.5	31
Fourth-grade	120.0	5.4	59
Male	121.4	5.6	32
Female	118.7	5.1	27

Table 2

Means and Standard Deviations[1]

JAPAN

Variable	Male M	Male n	Male SD	Male RCM[2]	Female M	Female n	Female SD	Female RCM
Kindergarten								
Dur. of Look.	1.27	16	.11	.63	1.27	22	.12	.61
Dur. Per Look	1.15	16	.10	.33	1.19	22	.24	.42
Total Comp.	1.73	16	.52	1.99	1.98	22	.55	2.92
Concrete Comp.	1.49	16	.42	1.22	1.55	22	.46	1.40
Infer. Comp.	1.34	16	.30	0.80	1.58	22	.40	1.49
Fourth-grade								
Dur. of Look.	1.31	18	.11	.72	1.35	27	.10	.82
Dur. Per Look	1.19	18	.16	.42	1.33	27	.37	.78
Total Comp.	2.53	20	.88	5.40	2.49	27	.59	5.20
Concrete Comp.	1.92	20	.67	2.69	1.88	27	.47	2.53
Infer. Comp.	1.94	20	.53	2.76	1.91	27	.41	2.65

(Table 2 continued)

USA

				Kindergarten				
Dur. of Look.	1.24	21	.12	.54	1.20	31	.12	.61
Dur. Per Look	1.14	21	.15	.30	1.16	31	.35	.35
Total Comp.	2.45	21	.51	5.00	2.45	31	.63	5.00
Concrete Comp.	1.85	21	.47	2.42	1.84	31	.49	2.39
Infer. Comp.	1.88	21	.32	2.53	1.89	31	.40	2.57
				Fourth-grade				
Dur. of Look.	1.21	32	.14	.46	1.20	27	.12	.44
Dur. Per Look	1.12	32	.22	.25	1.09	27	.12	.19
Total Comp.	2.93	31	.66	7.59	2.72	27	.69	6.40
Concrete Comp.	2.11	31	.51	3.45	1.90	27	.60	2.61
Infer. Comp	2.26	31	.48	4.11	2.18	27	.42	3.75

1 Square root transformation

2 RCM=Reconverted raw score equivalent mean

Table 3

Multiple Regressions

A. Mean Duration of Looking

R	R^2	F	p	Predictor*	Beta	t	p
.37	.14	10.35	.001	Nation.	-.37	-5.45	.001
				Grade	.07	1.08	.282
				Sex	-.01	-0.20	.845

B. Mean Duration Per Look

R	R^2	F	p	Predictor*	Beta	t	p
.20	.04	3.18	.03	Nation.	-.19	-2.72	.008
				Sex	.08	1.15	.251
				Grade	.04	0.52	.536

C. Total Comprehension

R	R^2	F	p	Predictor*	Beta	t	p
.46	.22	17.21	.001	Grade	.35	5.47	.001
				Nation.	.30	4.68	.001
				Sex	-.02	-0.23	.820

D. Concrete Comprehension

R	R^2	F	p	Predictor*	Beta	t	p
.31	.10	6.92	.001	Grade	.24	3.44	.001
				Nation.	.20	2.82	.006
				Sex	-.05	-0.75	.457

(Table 3 continued)

E. Inferential Comprehension

.53	.28	24.34	.001	Grade	.40	6.50	.001
				Nation.	.35	5.66	.001
				Sex	.02	0.31	.760

* Nation.: 1=Japan, 2=USA

Grade: 1=kindergarten, 2=fourth-grade

Sex: 1=male, 2=female

Table 4

Age in Months for Age-Matched Subsample

	Mean	SD	N
	JAPAN (N=71)		
Kindergarten	64.6	2.4	24
Male	65.1	2.1	12
Female	64.1	2.6	12
Fourth grade	123.5	3.6	47
Male	124.2	3.8	20
Female	122.8	3.4	27
	USA (N=61)		
	Mean	SD	N
Kindergarten	66.1	2.6	21
Male	65.8	2.9	9
Female	66.3	2.3	12
Fourth-grade	122.4	2.9	40
Male	123.2	3.0	23
Female	121.5	2.7	17

Table 5

Means and Standard Deviations

for Age-matched Subsample[1]

JAPAN

Variable	Male M	Male n	Male SD	Male RCM[2]	Female M	Female n	Female SD	Female RCM
Kindergarten								
Dur. of Look.	1.25	12	.12	.56	1.27	12	.11	.61
Dur. Per Look	1.14	12	.11	.30	1.16	12	.13	.35
Total Comp.	1.74	12	.53	2.10	2.08	12	.55	3.33
Concrete Comp.	1.50	12	.42	1.25	1.58	12	.54	1.50
Infer. Comp.	1.35	12	.33	0.82	1.64	12	.39	1.69
Fourth-grade								
Dur. of Look.	1.31	18	.11	.72	1.35	27	.10	.82
Dur. Per Look	1.19	18	.16	.42	1.33	27	.37	.77
Total Comp.	2 53	20	.88	5.40	2.49	27	.59	5.20
Concrete Comp.	1.92	20	.67	2.69	1.88	27	.47	2.53
Infer. Comp	1.94	20	.53	2.76	1.91	27	.41	2.65

(Table 5 continued)

USA

Kindergarten

Dur. of Look.	1.28	9	.10	.64	1.23	12	.11	.51
Dur. Per Look	1.17	9	.16	.37	1.11	12	.11	.23
Total Comp.	2.65	9	.49	[illegible].02	2.30	12	.70	4.29
Concrete Comp.	1.90	9	.42	2.61	1.76	12	.52	2.10
Infer. Comp.	2.09	9	.31	3.37	1.80	12	.45	2.24

Fourth-grade

Dur. of Look.	1.21	23	.14	.46	1.18	17	.11	.39
Dur. Per Look	1.13	23	.25	.28	1.08	17	.12	.17
Total Comp.	2.94	23	.63	7.64	2.84	17	.67	7.07
Concrete Comp.	2.13	23	.45	3.54	2.00	17	.60	3.00
Infer. Comp.	2.25	23	.51	4.06	2.22	17	.43	3.93

1 Square root transformation

2 RCM=Reconverted raw score equivalent mean

Table 6

Multiple Regressions

for Age-matched Subsample

A. Mean Duration of Looking

R	R^2	F	p	Predictor*	Beta	t	p
.36	.13	6.27	.001	Nation.	-.35	-4.24	.001
				Grade	.51	0.61	.541
				Sex	.25	0.31	.758

B. Mean Duration Per Look

R	R^2	F	p	Predictor*	Beta	t	p
.24	.06	3.37	.03	Nation.	-.24	-2.73	.008
				Grade	.11	1.27	.206
				Sex	.07	0.79	.430

C. Total Comprehension

R	R^2	F	p	Predictor*	Beta	t	p
.47	.22	11.78	.001	Grade	.36	4.51	.001
				Nation.	.30	3.78	.001
				Sex	-.03	-0.38	.702

D. Concrete Comprehension

R	R^2	F	p	Predictor*	Beta	t	p
.35	.12	5.81	.001	Grade	.28	3.31	.002
				Nation.	.20	2.38	.019
				Sex	-.05	-0.63	.529

(Table 6 continued)

E. Inferential Comprehension

.50	.25	14.19	.001	Grade	.37	4.75	.001
				Nation.	.34	4.42	.001
				Sex	-.02	-0.20	.846

* Nation.: 1=Japan, 2=USA

Grade: 1=kindergarten, 2=fourth-grade

Sex: 1=male, 2=female

Table 7

Pearson Correlation Coefficients for

Attention and Comprehension

for the Age-matched Subsample

	Comprehension		
	Total	Concrete	Inferential
NATIONALITY			
Japan (N=69)			
Mean Dur. of Looking	.53***	.45***	.50***
Mean Dur. per Look	.45***	.44***	.39***
USA (N=61)			
Mean Dur. of Looking	.51***	.54***	.39***
Mean Dur. per Look	.29*	.31**	.25*
GRADE			
Kindergarten (N=45)			
Mean Dur. of Looking	.25	.28*	.16
Mean Dur. per Look	.24	.26*	.19
Fourth-grade (N=85)			
Mean Dur. of Looking	.41***	.42***	.32**
Mean Dur. per look	.29**	.32***	.20*

***p<.001 **p<.01 **p<.05

(Table 7 Continued)

	Comprehension		
	Total	Concrete	Inferential
SEX			
Males (N=62)			
Mean Dur. of Looking	.46**	.37***	.30**
Mean Dur. per Look	.16	.16	.15
Females (N=68)			
Mean Dur. of looking	.37***	.39***	.25*
Mean Dur. per Look	.41***	.44***	.29**
NATIONALITY X GRADE			
Japanese Kindergarten (N=24)			
Mean Dur. of Looking	.24	.21	.20
Mean Dur. per look	.30	.28	.23
Japanese Fourth-grade (N=45)			
Mean Dur. of Looking	.57***	.48***	.54***
Mean Dur. per Look	.44***	.44***	.36**
USA Kindergarten (N=21)			
Mean Dur. of Looking	.34	.42*	.21
Mean Dur. per Look	.29	.29	.25

***p<.001 **p<.01 *p<.05

(Table 7 continued)

	Total	Concrete	Inferential
USA Fourth-grade (N=40)			
Mean Dur. of Looking	.74***	.70***	.60***
Mean Dur. per Look	.36*	.36*	.27*

	Comprehension		
	Total	Concrete	Inferential
NATIONALITY X SEX			
Japanese Males (N=30)			
Mean Dur. of Looking	.40*	.39*	.35*
Mean Dur. per Look	.21	.18	.19
Japanese Females (N=39)			
Mean Dur. of Looking	.67***	.51***	.64***
Mean Dur. per Look	.65***	.60***	.52***
USA Males (N=32)			
Mean Dur. of Looking	.62***	.58***	.54***
Mean Dur. per Look	.25	.22	.23
USA Females (N=29)			
Mean Dur. of Looking	.38*	.52**	.19
Mean Dur. per Look	.40*	.49**	.26

*** p<.001 **p<.01 *p<.05

Figure Captions

Figure 1. Means and pattern of means of the visual attention and comprehension measures.

Figure 2. Age-matched subsample means and pattern of means for the visual attention and comprehension measures.

FIG. 1-A Mean Duration of Looking (Reconverted Raw Score Equivalent)

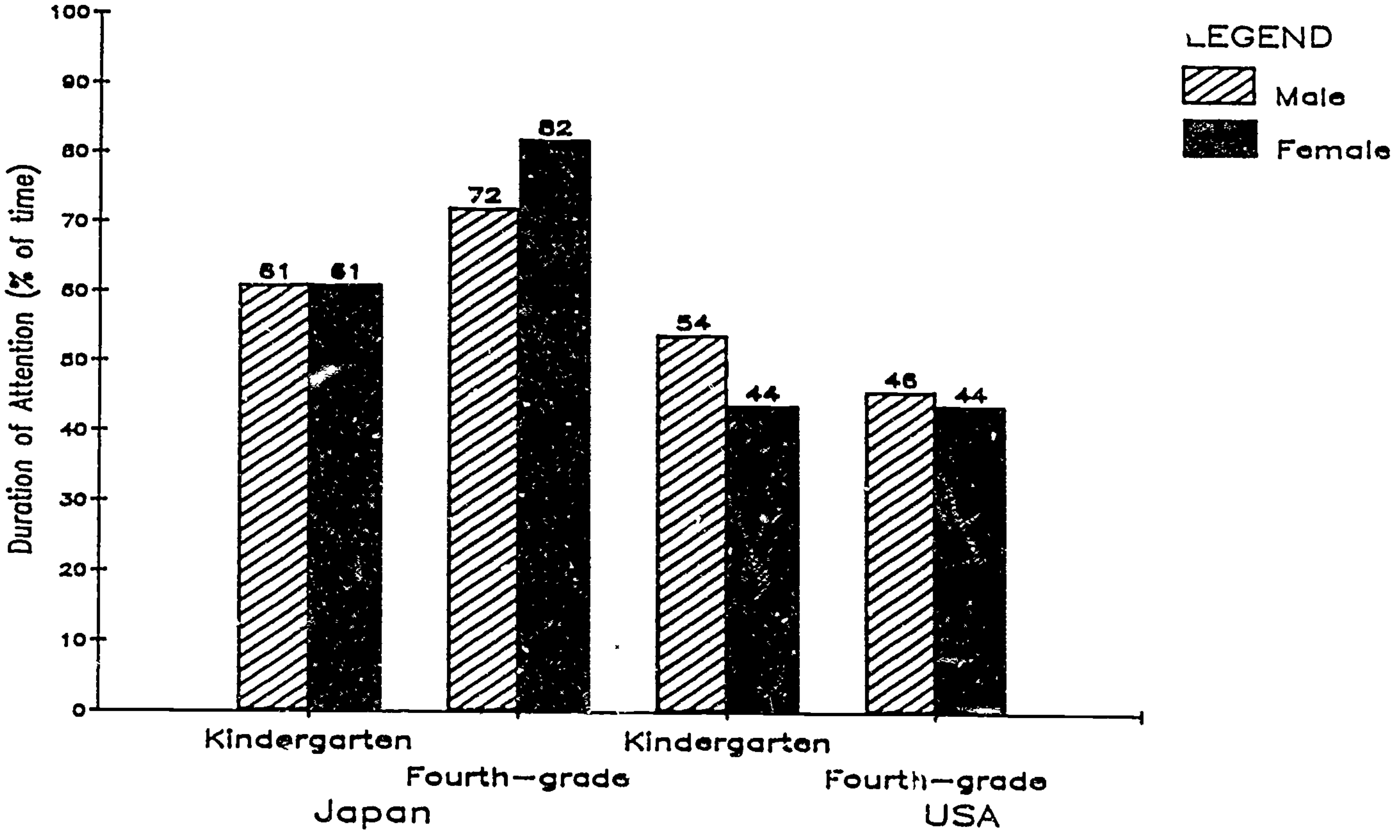


FIG. 1-B Mean Duration Per Look (Reconverted Raw Score Equivalent)

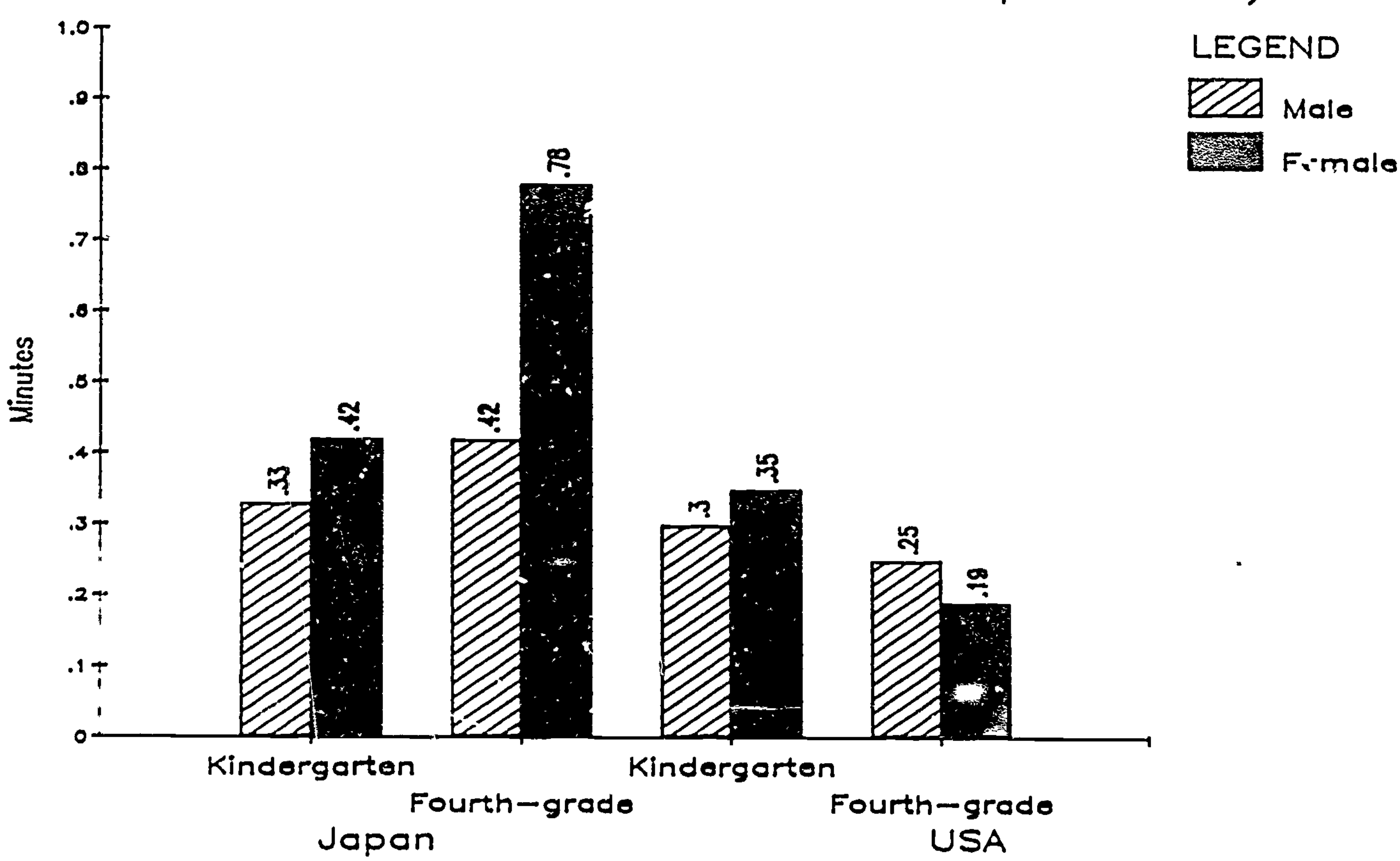


FIG. 1-C

Concrete Comprehension (Reconverted Raw Score Equivalent)

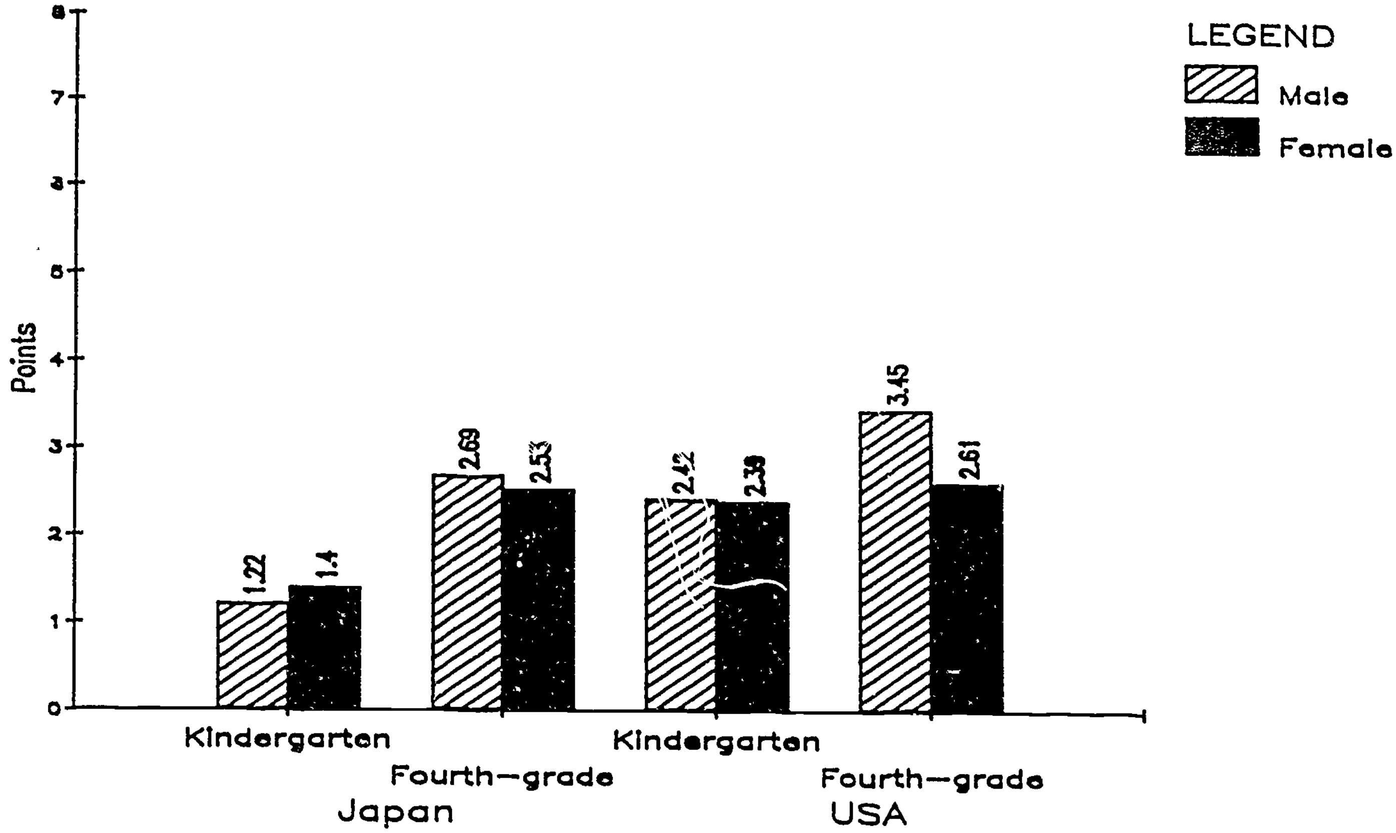


FIG. 1-D

Inferential Comprehension (Reconverted Raw Score Equivalent)

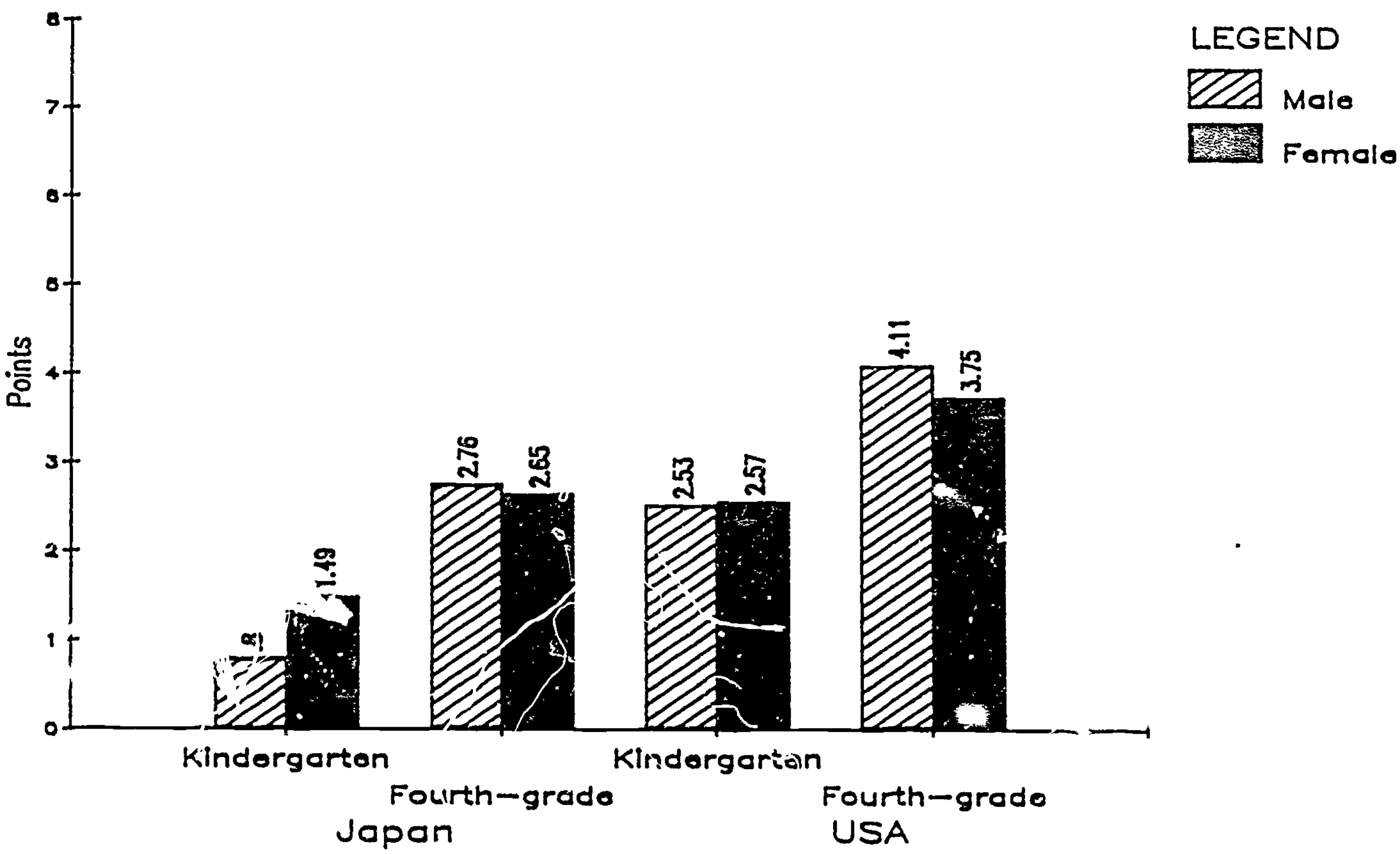
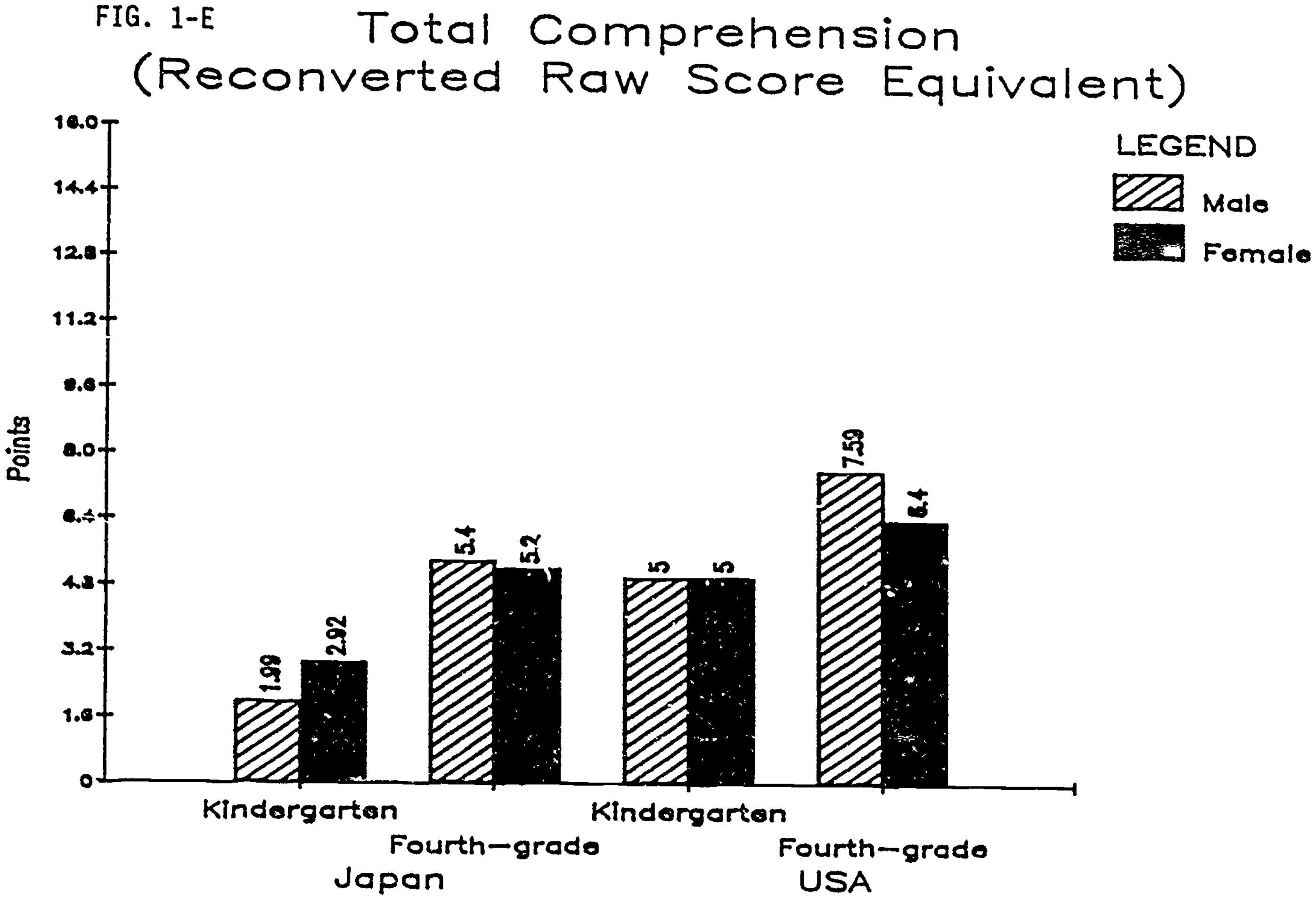


FIG. 1-E



Total Comprehension
(Reconverted Raw Score Equivalent)
LEGEND
Male
Female
Points
16.0
14.4
12.8
11.2
9.6
8.0
6.4
4.8
3.2
1.6
0
1.99
2.92
5.4
5.2
5
5
7.59
6.4
Kindergarten
Fourth-grade
Japan
Kindergarten
Fourth-grade
USA

FIG. 2-A Mean Duration of Looking for Age-matched Subsample (Reconverted Raw Score Equivalent)

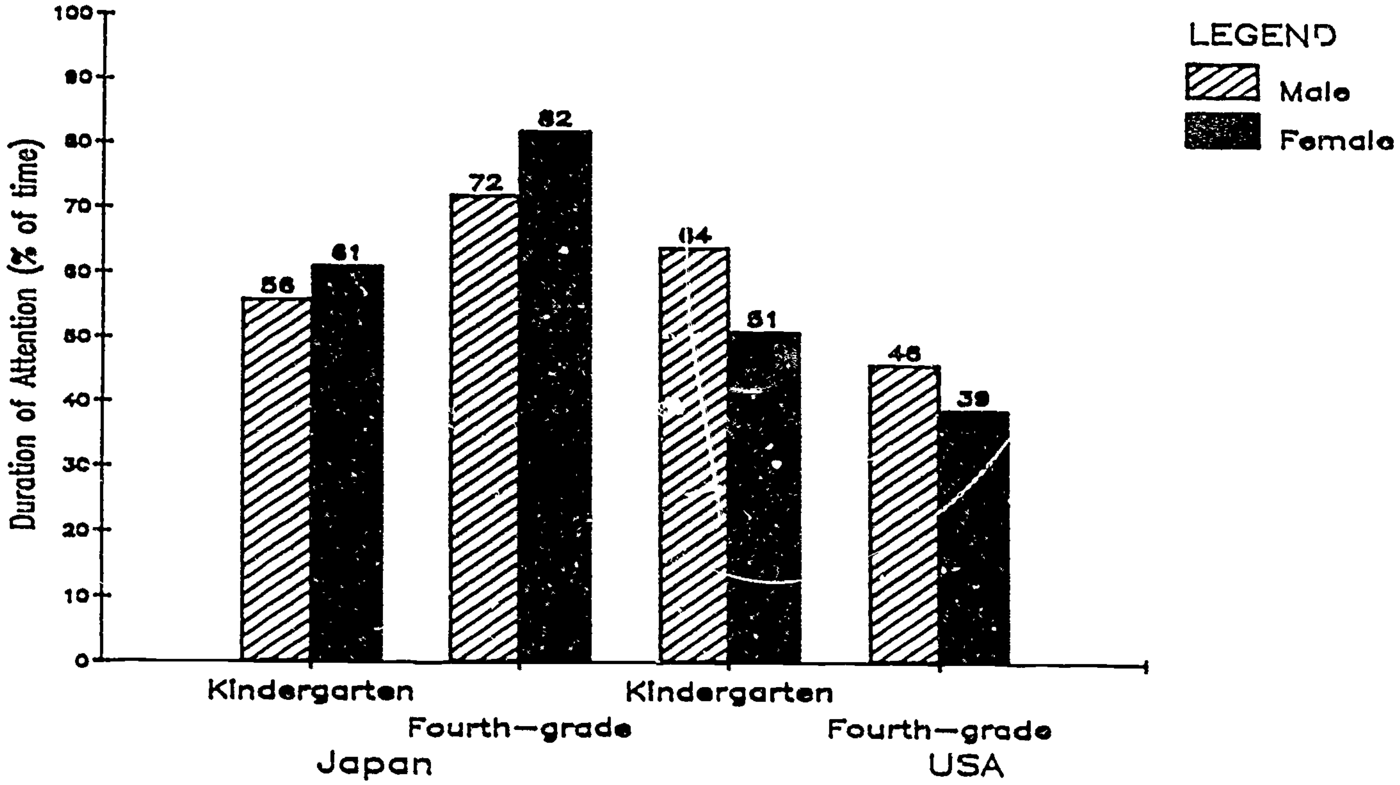


FIG. 2-B Mean Duration Per Look for Age-matched Subsample (Reconverted Raw Score Equivalent)

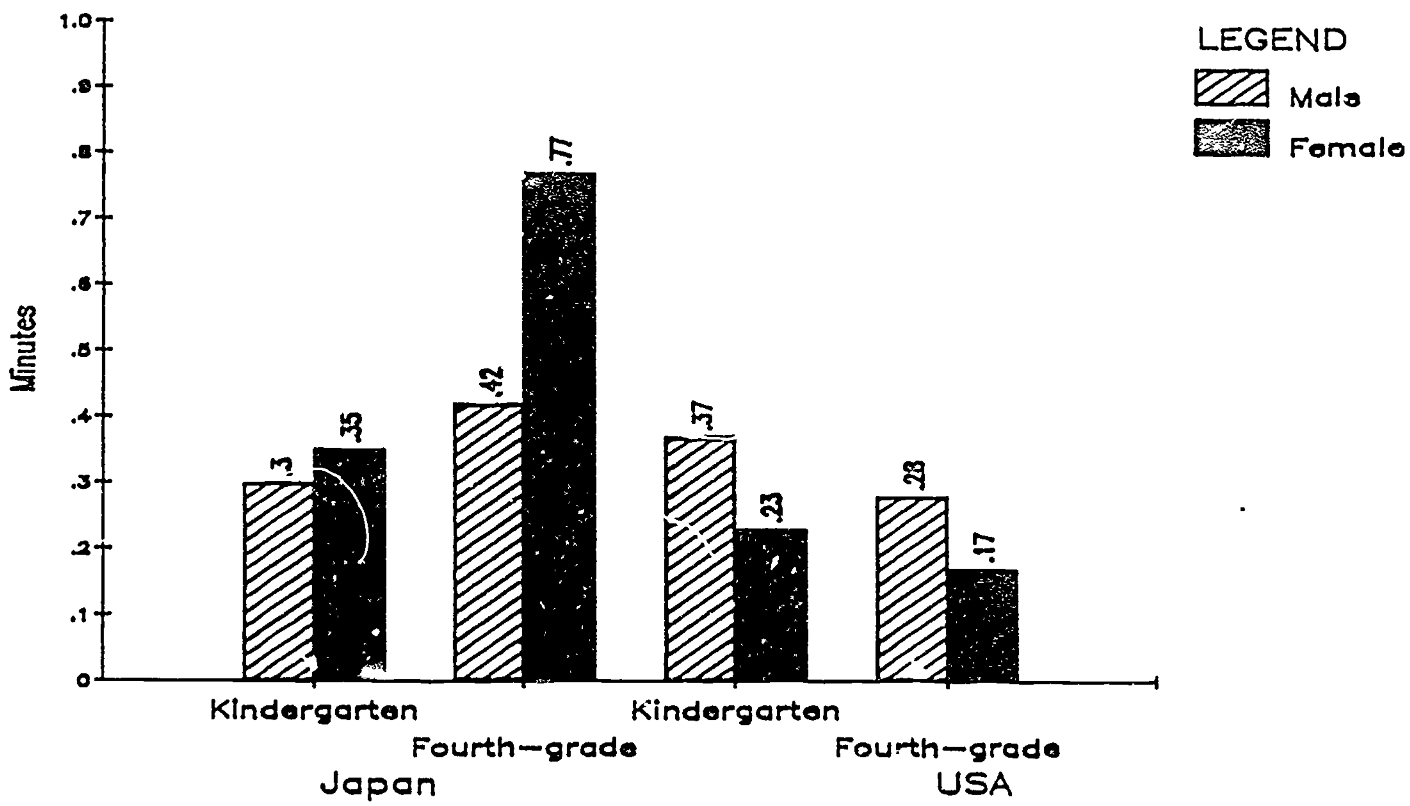


FIG. 2-C Concrete Comprehension for Age-matched Subsample (Reconverted Raw Score Equivalent)

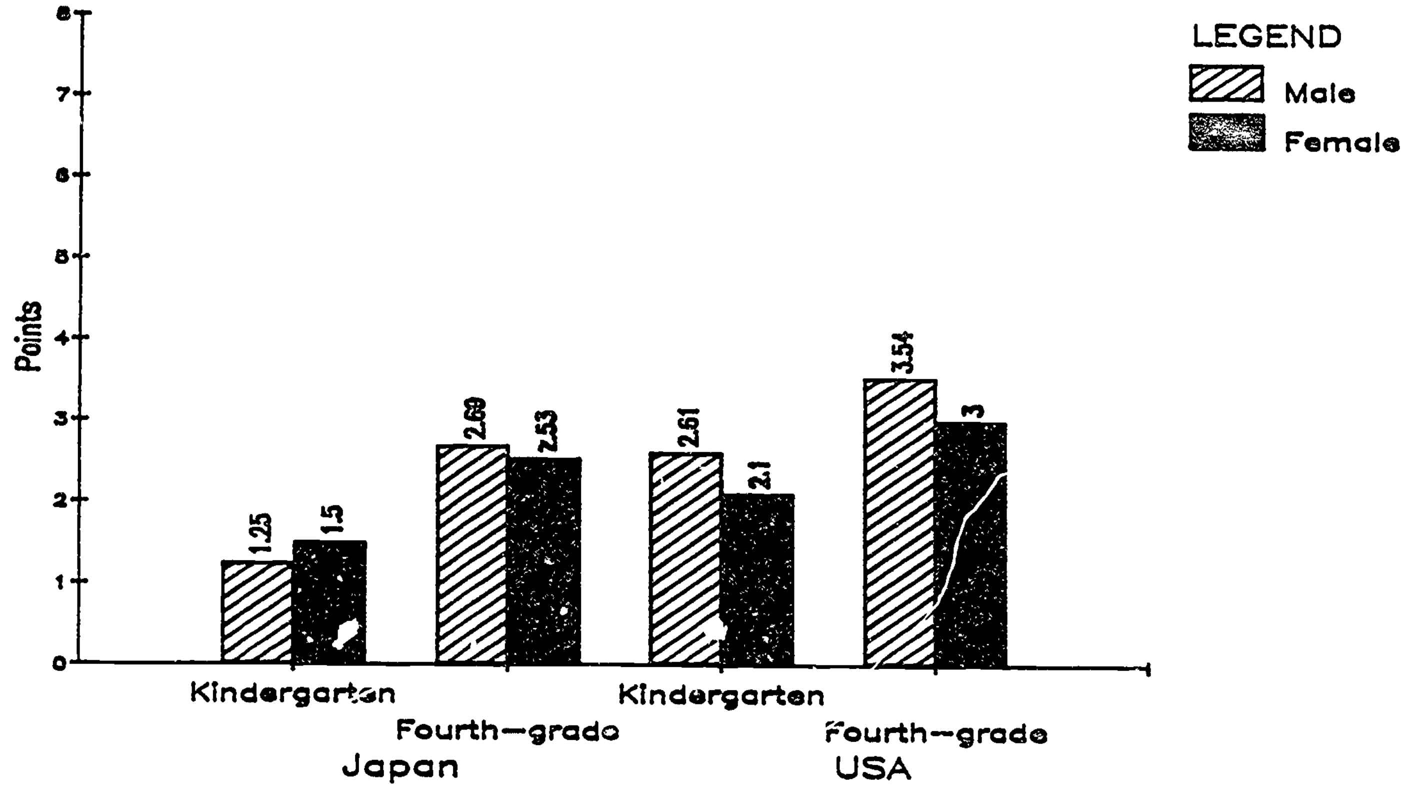


FIG. 2-D Inferential Comprehension for Age-matched Subsample (Reconverted Raw Score Equivalent)

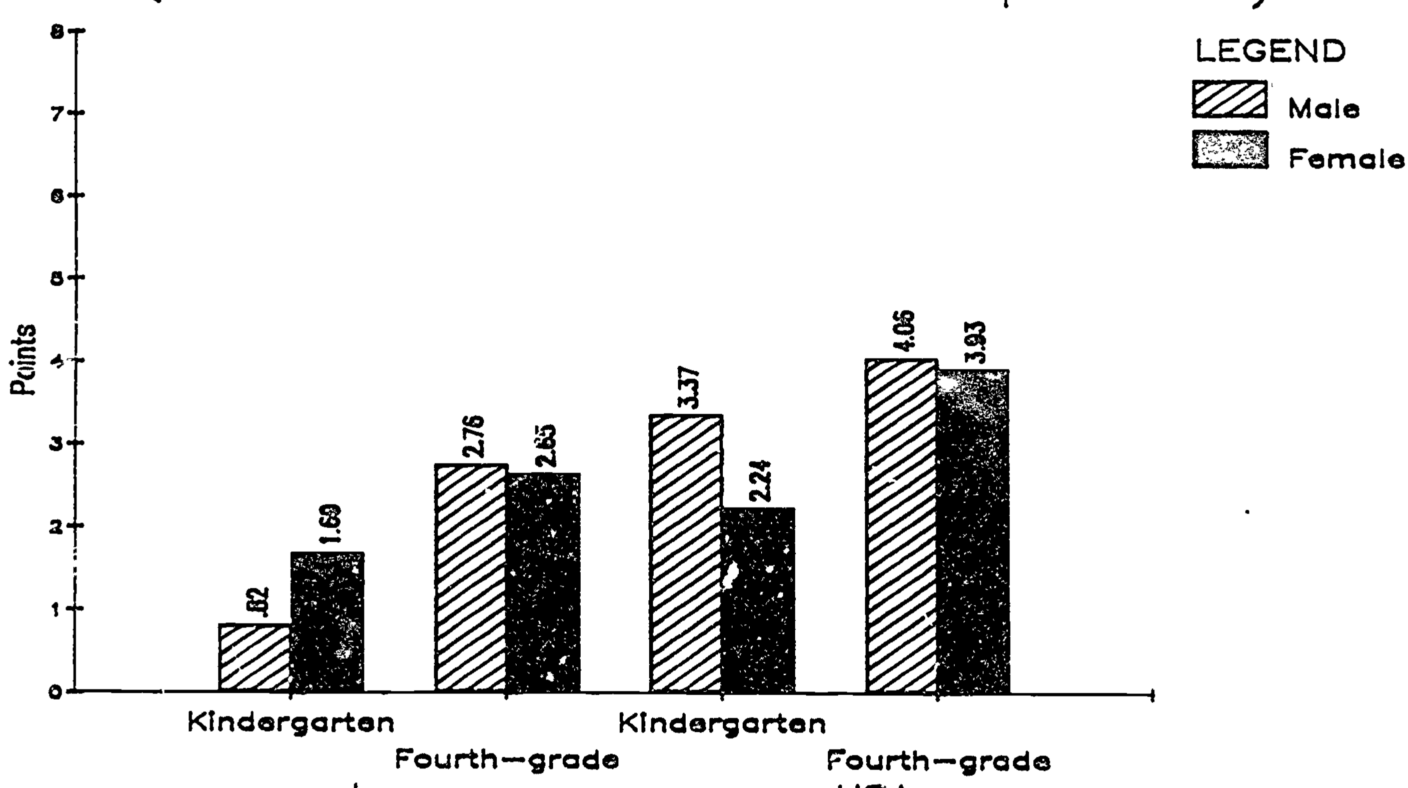


FIG. 2-E Total Comprehension for Age-matched Subsample (Reconverted Raw Score Equivalent)