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The Influence of Facial Characteristics on Children's Age Perceptions

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To examine the impact of age-related variations in facial characteristics on children's age judgments, two experiments were conducted in which craniofacial shape and facial wrinkling were independently manipulated in stimulus faces as sources of age information. Using a paired-comparisons task, children between the ages of 2½ and 6 were asked to make age category as well as relative age judgments of stimulus faces. Preschool-aged children were able to use variations in craniofacial profile shape, frontal face feature vertical placement, or facial wrinkling to identify the age category of a stimulus person. Children were also able to identify the older, but not the younger, of two faces on the basis of facial wrinkling, a finding consistent with previously demonstrated limitations in young children's use of relative age terms. The results were discussed in the context of research which reveals parallel effects of craniofacial shape and wrinkling on the age judgments of adults.

In contrast to the initial observations of Piaget (1969), research has revealed that when children are not distracted by size cues, they are able to use facial information to make judgments about people who differ in age. More specifically, research has shown that by 5 years of age, children not only are able to accurately identify the relative age of people presented in facial photographs, but also they express systematic expectations about the behavior of these individuals (Burke, 1982; Kogan, Stephens, & Shelton, 1961; Seefeldt, Jantz, Galper, & Serock, 1977; Weinberger, 1979). Thus, age is a meaningful social category to young

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children, and it has been postulated to be one of the basic dimensions along which young children organize their perceptions of people in the social environment (Lewis & Brooks-Gunn, 1979).

While the research on children's sensitivity to the age information provided by facial appearance has been informative, it has virtually ignored a fundamental question: What specific sources of stimulus information provided in a person's face reveal age to young children? This question has theoretical importance, since an understanding of the development of the concept of age will be furthered by determining whether the age judgments of very young children are responsive to the same information as those of adults. The question also has potential practical importance. Since it has been shown that young children ascribe stereotyped behavioral characteristics to aged faces, discovering what specific facial characteristics communicate age may suggest interventions that would combat these stereotyped conceptions.

To date, only one study has attempted to identify the sources of facial information that influence children's age judgments (Jones & Smith, 1984). In this research, different facial areas were masked out of facial photographs of people who varied in age, and children were asked to rank order their relative ages. The results revealed that when the hair and neck or the mouth and chin were masked, the children's age judgments were as accurate as their judgments of unmasked faces. On the other hand, masking of the eyes produced a significant decrement in the accuracy of age judgments.

While the greater impact of eyes than other facial areas on children's age judgments is an interesting finding, the explanation for this result is not clear. One possibility suggested by Jones and Smith is that because the eyes commonly draw attention in real life interactions, the children may not have attended carefully to the faces when the eyes were masked and consequently made more errors in age judgments. Another possibility is that there is more age-related information in the eye region than other areas. Unfortunately, the only data the authors collected pertinent to age-related changes in the eyes of their stimulus faces were the children's verbal reports regarding what it was about a face that made it old/young. Although none of the children commented on the eyes, several did mention wrinkles, and the authors suggested that children may have responded to variations in the degree of facial wrinkling around the eyes. An additional possibility is that children responded to the relative size of the eyes which is known to vary from infancy to maturity and has been shown to influence adults' age judgments (Berry & McArthur, 1985; McArthur & Apatow, 1983–1984).

The masking technique employed by Jones and Smith (1984) has limited utility for ascertaining what facial qualities reveal age to young children. At best it can reveal the locus of age information, but, as revealed in the ambiguity of interpreting the effects of eyes, it may not even do this.

An alternative strategy for addressing this questi
vary facial qualities that are known to contain age
with adults had employed this method to identify
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has revealed that increased wrinkling of facial
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Evidence that craniofacial shape provides su
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The purpose of the present research was to
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profiles varying in cardiodal strain, and Study 2 i
to identify the age of frontal view faces varying in fe
and wrinkling. Both of these studies employed a
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STUDY 1

Method

Subjects

Thirty-two preschool children attending local
as subjects. All children were Caucasian and

An alternative strategy for addressing this question is to systematically vary facial qualities that are known to contain age information. Research with adults had employed this method to identify facial information that is sufficient for age identification. For example, one source of age information is the extent of facial wrinkling, and research using adult judges has revealed that increased wrinkling of facial profiles yields a linear increase in age judgments (Mark et al., 1980). Another source of age information is craniofacial shape. As an individual ages, the maturation of the facial structure combined with the force of gravity produces a distinctive remodeling of the cranium. The impact of this change on the appearance of the face seen in profile is a lessening of the predominance of the brain capsule with increasing age. The impact on facial appearance viewed from the frontal position is that with maturation there is a lowering of facial features in the vertical plane of the face and a concomitant decrease in relative forehead size and an increase in relative chin size.

Evidence that craniofacial shape provides sufficient information for adults' age identification is provided by research investigating perceptions of profiles which have been subjected to a growth-stimulating cardiodal strain transformation. This transformation, an accurate approximation of real growth (Todd & Mark, 1981), systematically influences adults' age estimates (Todd, Mark, Shaw, & Pittenger, 1980). Feature vertical placement, a frontal face manifestation of age-related changes in craniofacial shape, also affects adults' age judgments (Mark & Todd, 1983; McArthur & Apatow, 1983–1984).

The purpose of the present research was to determine whether craniofacial shape and wrinkles influence children's age judgments. To this end, Study 1 investigated children's ability to identify the age of facial profiles varying in cardiodal strain, and Study 2 investigated their ability to identify the age of frontal view faces varying in feature vertical placement and wrinkling. Both of these studies employed a methodology that suited the cognitive and linguistic skills of young preschoolers. The majority of past age-identification studies have utilized ranking tasks that require children to make relative age judgments, and some researchers have found that children below the age of 5 have difficulty performing these tasks (Weinberger, 1979). The present studies, on the other hand, employed a two-choice paired comparisons procedure and requested relative as well as categorical age judgments. This procedure permitted investigations of the age-identification ability of children as young as $2\frac{1}{2}$ years.

STUDY 1

Method

Subjects

Thirty-two preschool children attending local daycare centers served as subjects. All children were Caucasian and were from middle level socioeconomic backgrounds. Children were divided into two age groups. The younger group consisted of 16 children between the ages of 31 and 44 months (M = 40 months). The older group consisted of 16 children between the ages of 49 and 68 months (M = 59 months). An approximately equal number of boys and girls were included in each age group. Children from both age groups were randomly assigned to one of two orders of stimulus profiles, and to one of two orders of age measures (age category or relative age first).

Independent Variables

A profile containing several schematically drawn internal features was subjected to a cardiodal strain transformation using a digital computer to create three facial profiles representing strain levels of −0.20, 0, and 0.20. The following transformation was used to generate the stimulus profiles: $\theta' = \theta$, $r' = r(1 - k \sin \theta)$ where k is a free parameter (Shaw & Pittenger, 1977). Figure 1 represents the stimulus profiles used in the present experiment.

All stimulus profiles were approximately 7.62 × 11.43 cm in size. Each profile was paired with the other two profiles to yield three different profile pairs which were photocopied onto a 21.59 × 27.94-cm piece of white paper and covered with a protective sheet of clear plastic. Placement of the profiles was counterbalanced such that the older profile in a pair appeared as often on the left as on the right. Each profile pair was presented twice to subjects in one of two orders. The first order was random except for the constraint that the same pair of profiles never appeared in succession. The second order was the reverse of the first.

Age Identification Measures

Children were asked to identify the age category of the profiles by pointing to the profile in a pair that was best described by an age category label provided by the experimenter. More specifically, children were told, "One of these people is a baby (boy, man) and one is a man (boy, baby). Which is the baby?" If children were asked, "Which is the baby?" on the first presentation of a particular pair of profiles, they were asked, "Which is the man?" on the second presentation. Relative age judgments

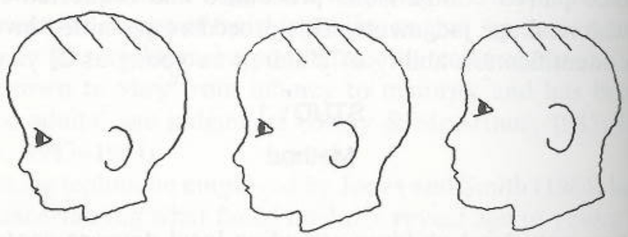

FIG. 1. Stimulus profiles varying in craniofacial shape used in Study 1.

were made by having children point to the "older" pair. The order in which a particular age catego was counterbalanced across subjects as was the versus relative age judgments.

Procedure

All children were interviewed individually. At children were escorted to a private area and sat at a small table upon which the stimulus materials were told that they would be looking at faces of some questions about them. After indicating a the task, the stimulus pairs were presented, one were asked to make their age identifications. All re by the experimenter on a coding sheet. At no tin procedure were children given feedback about responses. None of the children who were intervie the experimental task or appeared to be confused the task.

Results

A 2 × 3 × 2 (subject age × stimulus face age p measure) analysis of variance for repeated measu the between-groups factor and stimulus face pair measure as the within-groups factors was perfor of correct choices. Results revealed a significa identification measure, $F(1, 30) = 8.03$, $p < .00$ effects or interactions were found for subject ag (all p's > .05), and these factors were exclude analyses to increase the sample size in each cell.

A follow-up one-way analysis of variance for r formed on the proportion of correct age identific that the proportion of correct choices was signif category judgments (M = 0.65) than for relative 0.52), $F(1, 31) = 8.02$, $p < .008$. One-sample t tests whether the proportion of correct choices for e measure differed from a chance level of .5 revealed at better than chance levels when asked to apply to the facial profiles, $t(31) = 4.27$, $p < .001$. Howev at chance levels in designating which of the two "older", $t < 1$.

STUDY 2

Study 2 further examined the impact of age-re on children's age perceptions. The methodology v ployed in Study 1 with the following modificatior ere made by having children point to the "older" person in each stimulus air. The order in which a particular age category label was provided as counterbalanced across subjects as was the order of age category ersus relative age judgments.

rocedure

All children were interviewed individually. At the time of testing, the hildren were escorted to a private area and sat with the experimenter t a small table upon which the stimulus materials were located. Children ere told that they would be looking at faces of people and answering ome questions about them. After indicating a willingness to perform e task, the stimulus pairs were presented, one at a time, and children ere asked to make their age identifications. All responses were recorded y the experimenter on a coding sheet. At no time during the selection rocedure were children given feedback about the accuracy of their sponses. None of the children who were interviewed refused to perform e experimental task or appeared to be confused about the demands of e task.

Results

A 2 × 3 × 2 (subject age × stimulus face age pair × age identification easure) analysis of variance for repeated measures with subject age as e between-groups factor and stimulus face pair and age identification easure as the within-groups factors was performed on the proportion correct choices. Results revealed a significant main effect for age entification measure, $F(1, 30) = 8.03$, $p < .008$. No significant main fects or interactions were found for subject age or stimulus face pair ll p's $> .05$), and these factors were excluded from the remaining alyses to increase the sample size in each cell.

A follow-up one-way analysis of variance for repeated measures per- rmed on the proportion of correct age identification choices revealed at the proportion of correct choices was significantly greater for age tegory judgments ($M = 0.65$) than for relative age judgments, ($M =$ 52), $F(1, 31) = 8.02$, $p < .008$. One-sample t tests performed to determine hether the proportion of correct choices for each age identification easure differed from a chance level of .5 revealed that children performed better than chance levels when asked to apply an age category label the facial profiles, $t(31) = 4.27$, $p < .001$. However, children performed chance levels in designating which of the two profiles in a pair was lder", $t < 1$.

STUDY 2

Study 2 further examined the impact of age-related facial variations children's age perceptions. The methodology was similar to that em- oyed in Study 1 with the following modifications:

1. Age-related changes in craniofacial shape were simulated by manipulating the vertical placement of the facial features in frontal views of faces.

2. To obtain data on children's ability to use facial information to identify a wider range of ages than that represented in Study 1, the stimulus faces included faces of old men in addition to a baby, boy, and young man. Since changes in craniofacial shape are complete by adulthood, facial wrinkling was manipulated to represent older adult faces.

3. Children were asked to identify the "younger" person in stimulus face pairs in addition to identifying the "older" person and applying an age category label.

Method

Subjects

Thirty-two children attending local daycare centers served as subjects. All children were Caucasian and were from middle level socioeconomic backgrounds. Sixteen children between the ages of 30 months and 45 months (M = 38 months) were included in the younger age group and 16 children between the ages of 47 and 66 months (M = 53 months) were included in the older age group. There was an approximately equal number of boys and girls in each age group. Children from both age groups were randomly assigned to one of two stimulus face sets and to one of two orders of the dependent measures.

Independent Variables

Two male faces were created by selecting two different sets of hair styles, eyebrows, eyes, mouths, ears, and chins from a police Identi-kit. The stimulus faces had the same overall dimensions as those used in Study 1. For each face, the vertical placement of the internal features (eyes, mouth, and nose) was manually varied as it had been done in previous research with adults (McArthur & Apatow, 1983–1984). Keeping constant the relation of all internal features to one another, features were relocated as a group by varying the distance between the lower lip line and the chin by 0.5-cm steps. As a result, two series of faces representing a baby, a boy, and a man were created in which the distance between the lower lip line and the chin was 0.5 cm, 1 cm, and 1.5 cm, respectively. An older adult face was created for each set of faces by applying a set of facial wrinkles to the adult face. The wrinkle pattern used for each face represented that of a 55-year-old adult as indicated by Identi-kit specifications. A different set of wrinkles was used for each face to increase the generality of observed effects across wrinkle type. Figure 2 depicts the two sets of four faces used in the present study.

Within each set, each face was paired with the other three faces to yield six face pairs for that set. Each face pair was mounted on stimulus

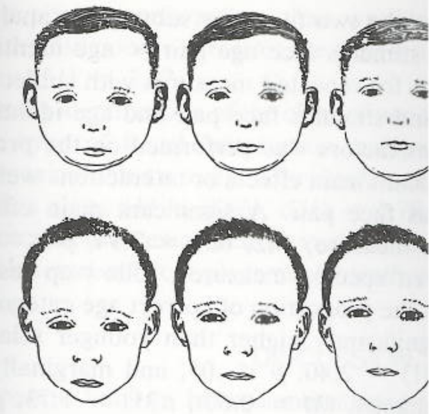

FIG. 2. Stimulus faces varying in feature vertical pla
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Age Identification Measures

Age category judgments were made as des
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Two orders of presentation of the age identifi
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and the "older" age judgments last.

Procedure

The procedure was the same as in Study 1.

Results

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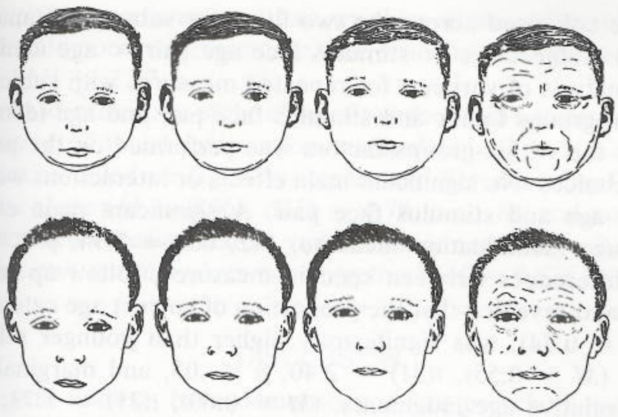

FIG. 2. Stimulus faces varying in feature vertical placement and facial wrinkling used in Study 2.

cards as described earlier, counterbalancing the position of the older face in a pair. Two orders of presentation of stimulus faces were generated. The first order was applied to the first set of six face pairs. This order consisted of a random sequence of face pairs alternated such that an older–younger (left–right) pair was followed by a younger–older pair (right–left). The second order was applied to the second set of face pairs. In this order, the sequence of face pairs was the reverse of the first order.

Age Identification Measures

Age category judgments were made as described in Study 1 with the exception that the young man in a stimulus pair was referred to as "a man like a daddy," while the old man was referred to as "an old man like a grandfather." Relative age judgments included children's judgments of the "older" as well as "younger" of two faces in a stimulus pair. Two orders of presentation of the age identification measures were employed. In the first order, children were asked to make the "older" relative age judgments first, the age category judgments second, and finally, the "younger" age judgments. In the second order, children made the "younger" age judgments first, the age category judgments second, and the "older" age judgments last.

Procedure

The procedure was the same as in Study 1.

Results

Preliminary analyses indicated that children's proportion of correct choices did not differ across the two stimulus face sets, therefore, response scores were collapsed across the two faces for subsequent analyses. A 2 × 6 × 3 (subject age × stimulus face age pair × age identification measure) analysis of variance for repeated measures with subject age as the between-groups factor and stimulus face pair and age identification measure as the within-groups factors was performed on the proportion of correct choices. No significant main effects or interactions were found for subject age and stimulus face pair. A significant main effect was found for age identification measure, $F(2, 60) = 7.94$, $p < .001$. To elucidate differences between specific measures, follow-up tests were conducted and revealed that the proportion of correct age category judgments, ($M = 0.74$), was significantly higher than younger relative age judgments, ($M = 0.55$), $t(31) = 2.40$, $p < .05$, and marginally higher than older relative age judgments, ($M = 0.60$), $t(31) = 1.73$, $p < .10$. The proportion of correct younger and older relative age judgments did not differ from each other, $t < 1$.

One-sample *t* tests were performed to determine whether children's proportion of correct choices for each age identification measure differed from a chance level of .5. Consistent with the results of Study 1, children performed at better than chance levels when asked to apply age category labels to stimulus faces, $t(31) = 6.28$, $p < .001$. Contrary to findings in Study 1, children also performed at better than chance levels in identifying the "older" person in a stimulus pair, $t(31) = 2.84$, $p < .01$. However, their identification of the "younger" of two faces in a pair was no better than chance.

The impact of specific facial information on age judgments was assessed by combining stimulus face pairs into three groups on the basis of the type of available age information: feature vertical placement alone, wrinkles alone, or vertical placement and wrinkles together. One-way analyses of variance were then performed to assess the impact of the different types of facial information on age category judgments and older age judgments, the two age measures children used with better than chance accuracy.

Results revealed a marginally significant main effect for facial information type on age category judgments, $F(2, 62) = 2.47$, $p = .09$. Children performed at better than chance levels when asked to apply age category labels to faces varying in wrinkles alone ($M = 0.78$), $t(31) = 3.11$, $p < .01$, and to faces varying in feature vertical placement and wrinkles together ($M = 0.83$), $t(31) = 3.67$, $p < .001$, and the proportion of correct choices did not differ across these two face groups, $t < 1$. Children also performed marginally better than chance when asked to identify the age category of faces varying in vertical placement alone, $t(31) = 1.78$, $p < .10$, and the proportion of correct choices in this condition ($M = 0.66$) was essentially the same as that obtained in Study 1 for profile shape ($M = 0.65$). Although vertical placement alone did not yield sig-

nificantly poorer performance than wrinkles
.12, it did yield poorer performance than wrin
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Children's identification of the older of two fa
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or wrinkles and vertical placement together,
$p = .16$.

DISCUSSION

The present findings have demonstrated th
can use variations in craniofacial profile shape,
placement, or facial wrinkling to identify the
person. Moreover, the performance of subject
with a mean age of 3.3 years, was equal to th
age group, with a mean age of 4.8 years. Th
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children are proficient at using age category
pictured in facial photographs. However, the
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preschoolers are sensitive, and it has demons
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judgments is consistent with the impact of the
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1983–1984; Todd et al., 1980).

While the present results indicated that all o
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better performance than wrinkles alone.

One possible explanation for the differential
shape and facial wrinkling manipulations is that
of wrinkles used in the present stimulus ma
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variations in craniofacial shape that differentia
less salient to children than the wrinkle variati
persons. Indeed, this explanation is consiste

nificantly poorer performance than wrinkles alone, $t(31) = 1.60$, $p = .12$, it did yield poorer performance than wrinkles and vertical placement together, $t(31) = 2.27$, $p < .05$.

Children's identification of the older of two faces did not vary significantly with the type of facial information manipulated, $F < 1$. Comparisons with chance revealed a marginally significant difference when faces varied in wrinkles alone ($M = 0.66$), $t(31) = 1.78$, $p < .10$, and no significant difference when faces varied in vertical placement ($M = 0.56$), $t < 1$, or wrinkles and vertical placement together, ($M = 0.63$), $t(31) = 1.44$, $p = .16$.

DISCUSSION

The present findings have demonstrated that preschool-aged children can use variations in craniofacial profile shape, frontal face feature vertical placement, or facial wrinkling to identify the age category of a stimulus person. Moreover, the performance of subjects in the younger age group, with a mean age of 3.3 years, was equal to that of subjects in the older age group, with a mean age of 4.8 years. These findings are consistent with the work of Edwards (1984) who found that by the preschool years children are proficient at using age category labels to identify people pictured in facial photographs. However, the present results go beyond those of Edwards in identifying age-specifying facial information to which preschoolers are sensitive, and it has demonstrated that young children are sensitive to the same information as adults: The impact of profile shape, feature vertical placement, and facial wrinkling on children's age judgments is consistent with the impact of these facial characteristics on the age judgments of adults (Mark & Todd, 1983; McArthur & Apatow, 1983–1984; Todd et al., 1980).

While the present results indicated that all of the feature manipulations affected children's age category judgments, facial wrinkling appeared to have a somewhat stronger impact on age category judgments than did craniofacial shape. Whereas wrinkles alone had a significant impact on children's age category labels in Study 2, vertical placement alone had only a marginally significant effect. Moreover, wrinkles plus vertical placement information yielded more accurate judgments than vertical placement alone, while the combined information did not yield significantly better performance than wrinkles alone.

One possible explanation for the differential impact of the craniofacial shape and facial wrinkling manipulations is that the schematic manipulation of wrinkles used in the present stimulus materials was more obvious than the craniofacial shape manipulation. Another possibility is that the variations in craniofacial shape that differentiate younger individuals are less salient to children than the wrinkle variations that differentiate older persons. Indeed, this explanation is consistent with children's verbal reports to researchers asking how they knew that a real face was that of an older adult (Kogan et al., 1961; Jones & Smith, 1984). For example, Jones and Smith (1984) reported that approximately 25% of their subjects mentioned wrinkles, whereas only one made reference to craniofacial shape, saying, "He's a baby because he's got a big forehead. It's bigger for his face than mine is or yours is" (p. 336). It is interesting to note that the greater salience for children of wrinkles than craniofacial shape parallels the relative impact of these two facial cues on adults' age judgments (Mark et al., 1980).

Although children could identify the age category to which a face belonged on the basis of profile shape, feature vertical placement, or wrinkles, they were able to identify the "older" of two faces only on the basis of wrinkles, and they were not able to use any of the manipulated facial information to identify the "younger" of two faces. One interpretation of the latter two findings is that relative age terms initially serve as age category labels for very young children with the result that they are able to identify relative age only when the label is "older" and when the face is that of an "old" man. The limitations in young children's use of relative age terms observed in the present investigation are consistent with previous research. For example, Britton and Britton (1969) obtained fewer successful age rankings among 3- to 5-year-olds when they were asked who is younger than Jones and Smith (1984) did when children of the same age were asked who is older. The present results are also consistent with Clark's semantic feature hypothesis (1975) which holds that children acquire the ability to use the positive member of an antonym pair before the negative one, and with evidence that children's use of the term "older" is not always accompanied by their correct application of the term "younger" (Kuczaj & Lederberg, 1976).

The present research has demonstrated that the paired comparisons procedure and the technique of independently manipulating specific facial information are effective methods for studying the age perceptions of very young children. It has further revealed that preschoolers' ability to identify a person's age is more sensitively measured by assessing their ability to apply age category labels than to make relative age judgments. Future research on the development of age perceptions may profit from the use of these methods to examine (1) age perceptions of children from a wider age range than has typically been sampled in the past, and (2) the influence of other age-related appearance cues on children's age perceptions.

Whether age-related variations in facial characteristics communicate behavioral, as well as age, information to young children is an important unanswered question that some preliminary findings from the present research begin to address. In addition to making age judgments, children made judgments about likely behaviors of the stimulus faces. Although

these data were not reported in detail due to inc
the two studies, one interesting finding was that
pair was selected more often than chance as the
often than chance as the "smart" one, even
identifications were no better than chance. One
effects is that impressions of wrinkled adult face
associated with facial wrinkles rather than any t
related variations in behavior. If so, then one w
negative impressions of the elderly might be to exp
to elderly faces, thereby modifying their reactions
1982; Zajonc, 1980).

Further research is clearly needed to elabor
related variations in physical characteristics on chil
It is hoped that the present study will encourage
stimulus information which reveals significant so
and promote a greater understanding of the t
implications of these stimulus information effec

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these data were not reported in detail due to inconsistent effects across the two studies, one interesting finding was that the wrinkled face in a pair was selected more often than chance as the "mean" one and less often than chance as the "smart" one, even by children whose age identifications were no better than chance. One interpretation of these effects is that impressions of wrinkled adult faces reflect a negative halo associated with facial wrinkles rather than any true appreciation of age-related variations in behavior. If so, then one way to combat children's negative impressions of the elderly might be to expose them more frequently to elderly faces, thereby modifying their reactions to wrinkles (McArthur, 1982; Zajonc, 1980).

Further research is clearly needed to elaborate the impact of age-related variations in physical characteristics on children's social perceptions. It is hoped that the present study will encourage greater attention to the stimulus information which reveals significant social attributes to children and promote a greater understanding of the theoretical and practical implications of these stimulus information effects.

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Differences in the Associative Constraint from a Context Cue for Children

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How differences in associative constraint contribute to in using context cues to retrieve episodic information f in seven experiments. Second- and fifth-graders and c word triplets at acquisition and asked to recall the fin triplet in a cued recall task. The important manipulati associative information that could mediate retrieval se to which the triplet members were related, whether t or categorical, featured prototypical or nonprototypic concerned superordinate or subordinate categorical specification of episodic information, and the amount available in the retrieval cue. The results include th cued recall in children is more dependent than that constraint provided in an episode and cue, and that better use of thematic and subordinate than of superor a cue. © 1986 Academic Press, Inc.

On occasion, children and adults may find it ne to retrieve episodic information. Assuming that ret probabilistic and random (cf. Raaijmakers & Sh be constrained in some way to be successful. properties of memory that mediate or guide r search to be systematic and exhaustive. One so associative structure of memory.

The general purpose of the present study is to d in associative constraint contribute to developmen search from a context cue. The issue is impor from a few recent studies suggest that young c as effectively as do adults to search memory (cf.

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