Abstract. Implicit verb causality refers to the phenomenon that even minimal descriptions of interpersonal events (e.g., A dominates B, A amuses B) elicit causal attributions. Two experiments investigated whether children of different age groups are able to (a) perceive the causality implicit in interpersonal verbs and (b) to detect patterns of cause-effect covariation (consensus and distinctiveness) presumably mediating the verb causality effect. Experiment 1 found that 5-year-old children detect the causal structure inherent in verbs describing interpersonal events and are able to indicate corresponding covariation patterns. Experiment 2 replicated these findings for 3-year-old children using a more sensitive method for assessing causal and covariation beliefs. Statistical mediation analyses supported the hypothesis that the verb causality effect is mediated by implicit beliefs about cause-effect covariation. Taken together, the results provide support for a covariation-based explanation of the verb causality effect.

Keywords: missing, please supply

As . . . resemblance, contiguity, and causation are the only ties of our thoughts, they are really to us the cement of the universe, and all the operations of the mind must, in great measure, depend on them. David Hume (1739/1960)

Social interaction and the perception of the social world are essential elements of naïve psychology (Heider, 1958). One important characteristic of this social world is its underlying causal structure (e.g., White, 1988, 1990). A research paradigm that has highlighted the profound role of causal concepts in social perception and social interaction is research on the implicit causality in language (e.g., Brown & Fish, 1983 a,b; Corrigan, 1988, 1992, 1993; Greene & McKoon, 1995, Kasof & Lee, 1993; McArthur, 1972, Rudolph, 1997). To illustrate, consider descriptions of interpersonal events such as “Mary admires Joan because of the kind of person she is,” or “Mary dominates Joan because of the kind of person she is.” Brown and Fish (1983a) found that the vast majority of respondents, when asked to indicate who is referred to as “she,” will answer “Joan” (the sentence object) for the first sentence, but “Mary” (the sentence subject) for the second sentence. This phenomenon, known as implicit causality in verbs, has been observed with great regularity across different research paradigms, across different languages and cultures, and for children as well as adults (for a review, see Rudolph & Försterling, 1997). Thus, the implicit causality in verbs can be considered a universal phenomenon.

In this article, we study implicit verb causality in children. Previous research has shown that children perceive the implicit causality in language at an early developmental stage. For example, Au (1986) found that already 5-year-old children attribute different effects (e.g., admiration, protection) to the sentence object or the sentence subject, respectively, in the same way as adults do. In addition, Corrigan and Stevenson (1994) presented 4-year-old children with different kinds of interpersonal verbs (e.g., to comfort) and asked them to invent stories around these verbs. Typically, these stories contained information about the causation of the events described by the interpersonal verbs, and these events were attributed with high regularity to either the sentence subject or the sentence object, depending upon the verb type. However, thus far there is no agreement on the question of how, or by which processes, these causal attributions are mediated. The present study focuses on one explanation of the verb causality effect, first proposed by Brown and Fish (1983b), the covariation hypothesis, which has already received empirical support for adults. The present study tests whether the covariation hypothesis is also supported with children. To explain the covariation hypothesis and its present test, it is necessary to first describe the classification of interpersonal verbs.

Classification of Interpersonal Verbs

Heider (1958) was the first theorist who assumed that different kinds of interpersonal events give rise to different attributions. He proposed a fundamental distinction between actions, on the one hand (as in “A dominates B”), which are typically attributed to the sentence subject (the actor), and states or “sentiments,” on the other hand (as in “A admires B”), which are typically attributed to the sentence object, who is seen as stimulating the state or sentiment in A. Heider’s distinction was later supplemented by the linguistic concept of semantic roles (see Brown & Fish, 1983b). In addition, Rudolph and Försterling (1997), tak-
[Note: The text contains a mix of paragraphs and numbers, possibly indicating labeled sections.]

Section 1: Explaining Implicit Causality

Brown and Fish (1983b) suggested that causal inferences in verb causality are the product of the processing of covariation information (e.g., Kelley, 1967, 1972). This idea – labeled the covariation hypothesis – assumes that covariation information (i.e., consensus and distinctiveness; see below) is an implicit, schematic part of the meaning of verbs. This hypothesis is supported by studies in which participants rated consensus and distinctiveness for different kinds of interpersonal verbs. These studies found that interpersonal verbs are associated with patterns of perceived consensus and distinctiveness that perfectly fit the attributions elicited by these verbs (e.g., Brown & Fish, 1983b; Rudolph, 1997). More specifically, the actions or events described by AP and SE verbs (giving rise to subject attributions) are associated with perceptions of low consensus and low distinctiveness. That is, few persons perform these actions or elicit these kinds of experiences (low consensus), but many persons are the potential “patient” of these actions or the potential experiencer of the stimulated emotions (low distinctiveness). According to Kelley’s (1967) covariation principle, this covariation pattern leads to subject attributions. In contrast, AE and ES verbs are associated with perceptions of high consensus (many persons act or feel this way) and high distinctiveness (few persons are treated this way), which lead to object (i.e., entity) attributions according to Kelley.

However, given that 4- to 5-year-old children are already able to perceive the causal structure implicit in interpersonal verbs (e.g., Au, 1986), on which information do they rely? At first sight, it may seem implausible that children of this age have already acquired information about the relative frequencies with which these different kinds of actions and states occur in their social environment. However, if implicit causality is indeed mediated by covariation information inherent in the meaning of interpersonal verbs, then this is exactly what should be found. That is, the covariation hypothesis predicts that children who are able to understand the causal structure of interpersonal relations also have an understanding of the covariation patterns (patterns of consensus and distinctiveness) underlying these relations. This prediction provides, in my view, a strong test of the covariation hypothesis. So far, the only – and indirect – evidence relevant to this hypothesis are findings which suggest that children between the ages of three to five years are able to perceive and process explicit covariation information presented to them. For example, 4-year-old children are already able to process explicit consensus, distinctiveness, and consistency information in achievement-related scenarios (Schuster, Rudolph, & Försterling, 1998). Thus far, however, no studies have tested whether children have implicit knowledge of the patterns of consensus and distinctiveness associated with different interpersonal verbs. It is this question that will be addressed in the studies reported below.

Experiment 1

To test the covariation hypothesis of implicit verb causality with children, we developed an experimental paradigm suited to assess causal ascriptions and perceived patterns of covariation concerning interpersonal events in children of different age groups.

Note: The phenomenon of implicit verb causality refers to causal attributions for interpersonal events, and not to behavioral explanations; for an overview concerning this distinction see Malle (2004).
Method

Participants

Four different age groups participated in this experiment: 23 kindergarten children (7 girls, 16 boys; M = 5 years, 8 months); 20 third-grade school children (11 girls, 9 boys; M = 7 years, 10 months); 20 seventh-grade school-children (12 girls, 8 boys; M = 12 years, 3 months); and 15 adults (8 female, 7 male; M = 30 years). Participants or their parents were contacted by postings on the blackboards of kindergartens, schools, and youth centers in Munich (Germany). One female and one male experimenter tested the participants in a quiet, separate room at their homes. One session lasted between 15 and 30 minutes. The children received a gift for their participation; the adults were paid Euro 5 (approximately US$ 7).

Design

The experiment is based on a mixed factorial design, with age group as a between-subjects factor and verb type (AP, AE, SE, and ES verbs) as a within-subjects factor. Attributions, consensus and distinctiveness were the dependent variables.

Procedure

For the two younger age groups, the assessment of the dependent variables – attributions and perceived covariation patterns (consensus and distinctiveness) – was embedded into a game-like situation developed on the basis of pretests. In the game, the children proceeded through a series of “event fields,” each of which contained an “event card” for one of the interpersonal verbs used in the study. In each event field, the experimenter presented the corresponding card (e.g., the card for “comfort”) to the child and said: “Look, here is one child who comforts another child. Why is it that this happens?” As shown by Corrigan and Stevenson (1994), the perceived causal structure of events is an important part of the stories children produce spontaneously (see also Weiner, 1986). In line with these findings, the children answered the “why” – question with ease; less than 2% failed to give a causal attribution. If that happened, the experimenter repeated the question: “Would you please tell me why it is that this child comforts another child?”

After the children had mentioned a cause of the event (the sentence subject, the sentence object, or some other cause), the experimenter assessed their perceptions of consensus and distinctiveness, using a different set of event cards. The consensus card showed the same event with the same children that the participants had already seen on the event card; however, the card also contained four pictures that represented four kinds of frequencies with which the event might have occurred. For example, for the event “to comfort,” the first picture showed just one child comforting one other child, the second picture showed a few (3) children, the third picture many (6) and the fourth picture 12 (meant to represent all). Participants were asked: “Look, this child comforts another child; what do you think: Does only one child do this, are there a few children doing this, are there many children who do this, or do all children do this?” The order of the verbally presented answer alternatives was varied randomly.

In a similar vein, the distinctiveness card showed four different kinds of frequencies. To illustrate again for “to comfort,” the first picture showed one child comforting just one child, whereas the remaining pictures showed 3, 6, and 12 children, respectively, that were comforted by the child. The experimenter asked, by pointing to the different alternatives on the card: “Look at this card – what do you think: Does this child comfort only one other child, does this child comfort a few other children, does this child comfort many other children, or does this child comfort all other children?” The order of verbs and questions were varied randomly. The experiment took approximately 20 to 30 minutes for the two younger groups. For the 12-year-olds and the adults, the experimental situation was different: Instead of playing a game, these participants simply looked at the event cards and answered the respective questions by using the consensus and distinctiveness cards. As a consequence, the experiment took only about 15 minutes.

Materials

For each verb type (SE, ES, AP, AE), four verbs were selected randomly from a large corpus of German interpersonal verbs (see Rudolph & Försterling, 1997), with the restriction that the verbs were easy to comprehend even for the youngest age group. Half of the verbs had a positive valence (e.g., “to comfort”), whereas the other half had a negative valence (e.g., “to scare”). The pictures for the corresponding interpersonal events were taken from illustrations in children’s books, which were modified in two respects: First, the interactants were presented in a gender-neutral way, as gender may affect causal attributions (e.g., LaFrance, Brownell, & Hahn, 1997). Second, both interaction partners were identical in size, as larger persons might be viewed as causally more important. All materials are available from the author upon request.

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2 To test whether the causal judgments of the interpersonal events as described in the sentences were influenced by the presentation of the pictures, we conducted a pilot study with N = 50 adult participants. Half of them made attributions for the interpersonal events when they were only described by the sentences, the other half received the same sentences accompanied by the illustrating pictures. Mean attributions for each verb class were almost identical for these two groups of participants (all t values < 0.5; p > .80).
Coding of Answers

The two experimenters (who were blind to the hypotheses) coded the participants’ answers on a protocol sheet.\(^3\) Attributions to the sentence subject versus object were coded as “1” and “2,” respectively, and were subsequently averaged for each experimental condition. Thus, lower values indicate attributions to the sentence subject, and higher values indicate attributions to the sentence object. Consensus and distinctiveness answers were coded from 1 to 4, with 1 = “only one,” 2 = “few,” 3 = “many,” and 4 = “all.” Note that low consensus values imply low consensus in Kelley’s (1972) sense (few persons perform this action or experience this state) and high values indicate high consensus (many persons perform this action or experience this state). In contrast, low distinctiveness values refer to high distinctiveness in Kelley’s sense (e.g., this child admires only one child), and high values imply low distinctiveness (e.g., this child admires many other children). To estimate the reliability of the codings, the sessions were tape-recorded and the experimenters coding was subsequently compared with that of a second coder, who was blind to both the hypotheses and the experimental conditions. Inter-rater reliability was nearly perfect (Cronbach’s \(\alpha = .98\)).

Results

Treatment of Data

We conducted both frequency-based (i.e., \(\chi^2\)) analyses as well as ANOVAS for all dependent variables. No differences were obtained between the two kinds of analyses. Therefore, for the sake of simplicity, we will only report the results of the analyses of variance. In these analyses, the independent variables were verb type and age group; the dependent variables were the mean attribution, consensus and distinctiveness judgments for each experimental condition (these means were normally distributed). Additional analyses were conducted to test for possible effects of verb valence, sex of participants, and order of presentation. None of these variables had an effect on any of the dependent variables; hence, these are not considered further.

Attributions

A two-factorial 4 \(\times\) 4 analysis of variance with age group and verb type as independent variables revealed a significant effect of verb type, \(F(3, 48) = 70.58, p < .001\), \(\eta^2 = \ldots\)

| Table 1. Mean attribution, consensus, and distinctiveness judgments by age group and verb type, Experiment 1 |
|-------------------------------------------------|-------|-------|-------|-------|
| Attributions                                    | AP    | AE    | SE    | ES    |
| Age group 1                                     | 1.3\(^a\) | 1.9\(^b\) | 1.3\(^a\) | 1.8\(^b\) |
| Age group 2                                     | 1.2\(^a\) | 1.9\(^b\) | 1.3\(^a\) | 1.8\(^b\) |
| Age group 3                                     | 1.3\(^a\) | 1.6\(^b\) | 1.2\(^a\) | 1.7\(^b\) |
| Age group 4                                     | 1.2\(^a\) | 1.6\(^b\) | 1.3\(^a\) | 1.6\(^b\) |
| \(M\) (rating)                                  | 1.2\(^a\) | 1.8\(^b\) | 1.3\(^a\) | 1.7\(^b\) |
| Consensus                                       | AP    | AE    | SE    | ES    |
| Age group 1                                     | 2.0\(^a\) | 2.8\(^b\) | 2.0\(^a\) | 3.1\(^b\) |
| Age group 2                                     | 1.6\(^a\) | 2.7\(^b\) | 1.8\(^a\) | 2.7\(^b\) |
| Age group 3                                     | 1.8\(^a\) | 2.5\(^b\) | 2.0\(^a\) | 2.6\(^b\) |
| Age group 4                                     | 1.8\(^a\) | 2.3\(^b\) | 1.7\(^a\) | 2.4\(^b\) |
| \(M\) (rating)                                  | 1.8\(^a\) | 2.6\(^b\) | 1.9\(^a\) | 2.7\(^b\) |
| Distinctiveness                                 | AP    | AE    | SE    | ES    |
| Age group 1                                     | 2.8\(^a\) | 2.1\(^b\) | 2.8\(^a\) | 2.4\(^b\) |
| Age group 2                                     | 2.4\(^a\) | 2.1\(^b\) | 2.5\(^a\) | 2.0\(^b\) |
| Age group 3                                     | 2.1\(^a\) | 2.1\(^b\) | 2.5\(^a\) | 2.1\(^b\) |
| Age group 4                                     | 2.6\(^a\) | 1.7\(^b\) | 2.7\(^a\) | 2.0\(^b\) |
| \(M\) (rating)                                  | 2.5\(^a\) | 2.0\(^b\) | 2.6\(^a\) | 2.1\(^b\) |

Note. Means with different subscripts are significantly different (planned contrasts, \(p < .05\)).

\(^3\) The coding of the children’s answers was predominantly unproblematic. For example, a typical answer to the question why one child surprised another child was: “Because the child here with the book [the child points to that child] is reading out a silly joke.” However, in a few cases, further prodding was necessary to obtain a codable answer. For example, in response to the question why one child admired another, a participant answered: “Well, because this is really great.” The experimenter then repeated the question, upon which the child answered: “Well, he [pointing at the child who is admired] is great in soccer, and now he is admired by his class-fellow.”
As can be seen from Table 1, the data pattern was highly similar for all age groups: Children attributed interpersonal events described by AP and SE verbs predominantly to the sentence subject, whereas they attributed events described by AE and ES verbs predominantly to the sentence object. Planned contrasts ($p < .05$) were computed separately within each age group to test for differences between AP and AE verbs as well as between SE and ES verbs; all contrasts were significant.

In addition, there was a significant main effect for age group, $F(3, 48) = 4.91$, $p < .01$, $\eta^2 = .03$. As can be seen from Table 1, this effect was due to the fact that with increasing age, the mean subject attributions increased as well: The overall level (across all verb types) is $M = 1.6$ for the kindergarten children and the third-grade students, respectively, while it is $M = 1.5$ and $M = 1.4$ for the seventh-grade students and adults, respectively. That is, attributions were made slightly more often to the sentence object for the younger participants. No interaction effect between verb type and age group was obtained ($F < 1$).

Consensus and Distinctiveness

For *consensus*, there was a significant main effect of verb type, $F(3, 48) = 29.90$, $p < .001$, $\eta^2 = .36$. As can be seen from Table 1, participants perceived lower consensus for interpersonal events described by AP and SE verbs, and higher degrees of consensus for AE and ES verbs. All planned contrasts were significant at the .05 level. In addition, a significant main effect of age group was obtained, $F(3, 48) = 5.23$, $p < .01$, $\eta^2 = .04$, which reflected decreasing perceptions of consensus across age groups ($M = 2.5, M = 2.3, M = 2.3$, and $M = 2.0$, respectively). Finally, no interaction between verb type and age group was obtained.

For *distinctiveness* (see Table 1), a significant effect of verb type was obtained, $F(3, 48) = 26.46$, $p < .001$, $\eta^2 = .24$. Lower distinctiveness was obtained for AP and SE verbs, whereas higher scores were obtained for AE and ES verbs. No main effect of age group was found. However, an interaction effect between verb type and age group was obtained, $F(3, 48) = 4.06$, $p < .05$, $\eta^2 = .03$. This interaction reflected that the differences between the verb classes were not equally strong in the different age groups. Although the pattern of means was in the predicted direction in all age groups, follow-up tests (planned contrasts) showed that the difference between AP and AE verbs was not significant in age groups 2 and 3. All other planned contrasts were significant at $p < .05$.

Analyses of Covariance

Finally, we conducted analyses of covariance (ANCOVAs) to test whether the effect of verb type on attributions is indeed mediated by perceived covariation, as predicted by the covariation hypothesis. Two ANCOVAs were performed. In the first ANCOVA, attributions were the dependent variable, verb type and age group were the independent variables, and consensus and distinctiveness judgments served as covariates. This analysis revealed that (a) the effect of the covariates on the dependent variables was highly significant, with $F(1, 71) = 21.34$, $p < .001$, $\eta^2 = .28$; and (b) the effect of verb type on attributions was substantially reduced when consensus and distinctiveness were held statistically constant, $F(3, 71) = 6.11$, $p < .05$, $\eta^2 = .02$. In the second ANCOVA, which was conducted for control purposes, the role of covariate and dependent variable were reversed; that is, now attributions served as a covariate and consensus and distinctiveness judgments were the dependent variables (entered as a combined covariation index). In these analyses, and effect of the covariate was small, $F(1, 71) = 3.23$, $p < .05$, $\eta^2 = .01$, and the effect of verb type on covariation information remained almost unchanged, $F(3, 69) = 37.01$, $p < .001$, $\eta^2 = .30$.

Discussion of Experiment 1

The results of Experiment 1 confirmed that children as young as five years show similar attribution and covariation patterns as adults. These findings are in line with the hypothesis that perceived patterns of consensus and distinctiveness mediate implicit verb causality. Further supporting this hypothesis, the effects of verb type on attributions were greatly reduced when covariation was used as an additional predictor of attributions.

Experiment 2

Corrigan and Stevenson (1994) demonstrated that already children at the age of three and four years are able to perceive the causal structure of interpersonal events described by verbs. It remains unclear, however, whether children of this age have implicit knowledge about consensus and distinctiveness, and if so, whether these perceived covariation patterns predict their causal understanding. Pretests using the game situation created for Experiment 1 revealed that this experimental paradigm is unsuited for children at the age of three to four years: The number of verbs used was apparently too high and the use of different kinds of picture cards for the assessment of attributions and covariation appeared to be confusing for these younger children. Therefore, we developed a simplified variant of the procedure used in Experiment 1 to assess causal attributions and covariation beliefs.
Method

Participants

A total of 12 kindergarten children (6 girls and 6 boys; \( M = 3 \) years, 8 months) participated in this experiment. The children and their parents were contacted in the same way as in Experiment 1. The experiment was carried out in a silent room at the family’s home. Again, the subjects received a gift for their participation.

Design and Procedure

A one-factorial within-subjects design was used, with verb type as the independent variable (AP, AE, SE, and ES verbs). As in Experiment 1, attributions, consensus, and distinctiveness were the dependent variables. The procedure of Experiment 2 was similar to Experiment 1, except for the following changes.

First, we changed the event cards used in Experiment 1, by depicting the children on the event cards in different colors. Second, additional toy figures were used to illustrate the interpersonal events and to code the consensus and distinctiveness ratings. More specifically, when presenting an event card showing one child surprising another child, the surprising child was depicted in red color, whereas the surprised child was depicted in blue color. When the experimenter (blind to the hypotheses) explained the relevant events, she did so by using different kinds of toy figures, red ones for the sentence subject and blue ones for the sentence object. To illustrate, the experimenter first explained the relevant event by saying: “Look, this child [showing the red figure] surprises the other child [showing the blue figure]. Why does this happen?” If necessary, the experimenter rephrased her question. When the question remained unanswered, the experimenter coded the answer as a missing value and proceeded to the next event (overall, less than 0.5% of the responses were missing values). The assignment of colors to the sentence subject and sentence object was reversed for half of the participants.

Second, rather than using the consensus and distinctiveness cards used in Experiment 1, we used toy figures attached to pieces of cardboard. For the consensus information, 4 different cardboard figures were used, showing 1, 3, 6, or 12 figures, respectively. For the distinctiveness information, corresponding cardboard figures were used with figures in the color of the figure that had been used to refer to the sentence object in the previous attribution question. The experimenter then asked the children (here illustrated for “to envy”: (1) “How many other children envy this child?” [consensus] and (2) “How many other children does this child envy?” [distinctiveness]. To indicate the answer options, the experimenter pointed at the different cardboard figures in front of the child representing different levels of consensus and distinctiveness, respectively. The presentation order for the different consensus and distinctiveness cardboard was varied randomly. When the child pointed at one of the cardboard to indicate her/his answer, the experimenter verified the answer by asking, for example: “That is, you think that it is only one child that surprises this child?.” As in Experiment 1, the sessions were tape-recorded and an independent rater, blind to the hypotheses and experimental conditions, subsequently re-rated the answers of the children. Interrater reliability was Cronbach’s \( \alpha = .99 \).

Selection of Verbs

The eight interpersonal verbs used in Experiment 2 were selected from the verbs that had been used in Experiment 1, provided that children of this age were familiar with these verbs (as established in pretests; also see Appendix 1). These pretests suggested that eight events (i.e., two for each verb class) were about the maximum that children in this age were able to process within one experimental session.

Results

Preliminary analyses were conducted to test possible effects of verb valence, sex of participants, and the different order and color assignment conditions. None of these variables had an effect on any of the dependent variables; hence, they were ignored in the subsequent analyses.

Attributions

A one-factorial ANOVA was conducted for attributions with verb type as an independent variable. The effect of verb type was significant, \( F(3, 30) = 14.60, p < .001, \eta^2 = .58 \). As can be seen from Table 2, low values (i.e., attributions to the sentence subject) were obtained for AP and SE verbs, but high values (i.e., attributions to the sentence object) were found for AE and ES verbs. When comparing these results with those of Experiment 1, the overall level of object attributions is still higher (\( M = 1.7 \)) than that of the youngest group in Experiment 1 (\( M = 1.6 \)). Therefore, taken together, a linear decrease in object attributions is obtained across age groups.

### Table 2. Mean attribution and covariation judgments, Experiment 2

<table>
<thead>
<tr>
<th>Verb type</th>
<th>AP</th>
<th>AE</th>
<th>SE</th>
<th>ES</th>
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</thead>
<tbody>
<tr>
<td>Attribution</td>
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<td>1.9(^b)</td>
<td>1.3(^a)</td>
<td>1.9(^b)</td>
</tr>
<tr>
<td>Consensus</td>
<td>1.9(^a)</td>
<td>2.9(^b)</td>
<td>1.6(^a)</td>
<td>3.2(^b)</td>
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<tr>
<td>Distinctiveness</td>
<td>2.5(^a)</td>
<td>1.5(^b)</td>
<td>3.0(^a)</td>
<td>2.0(^b)</td>
</tr>
</tbody>
</table>

Note. Means with different subscripts are significantly different (planned contrasts, \( p < .05 \)).
Covariation Beliefs

For consensus, there was a significant effect of verb type, $F(3, 30) = 11.19, p < .001, \eta^2 = .38$. Children made lower judgments of consensus for AP and SE verbs, whereas they made higher ratings for AE and ES verbs (see Table 2). When comparing the results across the two experiments, a linear increase in consensus judgments is obtained for the younger participants. The overall level of consensus for this 3-year old group is higher than in the youngest group in Experiment 1 ($M = 2.8$ for the 3-year-old group as compared to $M = 2.5$ for the youngest group in Experiment 1). A significant effect of verb type was also obtained for distinctiveness, $F(3, 33) = 8.48, p < .001, \eta^2 = .32$. As expected, children perceived lower distinctiveness (i.e., higher ratings) for AP and SE verbs, and higher distinctiveness (i.e., lower ratings) for AE and ES verbs. The effects of verb types on attributions, consensus, and distinctiveness are consistently significant (planned pair-wise contrasts between the verb classes, with $p < .05$).

Analyses of Covariance

As in Experiment 1, analyses of covariance were conducted to test the hypothesis that causal judgments are mediated by perceived covariation. An ANCOVA with attribution as the dependent variable, verb type as the independent variable and distinctiveness and consensus judgments as covariates revealed that the formerly significant effect of verb type on attributions disappeared when covariation beliefs were statistically controlled, $F(3, 30) = 2.44, ns$. In contrast, when covariation judgments were the dependent variables and attributions the covariate, the effect of verb type remained almost unchanged, $F(3, 30) = 7.54, p < .01, \eta^2 = .28$.

General Discussion

Taken together, the two studies reported in this article found that children at the age of three to four years – who have just learned to understand and use the language to describe interpersonal events – already have knowledge concerning the implicit causality of interpersonal events. Moreover, these children perceive different patterns of covariation (consensus and distinctiveness) for different classes of interpersonal verbs, and these patterns correspond to those perceived by adults. Finally, if perceptions of implicit covariation beliefs are held statistically constant, the effect of verb type on causal attribution is substantially weakened. Thus, the covariation hypothesis – the assumption that the verb causality effect is mediated by different patterns of covariation implicit in the meaning of verbs – received strong support.

An additional, unanticipated effect obtained in our experiments was that younger children tend to attribute interpersonal events to the sentence object to a higher degree than older children. This effect was obtained for all verb classes; it is therefore independent of the verb schema used. As corresponding shifts were also obtained in the perception of consensus information, this age effect constitutes yet another line of support for the covariation hypothesis. A possible explanation of this finding is that the interpersonal verbs used in the present experiments were selected from children’s books and were intended to describe interpersonal actions and states especially relevant for the younger age groups. Consequently, these verbs represent actions and states typical for younger children (e.g., laugh at, catch, frighten). In these cases, the younger age groups are likely to use their own peer group as a standard of reference. This mechanism should increase perceived consensus in the younger age group, as children of this age are more likely to experience and witness these actions and states regularly. An increase in perceived consensus then should lead to a higher likelihood of object attributions.

This present findings conform well to other findings in the domain of implicit verb causality. First, a comprehensive review of the existing literature suggested that competing explanations of verb causality – especially explanations built around the notion that language determines thought – are not compatible with the data, whereas the covariation hypothesis is (Rudolph & Försterling, 1997). Second, the implicit verb causality effect is still obtained (though reduced in size) when explicit covariation information is present (Brown & Van Kleeck, 1989; Rudolph & von Hecker, 1997; Van Kleeck, Hillger, & Brown, 1988). This suggests that implicit and explicit covariation information are pitted against each other, and hints at the inescapable character of the implicit causality effect (for a summary, see Rudolph & von Hecker, 2006).

In sum, the present data provide additional evidence for the covariation hypothesis as an explanation of implicit verb causality. It appears, then, that different patterns of covariation are an implicit, schematic part of the meaning of interpersonal action and state verbs. Hence, the present studies suggest that thought, i.e., perceptions of consensus and distinctiveness as they are available in our observations of the social world, determines language. The meaning of words used to describe interpersonal relations is strongly shaped by our perceptions of the covariational structure of the social world (Heider, 1958).

Acknowledgments

Many thanks to Silvia Specht and Friedel Wolffhardt for the collection of the data, as well as to the LEGO GmbH (Germany) for generously sponsoring this research by providing the gifts for the children who participated in the experiments. Special thanks are due to Uschi Strömpf for her invaluable help in modifying the illustrations taken from the children’s books, and to Nadine Angermann and Rainer Reisenzein for their helpful comments on an earlier version of this manuscript. This research was supported by the Deutsche Forschungsgemeinschaft (AZ Ru 599/1–3).
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References


Appendix I

Verbs Used in Experiments 1 and 2

<table>
<thead>
<tr>
<th>Verb Type:</th>
<th>AP</th>
<th>AE</th>
<th>SE</th>
<th>ES</th>
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<td>protect*</td>
<td>comfort*</td>
<td>admire*</td>
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<tr>
<td></td>
<td>call (by phone)</td>
<td>congratulate*</td>
<td>surprise</td>
<td>yearn for</td>
</tr>
<tr>
<td>negative</td>
<td>take (sth.) away</td>
<td>accuse</td>
<td>distract</td>
<td>despise</td>
</tr>
<tr>
<td></td>
<td>hit*</td>
<td>laugh at</td>
<td>scare*</td>
<td>envy*</td>
</tr>
</tbody>
</table>

Note. Verbs marked with an asterisk were also used in Experiment 2. Please note that these are translations of German and may not always preserve the exact or full meaning of the German originals.

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