Verbs and nouns convey different types of motion in event descriptions*

ALAN W. KERSTEN

Abstract

This paper reviews the evidence for Kersten’s (1998a) theory of a division of labor between nouns and relational terms in the description of a motion event. According to this theory, nouns tend to convey intrinsic motion, or motion defined with respect to a frame of reference internal to the object carrying it out. Relational terms, on the other hand, tend to convey different types of motion from those conveyed by nouns. The prototypical relational term conveys extrinsic motion, or motion defined with respect to an external frame of reference. Even when verbs do convey intrinsic motion, the motions conveyed by such verbs are more general and abstract than the motions conveyed by nouns. Three lines of research provide support for this theory. The first demonstrates that word learners associate novel nouns with intrinsic motions and that they associate novel verbs with extrinsic motions. The second demonstrates that even when nouns and verbs are both associated with intrinsic motion, the way this motion is represented is different in the two cases. Finally, the third line of research provides evidence regarding the development of the division of labor, suggesting that it stems from a bias to associate novel words with novel referents.

Introduction

The event depicted in Figure 1 is probably quite familiar to the reader. In fact, most people have experienced it on many occasions. On the basis of this experience, one can probably make a number of inferences beyond the information that is depicted. For example, one may infer that there is some sort of predator or other large animal in the area, and that the rabbit is going into its hole for safety. The fact that one can identify this event as an example of a previously encountered class of events and that
one can use this identification to draw further inferences suggests that
one has a category for this type of event (Kersten and Billman 1997).

There is no one word in any language that adequately labels this
category, however. Language instead seems to have adopted the strategy
of using multiple words to describe complex events such as this one. As
a result, if one wanted another person to bring to mind this category of
events and one did not have a picture to show, one would probably use
a sentence such as “The rabbit went into its hole.” This may seem
obvious, but language would not necessarily have to be structured in this
way. For example, one can imagine a language in which there was a
different word to describe each category of events such as this one. For
example, such a language could have a word “elnugop” to label the event
category depicted in Figure 1. As pointed out by Talmy (1985), however,
such a language would require an immense vocabulary. In particular, it
would require a different word for each combination of semantic elements
such as figure, ground, and motion. For example, the word “elnugop”
would not apply to a fox going into its hole. Because such a language
would require an immense number of words, each of which would be
used very infrequently, such a language would be very difficult to learn.
This may explain why there do not seem to be any languages that have
adopted this strategy.

Given that language has instead adopted the strategy of using multiple
words to describe an event, an efficient use of these words would seem
to involve a division of labor among the different words in a sentence.
In particular, it would seem most efficient for different words to convey
different aspects of an event. In fact, such a division of labor was probably
suggested to the reader by his or her grade-school grammar teacher. In
particular, nouns may have been suggested to label persons, places, or
things, whereas verbs may have been suggested to label what those
persons, places, or things are doing. Thus, in the description of the event
depicted in Figure 1, the noun phrase, “the rabbit,” labels the actor in
the event, and the verb phrase, “went into its hole,” labels what the
rabbit is doing.

There is reason to believe, however, that this division of labor is too
simplistic. For example, even if someone who had never seen Figure 1

Figure 1. A familiar event
Different types of motion were presented with the sentence “The rabbit went into its hole,” he or she would probably picture a hopping motion such as the one depicted in Figure 1. There is nothing in the verb phrase, “went into its hole,” that would suggest a hopping motion. For example, if one were to hear the sentence, “The fox went into its hole,” one would probably not picture a hopping motion. The only difference between these two sentences is in the noun phrase. The fact that one pictures a hopping motion in the context of “rabbit” but not in the context of “fox” suggests that nouns as well as verbs convey motion information.

If both nouns and verbs convey motion information, does this mean that there is not in fact a division of labor between nouns and verbs? Kersten (1998a) proposed that there is a division of labor, just not the one suggested by one’s grade-school grammar teacher. According to Kersten’s division-of-labor theory, nouns typically convey intrinsic motions, or motions defined with respect to a frame of reference internal to the object carrying them out. For example, the noun “person” may be associated not only with a particular configuration of arms, legs, torso, and head, but also with the relative motions of those parts. Thus, one’s representation of a person may include the fact that the legs of a human move in a pendular fashion with respect to the hip, whereas the arms move in a pendular fashion with respect to the shoulder (Johansson 1973). Returning to the previous example, the noun “rabbit” may be associated with a hopping motion. In particular, a rabbit may be associated with alternating extensions and retractions of its back feet, accompanied by corresponding motions of the rabbit as a whole, first opposite to and then in the direction of the rabbit’s back feet. What these motions of a rabbit and a human have in common is that they do not require an external reference point, but rather can be defined solely in terms of the object carrying them out.

If nouns convey intrinsic motions, what is the role of relational terms such as verbs in the description of a motion event? Relational terms may convey different types of motion from those conveyed by nouns. According to Kersten (1998a), the prototypical relational term conveys extrinsic motion, or the motion of an object with respect to an external frame of reference, such as another object. For example, “entering” involves going inside some other object, whereas “passing” involves going by some other object. Evidence for the prototypicality of this type of relational term comes from a cross-linguistic analysis of verb meanings by Talmy (1985). According to Talmy, the most common type of verb across the world’s languages is the path-specifying verb. Such verbs convey the trajectory taken by an object with respect to an external reference point, such as another object. This is clearly an example of
extrinsic motion. Examples of languages in which this conflationary pattern is dominant are Romance languages such as Spanish and French, Semitic languages such as Arabic and Hebrew, and Japanese (Talmy 1991).

When path-specifying verbs are used, there is a clear division of labor between nouns and verbs, with verbs conveying extrinsic motion and nouns conveying intrinsic motion. For example, in the Spanish sentence *El conejo entró al hueco* ‘The rabbit entered the hole’, the verb conveys the extrinsic motion of the rabbit with respect to the hole. The noun, on the other hand, suggests a set of intrinsic motions that caused the rabbit to move along this path. In particular, the rabbit in all likelihood extended its back legs, causing the rest of its body to move in the direction opposite the back legs (i.e., forward and upward). In other words, on the basis of the noun ‘rabbit’ one can assume a hopping motion, in the absence of information suggesting otherwise.

The division of labor between nouns and relational terms is particularly clear in languages such as Spanish, in which the dominant verb type conveys extrinsic motion. The division of labor is less obvious but still present in other languages in which verbs more frequently convey intrinsic motion. Although Talmy (1985) has proposed that such languages are in the minority, there exist a number of prominent languages such as English, in which frequently used verbs such as “walking,” “running,” “hopping,” and “skipping” describe how the parts of an object move in relation to one another in order to achieve locomotion. Because these verbs describe the motions of the parts of an object with respect to the object itself, and provide no information about the motion of that object with respect to an external frame of reference, these verbs convey intrinsic motion.

Although both nouns and verbs convey information about intrinsic motion in languages such as English, there is evidence even in these languages for division of labor rather than redundancy in the use of nouns and relational terms. First, even in languages such as English, nouns are used to convey intrinsic motion and relational terms are used to convey extrinsic motion. The key difference between the English and Spanish conflationary patterns is simply that the relational terms that convey extrinsic motion in English are not verbs but rather verb particles and prepositions. For example, the Spanish sentence given above would likely be translated into English as “The rabbit went into the hole” or “The rabbit hopped into the hole.” The extrinsic motion conveyed by “entró” in Spanish continues to be conveyed by a relational term in English, namely the preposition “into.” Thus, in both English and Spanish, relational terms are used to convey the extrinsic motion of an
Different types of motion

object, but English allows for the optional specification of an additional level of detail through the use of intrinsic motion verbs.

Furthermore, evidence from English-language acquisition suggests that children view relational terms that convey extrinsic motion to be more essential than relational terms that convey intrinsic motion. In particular, the first relational terms used by children learning English are typically not verbs but rather verb particles such as “in,” “out,” “up,” “down,” “on,” and “off” (Choi and Bowerman 1991; Farwell 1977; Gentner 1982; Gopnik and Choi 1995; McCune-Nicolich 1981; Nelson 1974; Smiley and Huttenlocher 1995; Tomasello 1987). These verb particles are typically used by young children to convey extrinsic motion. For example, a child may say “down” as a request to be moved from a high chair to the floor, thus suggesting a path from one location to another. Children learning English typically do not start using intrinsic motion verbs such as “walk” and “run” until several months later. In fact, when children start producing multiword utterances, they often use verb particles in place of verbs, producing “sentences” such as “kitty down” and “leaf off my neck” (Tomasello 1987). Thus, in English as well as in Spanish, relational terms are used to convey extrinsic motion, and children learning English seem to view relational terms that convey extrinsic motion as the most important to convey. Therefore, from both a cross-linguistic and a developmental perspective, the use of relational terms to convey extrinsic motion would appear to be obligatory, whereas the use of relational terms to convey intrinsic motion would appear to be optional, consistent with a tendency to use relational terms that convey motion information that is different from that conveyed by nouns.

Second, even when verbs and nouns both convey intrinsic-motion information, the way this information is represented in verb meanings is quite different from the way it is represented in noun meanings. In particular, whereas the intrinsic motion associated with a noun may be quite specific to the object labeled by that noun, the intrinsic motion associated with a verb is typically much more general and abstract. For example, in the sentence “The man ran into the store,” both the noun “man” and the verb “ran” seem to be associated with particular modes of locomotion. The notion of running associated with “man” is very specific to humans, however, involving specific motions of the various limbs with respect to the body. The notion of running associated with “ran,” on the other hand, is much more general and abstract. For example, the motions conveyed by the verb “ran” vary dramatically in the different contexts provided by the sentences “The man ran into the store,” “The horse ran a good race,” “The politician ran for office,” and “The car’s engine ran for a few seconds and then sputtered out.”
It thus appears that although there are similarities between the types of motion conveyed by nouns and intrinsic motion verbs, there are also differences. These differences allow for the possibility of a division of labor not only between nouns and relational terms that convey extrinsic motion, but also for a division of labor between nouns and intrinsic motion verbs. The theory of Kersten (1998a) suggests one possible division of labor. Kersten proposed that most animate nouns are associated with a number of different intrinsic motions. For example, humans can carry out a variety of different intrinsic motions, such as “running,” “walking,” and “hopping,” which differ in the specific ways the various parts of the human body move with respect to one another in order to achieve locomotion. The role of an intrinsic motion verb, then, may be to select one of these intrinsic motions as being relevant in the given instance. The way this is accomplished in the theory is that each intrinsic motion verb is associated with a generic meaning. For example, the verb “running” in isolation may mean little more than “moving rapidly.” When a noun is used together with an intrinsic motion verb, the generic meaning of the intrinsic motion verb is compared to each of the specific intrinsic motions associated with the noun. The motion that best matches the verb is selected as the interpretation of the sentence. This mechanism explains why the same verb can carry markedly different meanings in the context of different nouns. In particular, the generic meaning of a verb matches different intrinsic motions when used with different nouns. For example, the verb “running” conveys motion on two legs when used with the noun “person,” but it conveys motion on four legs when used with the noun “horse” and the motion of engine parts when used with the noun “engine.”

The theory of Kersten (1998a) thus suggests that nouns as well as relational terms carry information about motion in the description of an event, and that there is a division of labor between nouns and different types of relational terms in the types of motion that are conveyed. I will next describe three experiments that provide support for the division-of-labor theory. The first experiment provides evidence for a tendency to associate nouns and verbs with different types of motion. In particular, it provides evidence of a tendency to associate nouns with intrinsic motions, and of a tendency to associate relational terms such as verbs with extrinsic motions. The second experiment provides evidence that even when nouns and verbs are both associated with intrinsic motions, the nature of those associations is different in the two cases. In particular, nouns are associated with the relative motions of the parts of particular objects, whereas verbs are associated with more general meanings that transcend individual objects. Finally, the third experiment provides
Different types of motion

Evidence of a developmental mechanism that may foster the creation of a division of labor between nouns and verbs in the description of a motion event.

Evidence for a division of labor between nouns and relational terms

Kersten (1998a) carried out a number of experiments to test the notion of a division of labor between nouns and relational terms in the description of a motion event. In particular, these experiments tested the prediction that nouns tend to be associated with intrinsic motions, whereas relational terms tend to be associated with extrinsic motions. This prediction was tested using a novel word learning task. Adult participants were presented with a number of novel, animated events on a computer screen. In each event, one character, hereafter referred to as the agent, moved into contact with a second character, hereafter referred to as the patient, causing a change in state in the patient. Each event was accompanied by a sentence involving a novel noun and a novel verb. For example, the event depicted in Figure 2 would have been accompanied by a novel sentence such as “The taigo is yimming.” The task was for participants to figure out what these novel words meant by relating them to attributes of the accompanying events.

The novel nouns and verbs were in fact related to a number of different attributes, some directly related to the predictions of the division of labor theory and some not directly related to the theory. The relations among the novel nouns and verbs heard by participants and the various attributes of the events are represented in Figure 3. One attribute that was not directly related to the predictions of the division-of-labor theory involved the appearance of one of the parts of the agent, namely its legs. As can be seen in the two leftmost columns of Figure 3, this attribute was sufficient to distinguish the four nouns heard by a participant. For example, the noun “zeebee” may have always accompanied an agent with two brown legs on each side of its body, whereas the noun “doovil” may have always accompanied an agent with three red legs on each side of its body. A second attribute that was not directly related to the predictions of the division-of-labor theory was the state change of the patient. As can be seen in the two rightmost columns of Figure 3, this attribute was sufficient to distinguish the four verbs heard by a participant. For example, the verb “morping” may have always accompanied a rotation of the patient, whereas the verb “spogging” may have always accompanied a shrinking of the patient. The purpose of these two attributes was to provide participants with a natural way to tell the four nouns and the
Figure 2. Three frames of an example event from Experiment 5 of Kersten (1998a). This event would have been accompanied by a sentence involving a novel noun and verb, such as “The taigo is yimming.” In this first frame, the agent, in the lower right-hand corner of the screen, starts moving on an indirect path toward the patient, in the upper left-hand corner. In the second frame, the agent has turned and is now heading directly toward the patient. In the third frame, the agent has just come into contact with the patient, causing the patient to expand. As it does this, the patient moves away from the agent, which remains at the point of contact with the patient. Animated examples of these stimuli are available on the world wide web at http://www.psy.fau.edu/akersten/jepgen/
Different types of motion

Figure 3. Relations among the novel nouns and verbs heard by participants and the attributes of the events seen by participants in Experiment 5 of Kersten (1998a). The set of attribute values that went with a particular word can be determined by following the arrows leading from that word. For example, the noun “zeebee” always went with an agent with two brown legs on each side of its body, it always moved those legs by angling one leg forward as the other angled back, and it always moved on a path directly toward the patient (A = Agent and P = Patient in the column labeled “Path”). The verb “wunking,” on the other hand, always involved an event in which the patient flashed on and off after contact with the agent, it always involved an indirect path of the agent toward the patient (see Figure 2), and it always involved a leg motion in which the agent angled its legs forward and back in synchrony. Given this pattern of relations, a total of eight different sentences were possible. In particular, the nouns “zeebee” and “doovil” combined interchangeably with the verbs “morping” and “spogging,” yielding four possible sentences, and the nouns “racha” and “taigo” combined interchangeably with the verbs “yimming” and “wunking,” yielding four more possible sentences. Each of these sentences was presented ten times during the learning phase of the experiment, yielding a total of eighty learning events. The order of presentation of these different sentences (and their corresponding events) was determined randomly for each participant. It should be noted that this figure only represents the correlations for an example participant, as the particular values of each attribute that went with a given word were assigned randomly for each participant.

four verbs apart independently of the attributes of primary interest. Thus, participants were not forced by the experimental task to associate either nouns or verbs with the attributes of interest. As a result, if they did associate nouns or verbs with the attributes of primary interest, they did it because it was natural for them to do so.
The two attributes of primary interest were the path of the agent with respect to the patient and the leg motion of the agent as it moved along this path. The path of the agent was an example of extrinsic motion because it was defined with respect to the patient. In particular, one path was directly toward the patient, whereas a second path was indirect, involving a motion to one side of the patient followed by a 90-degree turn to bring the agent into contact with the patient (see Figure 2). The leg motion of the agent was an example of intrinsic motion because it was defined with respect to the body of the agent. In particular, one leg motion involved angling the legs forward and backward with respect to the body, with one leg angling forward as the other angled back. This leg motion resembled the movements of the arms of a swimmer doing the American crawl. A second leg motion again involved angling the two legs forward and backward, but with this leg motion both legs angled forward (and then backward) at the same time. This leg motion thus more closely resembled the motions of the arms of a swimmer doing the breaststroke.

As can be seen by following the arrows connecting the different columns in Figure 3, each noun and verb was always accompanied by a particular leg motion as well as a particular path. For example, the noun “zeebee” and the verb “morping” were always accompanied by the leg motion resembling the American crawl and a direct path, whereas the noun “taigo” and the verb “wunking” were always accompanied by the leg motion resembling the breaststroke and an indirect path. Because nouns and verbs were equally strongly related to these two different attributes, an unbiased learner would be expected to show the same patterns of association of nouns and verbs with these two different attributes. If the division-of-labor theory is correct, however, one would expect nouns to be more strongly associated with leg motions than with paths, whereas one would expect verbs to be more strongly associated with paths than with leg motions.

Participants saw a total of eighty learning events in which these relations were present. They were then tested on their learning of these relations by presenting them with pairs of events and asking them which event from each pair was the better example of a particular noun or verb. In these test events, participants were first presented with an event along with an isolated noun or verb. They were then presented with a second event along with the same noun or verb. The participant then indicated which of these two events was the better example of the presented word by clicking on one of two buttons on the computer screen, one labeled “first event” and the other labeled “second event.” The two events in a pair differed on only one of the relevant attributes in the
Different types of motion

927

experiment. For example, on a trial testing for knowledge of the relation between the verb “morping” and its associated path, a participant who was assigned the schema depicted in Figure 3 would have seen one event in which an agent moved on a direct path toward the patient, angling its legs forward and back in alternation as it moved, and caused the patient to rotate when the two came into contact. In the second event in this test trial, the same agent would have been depicted moving with the same leg motion, and this agent would again have caused the patient to rotate when the two came into contact. Unlike the first event, however, an indirect rather than a direct path would have been depicted. The participant would have heard the verb “morping” in isolation as each of these two events was being presented. If a participant had no knowledge of which path had gone with this word during learning, he or she would be expected to choose the event involving the correct path about 50% of the time. If a participant did have some knowledge of this relation, on the other hand, he or she would be expected to choose the correct event (e.g. the one involving the direct path) more than 50% of the time.

The results of this experiment are depicted in Figure 4. As can be seen, participants revealed greater knowledge of relations between verbs and paths than between verbs and leg motions, consistent with a tendency to associate relational terms with extrinsic motions. On the other hand, they revealed greater knowledge of relations between nouns and leg motions than between nouns and paths, consistent with a tendency to associate nouns with intrinsic motions. These results are consistent with the division-of-labor theory. It is important to note that a tendency to associate verbs with extrinsic motions was found even though the participants in this experiment were native English speakers, and thus had a large

![Figure 4](image.jpg)

Figure 4. Results from Experiment 5 of Kersten (1998a). The y-axis depicts the percentage correct in the test events, where 50% reflects chance performance and 100% reflects perfect performance. Error bars reflect standard errors.
repertoire of intrinsic-motion verbs. Thus, even speakers of a language such as English appear to view relational terms that convey extrinsic motion as the prototypical relational terms.

**Different representations of intrinsic motion in noun and verb meanings**

The results of Kersten (1998a) provide evidence of a tendency to use relational terms to convey different types of motion from those conveyed by nouns. In particular, they provide evidence that nouns tend to be associated with intrinsic motions, whereas relational terms such as verbs tend to be associated with extrinsic motions. The second experiment to be reviewed here was designed to test the prediction that even when nouns and verbs are both associated with intrinsic motion, the way this motion is represented in verb meanings is very different from the way it is represented in noun meanings. In particular, it was designed to test the prediction that the representation of intrinsic motion in noun meanings is specific to particular objects, whereas the representation of intrinsic motion in verb meanings is more general and not tied to particular objects.

The reason that the representation of intrinsic motion in noun meanings is specific to particular objects is related to the reason that nouns are associated with intrinsic motions in the first place. According to Kersten (1998a), the reason why nouns are associated with intrinsic motions is that there is a close relationship between intrinsic motion and the static structure of an object. In particular, the structure of an object constrains the possible intrinsic motions it can exhibit. For example, people walk on two legs because the structure of the human body is conducive to this mode of locomotion, whereas dogs walk on four legs because this is more consistent with their body structure. Thus, the structure of an object determines the set of intrinsic motions it can engage in.

The intrinsic motions of an object also influence its static structure. For example, one reason why humans have evolved strong hind limbs and an upright posture is to allow bipedal locomotion. Intrinsic motions thus influence object structure on an evolutionary time scale. Intrinsic motions also influence object structure on a shorter time scale. In particular, intrinsic motions determine the set of configurations of parts that an object can exhibit. For example, the two objects depicted in Figure 5 are composed of the same parts, but have different configurations of those parts and thus different shapes because they have moved those parts in different ways. Intrinsic motion can thus be restated as involving changes to the shape of an object over time. Given the evidence that children
Different types of motion

Figure 5. A demonstration of how two objects composed of the same parts can have different overall shapes if those parts move in different ways with respect to one another.

associate nouns with the shapes of objects (e.g. Landau et al. 1988), it would be surprising if people did not also associate nouns with changes to the shape of an object.

People may thus associate nouns with intrinsic motions because there is a close relationship between intrinsic motion and object structure. To test this idea, Kersten and Billman (1995) examined whether the association between nouns and intrinsic motions was dependent upon the static structure of an object. In particular, they tested whether the association of nouns with intrinsic motions was dependent upon the appearance of the parts that carried out those motions. As discussed above, one reason why the parts of an object have evolved a particular structure is because this structure is conducive to a particular kind of intrinsic motion. Thus, it may not be unreasonable to expect that two objects that share similar parts may also share similar ways of moving those parts. For example, if one were to encounter a new animal that had something akin to wings, one would expect this animal to fly. On the other hand, one may not expect two objects with very dissimilar parts to move in exactly the same way. Thus, one may only expect the set of creatures labeled by a noun to share the same intrinsic motion when there is similarity across those creatures in the appearance of the parts responsible for that motion.

To test this prediction, Kersten and Billman (1995) contrasted the performance of two conditions. In the related legs condition, all of the objects labeled by a particular noun shared the same type of legs and moved those legs in the same way. The intrinsic motion of an object was thus related to the static structure of the object, and as a result participants in the related legs condition were predicted to associate nouns not only with the static structure of an object but also with the intrinsic motions of that object. In contrast, in the random legs condition, all of the objects labeled by a particular noun moved their legs in the same way, but the appearance of the legs that carried out that leg motion varied randomly from individual to individual. The intrinsic motion of an object was thus unrelated to the static structure of the object. As a
result, participants in the random legs condition were predicted to have difficulty noticing the relation of nouns to intrinsic motions.

The participants in the related legs condition saw stimuli similar to those of Kersten (1998a). As in Kersten (1998a), the four nouns to be learned by a participant could only be fully differentiated on the basis of the appearance of the legs of the agent in each event. For example, as depicted in Figure 6, the noun “zeebee” may have always accompanied an agent with two brown legs on each side of its body, whereas the noun “doovil” may always have accompanied an agent with three red legs on each side of its body. As in Kersten (1998a), nouns were also related to an intrinsic motion attribute, namely the motions of the legs with respect

<table>
<thead>
<tr>
<th>Noun</th>
<th>Legs</th>
<th>Leg Motion</th>
<th>Path</th>
<th>Orientation</th>
<th>Verb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zeebee</td>
<td><img src="image" alt="Zeebee Legs" /></td>
<td><img src="image" alt="Zeebee Leg Motion" /></td>
<td><img src="image" alt="Zeebee Path" /></td>
<td><img src="image" alt="Zeebee Orientation" /></td>
<td><img src="image" alt="Zeebee Verb" /></td>
</tr>
<tr>
<td>Doovil</td>
<td><img src="image" alt="Doovil Legs" /></td>
<td><img src="image" alt="Doovil Leg Motion" /></td>
<td><img src="image" alt="Doovil Path" /></td>
<td><img src="image" alt="Doovil Orientation" /></td>
<td><img src="image" alt="Doovil Verb" /></td>
</tr>
<tr>
<td>Rachda</td>
<td><img src="image" alt="Rachda Legs" /></td>
<td><img src="image" alt="Rachda Leg Motion" /></td>
<td><img src="image" alt="Rachda Path" /></td>
<td><img src="image" alt="Rachda Orientation" /></td>
<td><img src="image" alt="Rachda Verb" /></td>
</tr>
<tr>
<td>Taigo</td>
<td><img src="image" alt="Taigo Legs" /></td>
<td><img src="image" alt="Taigo Leg Motion" /></td>
<td><img src="image" alt="Taigo Path" /></td>
<td><img src="image" alt="Taigo Orientation" /></td>
<td><img src="image" alt="Taigo Verb" /></td>
</tr>
</tbody>
</table>

Figure 6. Relations among the novel nouns and verbs heard by participants and the attributes of the events seen by participants in the related legs condition of Kersten and Billman (1995). The set of attribute values that went with a particular word can be determined by following the arrows leading from that word. For example, the noun “zeebee” always went with an agent with two brown legs on each side of its body, it always moved those legs by angling one leg forward as the other angled back, and it always moved on a path directly toward the patient (A = Agent and P = Patient in the column labeled “Path”). The verb “wunking,” on the other hand, always involved an event in which the agent moved sideways to its right, it always involved a path of the agent directly away from the patient, and it always involved a leg motion in which the agent angled its legs forward and back in synchrony. It should be noted that this figure only represents the correlations for an example participant, as the particular values of each attribute that went with a given word were assigned randomly for each participant.
Different types of motion

to the body of the agent, and an extrinsic motion attribute, namely the path of the agent with respect to the patient. For example, “zeebees” and “doovils” may have always angled their legs forward and back in alternation, and moved on a path directly toward the stationary character in each event. In contrast, “rachas” and “taigos” may have always angled their legs forward and back in synchrony, and moved on a path directly away from the stationary character. Because the intrinsic motion of an object was related to the static structure of the object, participants were expected to associate the noun that labeled an object not only with the static characteristics of the object but also with the intrinsic motions of the object.

The random legs condition was identical to the related legs condition except that the appearance of the legs of the agent varied randomly from event to event, and the appearance of the head of the agent instead differentiated the four nouns. For example, as depicted in Figure 7, the

![Figure 7](image-url)
noun “zeebee” may have always accompanied an agent with a round red head and round yellow eyes, whereas the noun “taigo” may have always accompanied an agent with green eye stalks and rectangular yellow eyes. As in the related legs condition, nouns were also related to the leg motions of the agent as well as the path of the agent with respect to the patient. Because the appearance of the legs varied randomly, however, the leg motion that went with a given noun was carried out by different sets of legs in different events. For example, the noun “zeebee” may have always accompanied a creature that angled its legs forward and back in alternation, as depicted in Figure 7. Sometimes the legs that carried out this motion were two thick green legs, one on each side of the bug’s body, as depicted in Figure 7. In other events, however, this leg motion was carried out by six thin red legs, three on each side of the bug’s body. Participants in this condition were thus predicted to have difficulty noticing the relation of nouns to intrinsic motions, because they would not expect a set of creatures with very different legs to all move those legs in exactly the same way. Thus, the association of nouns with intrinsic motions was predicted to be dependent upon consistency in the appearance of the parts responsible for those motions, suggesting a close relationship between intrinsic motion and static object structure.

Kersten and Billman (1995) also tested whether the association of verbs with intrinsic motions was related to the appearance of the parts that carried out those motions, or whether the association of verbs with intrinsic motions was more general in nature. The experiment of Kersten (1998a) described above, however, revealed only a weak association of verbs with intrinsic motions. Thus, in order to examine the nature of the association of verbs with intrinsic motions, steps had to be taken to increase the level of association of verbs with intrinsic motions. Other experiments by Kersten (1998a) revealed that associations of verbs with intrinsic motions were stronger when verbs could not be differentiated in terms of a prototypical verb attribute such as path or state change, but rather could only be differentiated in terms of a less prototypical verb attribute. It appears that when verbs could be fully differentiated in terms of paths or state changes, participants discovered these relations very quickly and subsequently stopped looking for further information to associate with verbs, thus failing to notice the relation of verbs to intrinsic motions. When verbs were differentiated in terms of a less prototypical verb attribute, on the other hand, participants were more likely to notice the relation of verbs with intrinsic motions before discovering the attribute that fully differentiated verbs. Thus, in order to increase the level of association of verbs with intrinsic motions, in Kersten and Billman (1995) verbs were differentiated not in terms of state changes but rather
Different types of motion

Different types of motion in terms of a less prototypical verb attribute, namely the orientation of the agent as it moved. For example, as depicted in Figures 6 and 7, the verb “spogging” may have been associated with moving head first, the verb “yimming” may have been associated with backing up, and the verbs “morping” and “wunking” may have been associated with moving sideways to the left and right, respectively.

Although verbs could only be fully differentiated in terms of orientation, verbs were also related to an intrinsic-motion attribute, namely leg motion, and an extrinsic-motion attribute, namely path, just as in Kersten (1998a). Kersten and Billman (1995) thus allowed a further test of the prediction that verbs should be associated more strongly with extrinsic motion than with intrinsic motion. Moreover, by comparing performance in the related legs condition and in the random legs condition, one could also test whether the association of verbs with intrinsic motions was dependent upon consistency in the parts that carried out those motions. In particular, in the random legs condition, any of the four sets of legs could be seen carrying out the leg motion that went with a given verb. In contrast, in the related legs condition, only two sets of legs could be seen carrying out the leg motion that went with a particular verb. For example, as can be seen in Figure 6, the leg motion associated with “morping” was only carried out by the legs associated with the nouns “zeebee” and “doovil.” The related legs condition thus involved greater consistency in the parts that carried out intrinsic motions. As a result, if the association of verbs with intrinsic motions is dependent upon consistency in the parts that carry out those motions, then one would expect to see stronger associations of verbs with intrinsic motions in the related legs condition than in the random legs condition.

Participants were tested on their knowledge of nouns and verbs in the same manner as in Kersten (1998a). The results are depicted in Figures 8 and 9. As can be seen in Figure 8, when the set of creatures labeled by a noun all shared the same type of legs, participants associated nouns not only with the appearance of those legs but also with the motions of those legs with respect to the body of a creature. In replication of Kersten (1998a), participants associated nouns with these leg motions more strongly than with paths, providing further evidence of a tendency to associate nouns with intrinsic motions. In contrast, as can be seen in Figure 9, when the appearance of the legs of a creature varied randomly and only the heads of creatures could be used to differentiate the four nouns, participants failed to reveal significant knowledge of relations between nouns and leg motions. Thus, participants associated nouns with intrinsic motions only when the parts responsible for those motions had
Figure 8. Results of Kersten and Billman (1995). Performance in the condition in which the four nouns heard by a participant were related to the appearance of the legs of the agent. The y-axis depicts the percentage correct in the test events, where 50% reflects chance performance and 100% reflects perfect performance. Error bars reflect standard errors.

Figure 9. Results of Kersten and Billman (1995). Performance in the condition in which the appearance of the legs of the agent varied randomly and the four nouns were related to the appearance of the head of the agent. See Figure 8.

In contrast to nouns, participants associated verbs more strongly with paths than with leg motions, consistent with a tendency to associate verbs with extrinsic motions. Participants also revealed significant knowledge of associations of verbs with leg motions, however. Furthermore, these associations of verbs with leg motions were unaffected by variation in the appearance of the legs. In particular, associations of verbs with leg motions were just as strong in the random legs condition as in the related legs condition. This finding suggests that even when nouns and verbs are both associated with intrinsic motion, the nature of this association is different in the two cases. In particular, the association of nouns with
Different types of motion reflects knowledge of particular parts moving in particular ways with respect to one another. In contrast, the association of verbs with intrinsic motions is more general and abstract, reflecting particular patterns of motion among object parts, regardless of the specific appearance of those parts.\(^3\)

**Development of the division of labor**

The results of Kersten (1998a) and Kersten and Billman (1995) provide evidence for a tendency of adults to use nouns and relational terms to convey different aspects of a motion event. Kersten (1998a) proposed a theory to explain the development of this division of labor. According to this theory, children learn at an early age that particular objects are associated with particular intrinsic motions. For example, they learn that people walk on two legs, dogs walk on four legs, frogs hop, and so on. The reason that these objects are associated with intrinsic motions is that intrinsic motions are related to and constrained by object structure.

In contrast to intrinsic motions, children do not associate objects with particular extrinsic motions. The reason that objects are not associated with extrinsic motions is that extrinsic motions are less constrained by object structure. For example, the structure of the human body provides little constraint regarding the paths that we may take. People can enter and exit equally well, as can seemingly all animate creatures, and thus no particular direction of motion is specifically associated with one’s concept of human. Children may thus associate objects and the nouns that refer to them with intrinsic motions but not with extrinsic motions.

As a result of this early learning of associations between nouns and intrinsic motions, children may subsequently expect further nouns to also be related to intrinsic motions. This would explain the tendency to associate nouns with intrinsic motions in the experiments of Kersten (1998a) and Kersten and Billman (1995).

How then can one explain the tendency to associate verbs with extrinsic motions? One can account for this tendency in terms of a bias to associate novel words with novel referents. There is ample evidence in the child word-learning literature of this bias, which has been given a number of names such as the principle of contrast, the mutual exclusivity constraint, and the novel-names-for-nameless-categories principle (Clark 1987; Golinkoff et al. 1992; Kersten et al. 1998; Markman and Wachtel 1988; Merriman and Bowman 1989). The general idea underlying all of these terms is that when one is presented with a novel word, one tries to associate it with something in the environment that does not already
have a label. Children learning verbs may thus focus on information that has not already been associated with nouns. If intrinsic motions are indeed associated with nouns, this would encourage children to focus on other types of motion, such as extrinsic motion.

Research by Kersten and Smith (2002) provides evidence supporting the prediction that children should attempt to associate verbs with information that has not already been associated with nouns. In this research, 3½- to 4-year-old children were presented with a novel verb learning task. Each verb was related not only to the motion of an object but also to the appearance of that object. For one group of children, these objects were familiar, and thus children had already associated these objects with nouns. In particular, the objects were cars and trucks. One verb, “morping,” always accompanied an event in which a car moved into contact with another object, namely a van. A second verb, “spogging,” always accompanied an event in which a truck moved away from the van. Thus, children could potentially have associated the novel verbs with the motions of the objects, the appearances of the objects, or both. For example, they could have associated “morping” with either moving into contact with another object, an event involving a car, or both. Because children were expected to already have labels for the objects (e.g. the car), however, they were expected to associate verbs with the motions of those objects (e.g. moving into contact with another object).

A second group of children was given the same task except that the objects were unfamiliar. In particular, they were the novel bug-like creatures used in Kersten (1998a) and Kersten and Billman (1995). One verb, “morping,” involved one type of agent moving toward the patient. The second verb, “spogging,” involved a second type of agent moving away from the patient. Because the objects seen by children in this condition were unfamiliar and unlabeled, children were predicted to associate verbs not only with the motion of an object but also with the appearance of an object. This experiment thus tested the general principle that children will associate verbs with information that has not already been associated with nouns.

Children were tested on the types of information that they associated with verbs by presenting them with a number of different test events. For each test event, children were asked “Is this one morping?” There were four different types of test events. Object + motion–match events were entirely consistent with prior examples of “morping.” Object-match events were consistent with prior examples of “morping” on the appearance of an object, but were inconsistent on the motion of that object. Motion-match events were consistent with prior examples of
“morping” on the motion of an object, but were inconsistent on the appearance of that object. Finally, no-match events were inconsistent with prior examples of “morping” on both the appearance of an object and its motion. The extent to which children associated verbs with the appearance of an object and its motion could thus be determined on the basis of their patterns of responses to these four different test types.

The results of Kersten and Smith (2002) are depicted in Figure 10. As can be seen in Figure 10, children in the familiar-objects condition associated verbs almost exclusively with the motions of objects. In particular, if the appearance of an object were changed in a test event (i.e. in the motion-match events), children were still quite likely to accept the event as an example of “morping.” If the motion were changed (i.e. in the object-match events), however, children were much less likely to accept it. On the other hand, children in the unfamiliar-objects condition performed quite differently. In particular, children associated verbs just as strongly with objects as with motions. Thus, children were less likely to accept an event as an example of “morping” if either the object or its motion were changed, and they were even less likely to accept an event if both the object and its motion were changed.

The results of Kersten and Smith (2002) are consistent with the idea that children tend to associate with verbs information that has not already been associated with nouns. In particular, when verbs were presented in the context of objects that already had noun labels, children ignored the appearance of the objects and associated verbs with what they were doing. In contrast, if verbs were presented in the context of unfamiliar, unlabeled objects, children focused as much on the objects themselves as on what the objects were doing. If children indeed associate nouns with

---

![Figure 10](image)

**Figure 10.** Results from Experiment 3 of Kersten and Smith (2002). The y-axis depicts the proportion of “yes” responses to the four different types of test questions. Error bars reflect standard errors.
intrinsic motions, this would suggest that they focus on other information when learning relational terms such as verbs. This would encourage the learning of extrinsic-motion–relational terms.

Although the prediction of facilitated learning of extrinsic-motion–relational terms in children was not directly tested in the study of Kersten and Smith (2002), there is evidence in the literature that is consistent with this prediction. In particular, there is evidence that children learn extrinsic-motion–relational terms earlier than intrinsic-motion–relational terms. For example, as described above, the first relational terms used by children learning English are typically not intrinsic-motion verbs such as “walk” and “run,” but rather extrinsic-motion verb particles such as “in,” “out,” “up,” “down,” “on,” and “off” (Choi and Bowerman 1991; Farwell 1977; Gentner 1982; Gopnik and Choi 1995; McCune-Nicolich 1981; Nelson 1974; Smiley and Huttenlocher 1995; Tomasello 1987). This developmental trend makes sense if one assumes that the motion of walking has already been associated with a noun (e.g. man) when children first start to learn relational terms. Children thus look to other types of motion when learning these relational terms, encouraging the acquisition of extrinsic-motion–relational terms.

Further evidence for facilitated learning of extrinsic-motion–relational terms comes from Korean, a language that more frequently uses verbs to convey extrinsic motions. Children learning Korean have been found to learn verbs at an earlier age than do children learning English (Choi and Bowerman 1991). In fact, Korean children seem to learn verbs at about the same time that English-speaking children learn verb particles. This cross-linguistic evidence is consistent with the idea that children selectively attend to extrinsic motion when learning relational terms. In particular, children may associate nouns with intrinsic motions at an early age, and thus a bias to associate novel words with novel referents may encourage children to focus on extrinsic motions in their subsequent acquisition of relational terms. If verbs indeed encode extrinsic motion, then these verbs are learned early. If verbs encode intrinsic motion, then children first learn other relational terms such as verb particles that encode extrinsic motion, and only later learn intrinsic-motion verbs.

Conclusions and future directions

The findings described in this paper are consistent with the idea of a division of labor between nouns and verbs in the description of a motion event. In particular, nouns tend to be associated with intrinsic motions, or motions defined with respect to a reference frame internal to the object.
Different types of motion

939
carrying them out. On the other hand, verbs and other relational terms
tend to be associated with extrinsic motions, or motions defined with
respect to an external reference frame. Furthermore, even when verbs are
associated with intrinsic motions, the nature of this association is different
from the association of nouns with intrinsic motions. In particular, the
association of nouns with intrinsic motions is specific to particular classes
of objects, whereas the association of verbs with intrinsic motions is more
general and abstract. A tendency to associate nouns and verbs with
different types of motion may stem from a bias to associate novel words
with novel referents, which encourages children to associate relational
terms with information that has not already been associated with nouns.
Children may associate objects with intrinsic motions starting at an early
age, with these objects eventually becoming labeled by nouns. A bias to
associate novel words with novel referents thus encourages children to
associate relational terms with other types of motion, such as extrinsic
motion.

It is important to note that the proposed tendencies for nouns to
convey intrinsic motions and for relational terms to convey extrinsic
motions are not absolute but rather probabilistic. Language is very
flexible, and offers a variety of devices for turning nouns into verbs and
verbs into nouns. Thus, there is by no means a perfect correlation between
the syntactic category of a word and the types of information that it
conveys. For example, the noun phrase “the fall” in the sentence “The
fall broke his leg” certainly conveys extrinsic rather than intrinsic motion,
whereas the verb “carted” in the sentence “He carted the books down
the hall” implicates the intrinsic motions associated with the noun “cart”
(i.e. wheels moving in relation to a connected flat surface). It is likely,
however, that the word “fall” was learned first as a verb and only later
converted by syntactic devices into a noun. Similarly, it is likely that the
word “cart” was learned first as a noun and only later converted into a
verb. These apparent exceptions to the proposed tendencies are thus in
fact quite consistent with the division-of-labor theory.

Although the correlation between syntactic category and meaning is
imperfect, there is a great deal of evidence to suggest that language
learners are able to abstract a central tendency for the meaning of a
given syntactic category, and to use this central tendency to guide their
learning of new examples of that category. For example, despite the
existence of nouns such as “event” and “justice” that do not refer to
objects, when presented with a novel noun to be learned, children and
adults alike tend to focus strongly on objects (Brown 1957; Kersten
Thus, despite the presence of exceptions, language learners seem to
consider objects to be the core of the noun-syntactic category. In this light, the primary contribution of the research described in this paper is to suggest that objects are not static entities, but rather are dynamic configurations that change in predictable ways. As a result, when language learners are presented with a novel noun to be learned, they focus not only on the static structure of an object but also the intrinsic motions of that object. Similarly, despite the presence of exceptions, the research described in this paper suggests that the prototypical relational term conveys a relation between objects (as opposed to relations among the parts of an individual object). Thus, when language learners are presented with a novel verb to be learned, they tend to focus on the extrinsic motions of an object.

A number of lines of research are currently in progress to follow up on these initial demonstrations of a division of labor between nouns and verbs. One line of research examines the idea that the role of an intrinsic-motion verb in the description of a motion event is to select from a number of intrinsic motions associated with a noun. It follows from this idea that the meaning of a verb will change more in the context of different nouns than the meaning of a noun will change in the context of different verbs. In particular, the verb will select different intrinsic motions in the context of different nouns, whereas the meaning of a noun will remain relatively stable despite changes in the verb. This idea is being tested by examining memory for nouns and verbs. Participants are presented with a series of noun–verb pairs and are later tested on their memory for the noun or the verb from each pair. Recognition of nouns is tested either in the context of the same verb that went with a given noun in the first part of the experiment, or in the context of a new verb. Similarly, recognition of verbs is tested either in the context of the same noun that went with a given verb in the first part of the experiment, or in the context of a new noun. Reinstatement of the same verb at retrieval as was present at encoding is predicted to have little effect on memory for nouns, because the meanings of nouns are presumed to be relatively stable despite changes in the verb. In contrast, memory for verbs is predicted to be strongly dependent upon reinstatement of the same noun that went with a verb at encoding, because the meanings of verbs are presumed to vary considerably in the context of different nouns.

A second line of research examines whether the explicit marking of intrinsic motion by verbs in languages such as English causes speakers of those languages to generally attend more strongly to manner of motion than do speakers of a language that does not explicitly mark intrinsic motion. According to the division-of-labor theory (Kersten 1998a), the prototypical relational term conveys information about extrinsic motion,
Different types of motion

and thus learners of a language will tend to focus on extrinsic motion when learning a relational term. This attention to extrinsic motion will be very beneficial to the learning of verbs in a language such as Spanish, in which verbs typically convey extrinsic motion. A child learning a language such as English, in which verbs often convey intrinsic motion, on the other hand, will have to overcome this tendency to focus on extrinsic motion and instead shift attention toward intrinsic motion in order to learn the meaning of a verb.

Research currently in progress examines whether learning to shift attention toward intrinsic motion in the context of verb learning encourages English speakers to generally attend more strongly to manner of motion than do Spanish speakers, even outside of a verb-learning context. This prediction follows from the linguistic relativity hypothesis (Whorf 1956), which suggests that one’s language influences one’s perception and conception of the world. In particular, one may learn to attend to attributes that are prominently marked in one’s language. Thus, in the present example, English speakers may learn to pay attention to manner of motion because this attribute is prominently marked in the English language, whereas Spanish speakers may not learn to attend as strongly to manner of motion because this attribute is less prominently marked in Spanish.

To test this prediction, English and Spanish speakers are presented with a simple category-learning task in which for some participants the categories to be learned can only be distinguished in terms of intrinsic motion, whereas for other participants they can only be distinguished in terms of extrinsic motion. Given that extrinsic motion is explicitly marked both in Spanish (by verbs) and in English (by verb particles and prepositions), the two groups are not predicted to differ in their learning of a category discrimination in terms of extrinsic motion. On the other hand, given that intrinsic motion is explicitly marked only in English (by verbs), English-speaking participants are predicted to attend more strongly than Spanish speakers to intrinsic motion, and thus to perform better than Spanish-speaking participants at learning a category discrimination in terms of intrinsic motion.

Preliminary results (Kersten and Rivera 2001) support these predictions. If these results are borne out in further experiments, it would suggest one reason why Spanish speakers learning English as a second language have difficulty distinguishing among English manner-of-motion verbs. For example, Spanish speakers often complain that they have difficulty telling apart simple English verbs such as “jumping” and “hopping” (Slobin 2001). One possible explanation for this difficulty is
that Spanish speakers have not learned to attend to intrinsic motion to the same extent that English speakers have, because learning the Spanish language does not require attention to intrinsic motion to the same extent as does learning the English language. As a result, Spanish speakers may not attend to the very information that distinguishes these verbs, making it difficult for them to tell those verbs apart.

Finally, a third line of research examines how intrinsic and extrinsic motions are processed at lower levels in the human perceptual system. The rationale for conducting this research is that language may tap into existing conceptual and perceptual representations rather than representing information in a completely different way. This proposal follows from the proposals of Barsalou (1999) and Langacker (1990) that complex concepts in language and thought are grounded in lower level perceptual representations.

If these proposals are correct, then the distinction between intrinsic and extrinsic motion may also be present at lower levels in the perceptual system. Kersten (1998a) proposed that the distinction between intrinsic and extrinsic motion may be related to the distinction between the “what” and “where” systems of perceptual processing (Ungerleider and Mishkin 1982), respectively. In particular, extrinsic motion may locate an object with respect to other objects in an external frame of reference. Intrinsic motion, on the other hand, may be more important in providing identifying information about an object, describing how the parts of an object relate to one another. This proposal suggests a resolution to a problem with Landau and Jackendoff’s (1993) discussion of the relation of language to the “what” and “where” systems. In particular, Landau and Jackendoff proposed that nouns and prepositions map onto the “what” and “where” systems, respectively, but they were not able to specify the relation of verbs to the two systems. If intrinsic motion and extrinsic motion indeed map onto the “what” and “where” systems, respectively, then different types of verbs may tap into different systems. In particular, extrinsic-motion verbs (e.g. “enter”) may tap into the “where” system, whereas intrinsic-motion verbs (e.g. “walk”) may tap into the “what” system. Experiments on the perception of these two types of motion are currently underway to determine their relation to these two systems of perceptual processing.

The division-of-labor theory thus not only accounts for the results of several lines of experimentation, but also makes novel predictions. It remains to be seen whether the specific division of labor described in this paper will be borne out in future experiments. It is highly likely that there exists some sort of division of labor between nouns and verbs in
Different types of motion

943

the description of a motion event, however, and it is probably not the one you learned in grade school.

Notes

* I would like to thank Dorrit Billman, Julie Earles, and Linda Smith for their valuable contributions to the research described in this paper. Correspondence address: Department of Psychology, Florida Atlantic University, Boca Raton, FL 33431-0991, USA. E-mail: akersten@fau.edu.

1. Although intrinsic-motion verbs may typically select from a number of intrinsic motions associated with a noun, there may also be cases in which an intrinsic-motion verb is paired with a noun that is not strongly associated with any particular kind of motion. For example, in the sentence “The garbage can rolled into the street,” the noun “garbage can” may not be strongly associated with any particular kind of motion. In cases such as these, rather than simply retrieving a stored intrinsic motion associated with the noun, a listener may have to piece together what must have happened on the basis of the meanings of both the noun and the verb. For example, one may infer that the garbage can must have been on its side, because its top and bottom are not rounded and thus do not support rolling, and that it must either have been rolling downhill or else it was being blown by a strong wind, because garbage cans do not move on their own. Thus, comprehending such sentences may be more of an active, problem-solving enterprise as opposed to the passive retrieval of a stored intrinsic motion associated with the noun. Once this action is experienced (or perhaps even imagined), however, this intrinsic motion may become associated with the noun, and thus passive retrieval may suffice in order to comprehend subsequent descriptions of this action.

2. One reason why the orientation of an object as it moves may not be a prototypical verb attribute is that it seems to be an example of intrinsic motion. For example, moving “head first” seems to involve moving in the direction faced by one’s head, whereas “backing up” involves moving in the direction of one’s back. Thus, this type of motion can be defined entirely with respect to the object carrying out that motion, making it an example of intrinsic motion. See Kersten (1998b) for evidence that this type of motion is not as readily associated with verbs as is a more prototypical verb attribute such as path.

3. Even the performance of the related legs condition when considered in isolation provides evidence for some generality in the association of verbs with intrinsic motions. In this condition, the leg motion associated with a given verb was carried out by creatures with two different sets of legs, and yet participants were able to generalize across these differences in the appearance of a given leg motion in order to associate that leg motion with verbs.

4. But see Kersten and Smith (2002) for a possible alternative explanation for these results.

5. It is currently a matter of debate whether nouns are in fact learned earlier than verbs in languages such as Korean. Some researchers (e.g. Gentner and Boroditsky 2001) argue that nouns are learned earlier than verbs in all languages, whereas others (e.g. Gopnik
A. W. Kersten and Choi 1995) argue that children learning Korean learn verbs earlier than nouns. A noun advantage is evident even in Korean, however, when a parental checklist rather than an interview method is used to measure a child’s vocabulary (Au et al. 1994). Regardless of how this controversy is resolved, it is clear that nouns are learned at least concurrently with verbs even in languages such as Korean, and thus if children are in the process of learning to associate nouns with intrinsic motions, there may be a tendency to focus on other types of motion when learning relational terms, encouraging the acquisition of extrinsic-motion verbs.

References


Different types of motion 945


