Abstract. The ability to conceptualize relational-roles and relational systems is central to several aspects of higher-order cognition. According to structure-mapping theory, relational category knowledge results from performing relational comparisons that are prompted by either natural invitations (spatio-temporal juxtaposition of exemplars) or cultural invitations (symbolic juxtaposition of exemplars). However, natural invitations are sparsely and contingently available in children’s natural environment, and the use of relational terms to generate symbolic juxtapositions is not generally effective for the younger child. This article proposes that the activity of pretend-play, instead of misrepresenting the world, offers a lens that allows children to focus on relational structures. During pretense, children use their own creativity to expand the availability of spatio-temporal juxtapositions. During dyadic pretend-play, care-givers use symbolic and tutorial-like methods in order to teach young children how to transfer relational knowledge.

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1. Introduction

Researchers in the cognitive sciences have recently converged on the importance of relational thinking in higher-order cognition. In particular, researchers agree that relational
category knowledge is central to causal-explanatory (Gentner & Medina, 1998; Ahn et al., 2000), analogical (Gick & Holyoak, 1983; Gentner & Kurtz, 2005), mathematical (Dixon & Bangert, 2004), perceptual (Kotovsky & Gentner, 1996; Green & Hummel, 2004), and creative (Gentner et al., 1997; Nersessian & Chandrasekhara, 2009) aspects of cognition. While the epistemic value of relational concepts is not controversial, how they are acquired during development is not well understood (Doumas, Hummel, & Sandhofer, 2008). This article builds on current research in the areas of pretense and comparison-based abstraction in order to develop a new proposal for the development of relational category knowledge. I argue that children’s common activity of pretending that one thing (e.g., a banana) is another (e.g., a telephone) requires them to focus on the causal importance of relational properties and, as a result, enables them to form concepts that are defined by relational properties rather than object-attributes.

The article proceeds as follows. In the next section I discuss the nature of relational categories and also a widely held view of how children acquire relational category knowledge. Section three offers two construals, one domain-specific and the other domain-general, of the developmental relationship between pretend-play and the learning of relational categories.

2. Relational Categories

A relational category is one whose members are united on the basis of relational properties rather than intrinsic properties.\(^1\) Gentner (2005, p. 246) distinguishes between relational role categories and relational schema categories (see Markman & Stillwell, 2001 for a similar distinction). The former, for example thief, predator, and president, consist of category

\(^1\) I will use the term “relational category” to denote a mind-independent class or kind. I will use the terms “relational concept” and “relational schema” to refer to epistemic structures that describe relational categories.
members that play the same role in a relational system. The latter, for example _robbery_, _ecosystem_, and _democracy_, are relational systems. Conceptualizing relational systems requires having a mental predicate that relates novel arguments (Doumas, Hummel, & Sandhofer, 2008; Gentner & Kurtz, 2005). For example, the relational predicate _chasing_ may take the arguments (dog, cat) in one context and the arguments (cat, mouse) in another, and understanding both as instances of chasing requires a representational matching of the relational symbol. Relational roles (e.g., pursuant) are defined by their superordinate relational systems (e.g., chasing). Concepts for relational-role categories therefore describe the roles that comprise relational systems.

Three aspects of relational categories are of particular interest. First, the elements of (scientific or folk) theory that warrant the most explanatorily useful generalizations and predictions are relational predicates that describe relational categories (Hempel, 1965; Carey, 1985; Gopnik & Meltzoff, 1997). For example, we explain how an ecosystem works in terms of relational roles such as _predator_ and _carrying capacity_; predict the motion of planets in terms of a _central force system_; and explain the _validity_ of an argument in terms of the relationship between premises and conclusion. Second, membership in a relational category is not generally conditional upon possession of surface, perceptual, and/or intrinsic features. Members of the relational category _predator_ include sharks, wasps, and leopards. The category _gift_ includes diamonds, flash-frozen steaks, and the act of naming a star after someone. On the other hand, members of object-categories exhibit substantial overlap of perceptual and intrinsic features.

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2 More pedestrian, we explain how a person can have a conversation with another person who is thousands of miles away in reference to the relational system of telecommunication but not in reference to the particular shape, color, or weight of a telephone.

3 There is the minimal condition that the object must possess whatever features are necessary to the performance of relational role. For example, a pursuant must possess features that allow movement. Markman and Stillwell call these “selection restrictions” (2001, p. 342). Certain relational role categories (e.g., gift) have very minimal selection restrictions.
Apples tend to have similar size and shape. Elephants each possess a trunk, are large, and have a grayish color. And so on.

Third, and most important for present purposes, relational categories are difficult to learn. Prior research indicates a learning bias during development in favor of object categories. According to the “career of similarity” thesis (Gentner & Ratterman, 1991), children initially respond to literal similarities within a domain (e.g., the similarity between a red ball and a red apple). Only after children gain domain experience are they able conceptually to isolate the relational features that define relational categories. This bias is also reflected in children’s linguistic development. Children learn object-terms before they learn relational terms, and when they are introduced to relational terms they initially interpret them as referring to concrete objects (Gentner & Ratterman, 1991). Learning relational terms is more challenging because their referents (in contrast to the referents of object terms) are not simply “out there in the experiential world” (Gentner & Kurtz, 2005, p. 156). Borrowing some terminology from the philosophy of mind, it is useful to frame this epistemic challenge in terms of the multiple realizability of relational categories (Fodor, 1968; Putnam, 1978). It is difficult to abstract the concept BARRIER because barriers are realized by concrete walls, cell membranes, and poverty. In fact, a common conceptual mistake is to identify a relational category with one of its realizers, as when a child identifies uncle with “a nice man with a pipe” (Gentner & Kurtz, 2005). Putnam’s and Fodor’s insight was that “Identity-Theorists” such as Smart (1959) and Place (1962) were guilty of a sophisticated version of this error when they mistakenly identified the relational category mental state with one of its object-level realizers, namely, brain states.

Children eventually undergo a “relational shift” and learn to conceptualize a domain in terms of relational concepts. Structure-mapping theory explains the relational shift in reference
to the processes of progressive alignment and re-representation. These processes occur as a result of representational alignment and mapping (see Kotovsky & Gentner, 1996; Gentner et al., 1995). When two structured representations are aligned and mapped, cognitive constraints act to promote the salience of relational information. Through this process, the aligned representations may be represented in order to centralize relational information. For example, the act of comparing the atom to the solar system can highlight the higher-order relation “the fact that a central object attracts peripheral objects causes peripheral objects to revolve around the central object”. In addition to learning about the atom, learners can develop a more abstract and explanatorily useful understanding of a central force system.4

Relational alignments are prompted both culturally and naturally. The former occurs when common labels symbolically juxtapose objects and induce relational comparisons. For example, labeling various cutting devices a “blick” across different contexts invites children to perform structural comparisons that result in the abstraction of a relational category (Gentner, 2005). The latter occurs when object or event pairs are either compresent or contiguous, such as a child’s repetitive act of knocking-over and reassembling a block tower (Gentner, 2005). Thus children’s opportunity to abstract relational knowledge is at the mercy of these natural and cultural invitations for relational alignment. As a result, the developmental gains produced by structural alignment are, as Gentner puts it, “largely constrained by luck” (Gentner, 2003, p. 221). I argue in the next section that children can overcome these constraints to some degree during pretense. By imaginatively augmenting the world around them, children can make their own luck for the availability of natural opportunities for structural alignment.

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4 See Kotovsky and Gentner (1996) for a more detailed discussion of the processes of progressive alignment and re-representation. See Falkenhainer et al. (1989) for an analysis of the computational mechanisms that underlie these learning processes.
3. Pretend-play and the development of relational thinking

3.1 The developmental paradox of pretense

A paradox surrounds the developmental value of pretend-play. On the one hand, pretense is a cultural universal (Taylor & Carlson, 2000), emerges reliably at around 18 months (Rubin et al., 1983), and consumes a significant portion of children’s unstructured time (Haight & Miller, 1993). On the other hand, pretense involves a misrepresentation of the surrounding environment, so it is not obvious what type of advantage this activity confers (see Leslie, 1987; Harris, 2001). In order to resolve this tension researchers have linked pretend-play to the development of several domain-general cognitive skills including semiotic ability (Vygotsky, 1978; McCune-Nicolich, 1981; Tamis-LeMonda et al., 1990), deductive reasoning (Dias & Harris, 1988) and counterfactual thought (Harris 2000). Researchers also investigate pretense in reference to the development of (domain-specific) theory-of-mind skill (Leslie, 1987; Harris, 2000; Lillard 2001). While there is an extensive literature on these proposals, research has yet to investigate a developmental correlation between pretend-play and relational category knowledge.

Pretense is often described as a zone of proximal development in which children rise above their normal capacities and, as a result, extend these capacities (Vygotsky, 1978; Lillard, 1993). One such capacity, though not put in these terms, is children’s ability to interpret a wide variety of object-level realizers for a given relational role. During pretense, children ascribe the same relational role to intrinsically dissimilar objects, as when both a banana and an empty soup-can play the role of a telephone. Outside of pretense, children are much more rigid in their interpretation of what objects can realize a relational role. It would be surprising if this pretense-
based precocity with relational properties did not correlate with the development of relational category knowledge. Below I provide two theoretical models for how the activity of pretend-play facilitates the acquisition of relational concepts. The first describes how pretend-play develops domain-specific relational knowledge. The second indicates how pretend-play develops a domain-general ability to engage in relational thinking.

3.2 Pretense and the development of domain-specific relational knowledge

Pretend-play is distinguished from other activities and other kinds of play on the basis of several necessary and defining properties (Lillard 1993, 1994, 2001; Harris 2000):

1. A pretender
2. A real or objective situation with which the pretend situation contrasts
3. The pretender’s mental representation of the pretense scenario
4. Projection of the pretense representation onto reality
5. The pretender’s awareness of the contrast between the pretense scenario and objective reality
6. The intention to pretend
7. Causal transformations within the pretend episode

To demonstrate these components, consider the classic example of a child pretending that a banana is a telephone. The child (1) forms a representation of a telephone (3) which contrasts

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5 While causal transformations within a pretend episode are not necessary for pretense, they are a ubiquitous feature of pretend-play.
with the real banana (2). The child intentionally (6) projects the phone representation onto the banana (4), and does so knowingly rather than mistakenly (5). The child then “receives a call” on the pretend phone and conducts a conversation (7).

In order to serve as a form of domain experience that facilitates relational concept acquisition, pretense must invite relational alignment and mapping between structured representations. Gentner (1989; 2005) distinguishes between two types of relational mapping, analogical projection and mutual alignment, both of which induce a relational focus and facilitate relational schema induction. During analogical projection, knowledge from one domain is carried over to another domain that is not well understood. During mutual alignment, two partially understood representations are juxtaposed and mapping is bi-directional. A common form of relational processing is a combination of these two in which a superficial, object-level match sanctions the mapping of relational information from one representation to another (Gentner, 1989, p. 202). For example, someone who encounters an unknown animal that is perceptually similar to a tiger may project the relation-role predicate predator from the TIGER representation onto a representation of the unknown animal.

I now describe how object-directed pretend-play exemplifies this combinatorial form of relational processing. In order to pretend that one object is another, children must first detect attribute (or superficial) similarities between the actual object and the pretend, substitute object. The degree of attribute overlap that is required in order for children to make this match varies with age and experience. Children under the age of three are able to pretend that a flat piece of wood is a comb because both the comb and the wood have a similar shape and size, but because a rubber ball does not share attribute features with a comb it fails to initiate substitute play (Elder & Pederson, 1978; see also Ungerer et al., 1981; Watson & Jackowitz, 1984). Putting this point
in representational terms, in order to initiate object-directed pretend-play children must match attribute features across two representations. For example, pretending that a banana is a telephone requires children to first match the attributes, *elongated, curved* and *medium-sized* across the representations TELEPHONE and BANANA (Fig. 1).

(a) **BANANA**

- **Attributes**: Elongated*, Curved*, Yellow, Medium-sized*, Smelly, Semi-hard
- **Relations**: Satisfies Hunger, Goes with Breakfast, Healthy, Edible

(b) **TELEPHONE**

- **Attributes**: Elongated*, Curved*, White, Medium-sized*, Hard
- **Relations**: Receives voice as input, Projects voice as output, Talking into one phone causes someone to hear a voice in another phone

Fig. 1. Shared attributes *elongated, curved, and medium-sized* in the representations of a banana and telephone.
After attribute similarity has been established, children can now substitute one object for another. Researchers typically explain pretend substitutions in terms of a transaction between representations, for example between the representations TELEPHONE and BANANA (Fein, 1975; McCune-Nicolich, 1981; Leslie, 1987). Because the behavior of a pretend object and the course of a pretend episode is determined by children’s real-world causal knowledge (see Harris & Kavanaugh, 1993; Harris, 2000) the transaction between representations must communicate causal information. Harris proposes that children use the following processing rule: while pretending, assume that pretend objects “are subject to the same causal principles as their real world equivalents” (2000, p. 23). A pretend phone, then, is subject to the same causal principles as a real phone.

Harris does not provide a detailed representational analysis of how real-world representations transmit this causal information. To provide such an analysis, it is important to take into account the different processing roles of attribute and relational information. Attribute information is useful for recognition and classification, as when tiger-like appearance causes a predator classification. As shown in Fig.1., this processing role of attribute features applies in the context of pretense as well. However, the attributes of a telephone (e.g., color and shape) do not explain what it will do, or what one ought to do with it. Rather, these questions depend on what the object is. If the object is a member of a relational category, then processing is guided by the relational information that is definitive of that category (Markman & Stillwell, 2001). Now, the various things that a child might do with a pretend phone (dial a friend, receive a call) are tasks that rely on the pretend-object’s membership in the category TELEPHONE – a category defined
by its role within a more global relational structure of telecommunication. Because the definitions of relational-role categories generally describe causal roles within a relational system (see Ahn et al., 2000), reference to this information offers an explanation of how children implement Harris’ processing rule during pretense.

This line of reasoning will require a representational model of pretense to describe a directional transference of relational information in order to explain children’s ability to understand the causal behavior of pretend objects. We know the source, or base, of the relational information in terms of the causal behavior of the pretend object. If one pretends to eat and peel a telephone, then one is mapping relational information encoded in a BANANA representation onto a representation of a phone. But if one is pretending to have a conversation through a banana, then one is mapping relational information from a TELEPHONE representation onto a representation of a banana.6 These relational predicates, carried over to the target, include *receives voice as input, projects voice as output*, and the higher-order relation *talking into one phone causes someone to hear a voice in another phone*. This mapping of relational information from a base representation to the target representation generates what can be termed a “Working Pretense Representation” (Fig. 2).

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6 A less common form of pretend-play may involve substitution of attribute features, such as when a child pretends that a yellow car is black (see Leslie, 1987 for a discussion of the attribution of pretend properties to objects). However, it is not clear that in cases like these attributes are being processed as predicates that take only one argument, e.g.: black (car). One has to look at the behavior of the pretending child. If the child pretends the car is black and then successfully “hides” the car at “nighttime”, it is likely that the child is processing the predicate as an argument value in a relational structure, e.g.: hides (Black, Car), in which case this is an example of relational-role pretend-play rather than attribute substitution.
Relations from base representation:
- Receives voice as input
- Projects voice as output
- Talking into one phone causes someone to hear a voice in another phone

Mapping Relations

Working Pretense Representation:
- Receives voice as input
- Projects voice as output
- Talking into one phone causes someone to hear a voice in another phone

Attributes
- Elongated
- Curved
- Yellow
- Medium-sized
- Smelly
- Semi-hard

Relations

PRETEND PHONE

Fig. 2. Working Pretense Representation for a pretend-phone, with attribute features from the BANANA representation and relational features transferred from the TELEPHONE representation.

This representational analysis of pretend substitutions construes pretending children as exploring the multiple realizability of relational properties: pretending a banana is a phone is much like imagining that something with the “hardware” (attributes) of a banana can realize the “software” (relational properties) of a telephone.

This model has important implications for the development of relational category knowledge. Children’s knowledge in the domain of telecommunication is initially conservative and contextually embedded. Prior to the relational shift in this domain, the concept TELEPHONE is extended only to objects that are, for example, superficially similar to a familiar
telephone. This fact explains why a banana, but not a sofa, is a candidate target for pretend substitution. Numerous studies reveal that while analogue retrieval is surface-driven, analogical mapping is structure-driven (Ross, 1987; Holyoak & Koh, 1987; Gentner et al., 1993). In this case, the attribute-similarity between banana and telephone bootstraps a relational mapping in which a system of causal relations from the child’s representation of telecommunication is carried over to a pretense-representation that allows appropriate processing of the banana and other aspects of the current play-environment. Following the developmental principles of structure-mapping theory, this mapping activity will induce a focus on the relational system of telecommunication and demote the importance of non-defining attribute features. The prediction is that with repeated play, children will re-represent this domain so that relational-causal features are central to the definition of the category and no longer conflated along with their familiar argument-values. Ironically, pretending that a banana is a telephone is instrumental to grasping that someone who is using a Bluetooth headset is talking on a telephone.

I now consider a more complex pretend-substitution in order to focus on how children can learn about the superordinate relational systems that provide definitions for relational-role categories. Harris describes a common type of pretend-play:

“Consider the following episode that we might enact in partnership with a 2-year-old. Having made a twiddling gesture at one end of a shoe box, we seat a Teddy Bear in the box. We ask ‘Where’s the soap?’, pick up a wooden brick and rub Teddy’s back with it. The 2-year-old joins in by lifting Teddy out of the box, announcing that, ‘He’s all wet’, and wraps him in a piece of paper” (Harris, 2000, p. 9).

Harris accounts for the child’s pretend behavior (e.g., wrapping the Teddy in paper) by appealing to the processing rule mentioned earlier. This case is more complicated than the previous,
however, because towels have numerous causal functions. In one instance a towel serves to separate a sun-bather from hot sand on a beach. In another it serves to dry a bathing toddler. Harris and Kavanaugh (1993) refer to different scripts (a bedtime script, a tea-party script, a mothering script), each of which encodes real-world causal principles that children can access in order to direct and understand pretend-play. According to the theoretical framework of relational categories, these knowledge structures are distinct relational systems that confer distinct relational roles onto objects. Thus a towel plays a certain relational-role in a bedtime relational system, and a different relational-role in a sun-tanning relational system. In order to participate in this episode of play, children must project their representation of the relational “bedtime-bathing” system from its familiar context onto a new context and new set of object-level realizers (Fig. 3).

Fig. 3. The relational structure of the bedtime-bathing schema defines the relational roles that are realized by soap, parent, water, bath, child, and towel. During pretend-play, this relational structure is mapped onto a novel set of realizers.
Prior to the relational shift in this domain, a child’s grasp of relational roles such as bather, bath, and cleanser is conflated with the objects that are the familiar realizers of these roles (e.g., oneself, the white rectangular tub, and the yellow bar of soap). During pretend substitution, the superordinate relational system in which these familiar realizers take part is projected onto a set of novel arguments. According to structure-mapping theory, this mapping activity will induce a focus on the defining roles that are common to the familiar and novel arguments. The implication is that continued play in this domain will enable children to centralize defining relational-roles rather than the non-defining attributes of particular arguments for these roles.7

To summarize: spatio-temporal juxtapositions of relational systems are sparsely and contingently available in the child’s natural environment. During pretense, children use their own creativity to generate additional spatio-temporal juxtapositions and map relational structures from familiar arguments to novel arguments. In this respect, pretending children can create their own luck for structural alignment opportunities and the learning of relational categories.

3.3 Abstracting relational knowledge while avoiding representational abuse

Any model of pretense must address what Leslie (1987) calls the problem of “representational abuse.” If during pretense the concept BANANA includes the predicate “receives voice as input,” then a long-term confusion about bananas may occur. Leslie argues

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7 This analysis of the development of domain-specific relational knowledge may also account for the correlation between role-play and theory-of-mind skill (see Lillard, 2001 for discussion of these correlational studies). If pretend-role play involves mapping cognitive-behavioral representations from a familiar to a less familiar domain (e.g., projecting one’s own “desire for Mommy” onto a doll), then resulting schema induction could facilitate a theoretical transition from, e.g., a desire-theory to belief-desire theory (see Wellman et al., 2001 for a discussion of the conceptual-change approach to theory-of-mind development).
that children avoid representational abuse by utilizing quarantined, “secondary” representations. Similarly, Harris and Kavanaugh (1993) and Harris (2000) theorize that children “flag” pretense representations for “pretend-use only.” With respect to the model advanced here, the worry is that, in addition to centralizing relational properties, children will over-extend their interpretation of what objects actually realize these properties.

This result can be avoided by employing either Leslie’s notion of quarantine or Harris’ flagging principle. Assuming the latter approach, children must flag the Working Pretense Representation for pretend-use only. However, this act of flagging does not affect the abstraction of relational schemas. Relational focus and abstraction are unintentional, subpersonal by-products of relational mapping. Because it is the process of creating the Working Pretense Representation that is developmentally important, it does not matter if the product itself is flagged. An analogous learning dynamic applies to the use of “thought-experiments” (see Lillard, 2001 for a related discussion). Philosophers construct thought-experiments in order to achieve conceptual clarity in debates that are empirically intractable. The content of thought-experiments have included zombies (Chalmers, 1996), Swamp-man (Davidson, 2001), and Twin Earth (Putnam, 1975). While these conceptual constructions are flagged as non-real, abstract conceptual principles that result from their construction and investigation may endure in the primary representational system.

3.4 Pretense and the development of structure-mapping ability

Structure-mapping processes are domain-general (see Gentner et al., 1995; Forbus et al., 1998). Indeed, the ability to map relations across domains is a central component of analogical
cognition. How structure-mapping abilities arise during development is currently not well understood (see, e.g., Leech et al., 2008). There is evidence that children can transfer relational knowledge at 10 and 13 months (Chen et al., 1997), and even at 7 months (Kuehne et al., 2000). This has led some researchers to claim that structure-mapping processes are innate (Gentner, 2003). But even if such processes are present at birth, children must develop an ability that informs how and when to implement them. To use Gentner’s phrase, “structural alignment processes are extremely powerful at aligning and revealing common relations when they are brought to bear” (Gentner, 2003, p. 220, emphasis hers). The problem is that children, and even adults, often fail to bring these processes to bear, particularly when exemplars are relationally but not superficially similar (Gick & Holyoak, 1983; Ross, 1987). An important corrective to this failure is the use of relational language to prompt a relational mapping. Put somewhat informally, adults can get children to use their structure-mapping abilities by labeling two superficially dissimilar objects with the same term. Thus common labels facilitate comparisons of objects that otherwise may not be compared. But while the use of relational nouns is effective for 4 and 6 yr. olds, it fails to induce relational comparisons for 3 yr. olds (Gentner & Klibanoff, 2005).

My claim is that dyadic pretend-play – joint pretense with a caregiver – serves a vehicle for the symbolic juxtaposition of relational structures, and that it instructs younger children how to implement structure-mapping processes. During dyadic play, which occurs frequently with children during their second year, care-givers do a number of things that encourage children to perform a relational mapping. They provide: prompts, descriptions of the pretend activity, demonstrations, “how-to” directions, and explicit requests for pretend actions from the child (see

8 Analogously, a baseball pitcher can have the ability to throw a 100 m.p.h. fastball yet throw it to the wrong hitters and in the wrong pitch counts; talent is one thing, implementing talent is another.
Kavanaugh, 2002 for a review). While some of these provisions are tutorial-like instructions for performing a relational mapping, others (i.e., demonstration, the use of props to initiate pretense) are symbolic invitations to perform a mapping. For example, care-givers stipulate pretend-identities – “this [block of wood] can be our soap” – and then describe how it can be used – “let’s wash our hands for dinner” (Kavanaugh, 2002, p. 96).

As argued earlier, the structural mappings that occur during such pretend activity can cause the abstraction of domain-specific relational knowledge. But it is also plausible, and perhaps of greater developmental significance, that dyadic play fosters a general ability to transfer relational knowledge – that dyadic play teaches children how to bring their structure-mapping abilities to bear. Kavanaugh notes that there is a “striking persistence in the mother’s attempt to induce pretend-play”, particularly for children under 2 years of age (Kavanaugh, 2002, p. 96). Tamis-LeMonda and Bornstein (1991) observed 45 mothers for just 15 minutes and found that 16 of them engaged in pretend-play with their 13 month olds. If the conclusions of section (3.2) are correct, then caregivers are literally training children how to transfer relational knowledge during dyadic pretend-play. The symbolic juxtapositions that occur during joint pretense can then serve as a bridge that prepares children for the more formal symbolic juxtapositions they receive when they have achieved greater linguistic competence.

The fact that pretending is fun supports this line of reasoning. This property of pretense has received limited attention in the literature on pretense but makes sense in the proposed model. Theories that investigate humor appeal to the perception of incongruity in order to explain why a situation is funny. For example, many Far Side cartoons are funny because they represent unexpected objects (e.g., animals) that comically realize various relational roles (e.g.,
the social roles of humans). For similar reasons, I suggest that the incongruous juxtaposition of attributes and relations within a Working Pretense Representation help explain why pretending is very enjoyable for young children. This appealing aspect of pretense may function as a positive reinforcement for the relational mapping that is required to achieve a representation of incongruity. In this respect, pretending provides children an incentive to use their structure-mapping ability, a difficult but highly valuable cognitive skill.

4. Conclusion

Structure-mapping theory explains the development of relational category knowledge in reference to natural and cultural invitations for relational alignment. This puts children’s learning opportunities at the mercy of these invitations. The present article described how object-directed play expands the availability of spatio-temporal juxtapositions, and how dyadic play instills a general ability to employ structure-mapping processes. By construing pretend-play as an activity that highlights (rather than misrepresents) causal structures in the environment, this proposal offers an explanation for the developmental value of pretense. These conclusions are theoretical, and they are located at the intersection of several areas of research in the cognitive sciences. These conclusions also have testable implications and point towards clearly defined areas of empirical research.

9 Both the Incongruity-Resolution and Nonsense theories of humor appeal to incongruous juxtapositions in order to explain some aspect of humor. See Ruch (1992). With respect to Jim Larson’s humor, Paolillo (1998, p.264) describes a particular Far Side cartoon as follows: “spectators at a sporting event cheer on the athletes in the foreground, running a relay race. One athlete, holding a duck by the neck, hands it off to another athlete. The cartoon is captioned “The duck relays”. (Larson, 1983: 15)” The incongruity is that the relational role “relay baton” is realized by, of all things, a duck. It is similarly incongruous, and also humorous and amusing, for a banana to realize the relational role of a telephone.
Works Cited


