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ABSTRACT

Piaget (1968) and Michotte (1963) studied children's perception of physical causality. While emphasizing perception, they deemphasized thinking. The present study extends research by these authors by identifying types of verbal thinking in preschoolers on the basis of judgment of three fundamental physical laws: the first law of static, the law of impulse conservation, and the law of the conservation of energy. Viewing either a computer simulation or realia, 75 children between 4 and 6 years of age who were enrolled in a public kindergarten in Moscow watched a series of physical phenomena which either conformed to or broke a physical law. Subjects described and explained what they saw. Findings suggested that children use three types of verbal thinking when they describe physical laws: play, projective, and scientific thinking. In verbal thinking characterized as play, physical and spatial-temporal relations between objects symbolized and modeled human relations. The projective type of verbal thinking was characterized by: (1) attributing "activity" to one object and "passivity" to others; and (2) the object's activity being determined by its inner state, not by its action. Children's scientific verbal thinking was characterized by equality of physical objects. Results also revealed a developmental shift with age from play to projective interpretation. (Author/RH)

TYPES OF PRESCHOOLERS' VERBAL THINKING: JUDGEMENT OF FUNDAMENTAL PHYSICAL LAWS

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ABSTRACT

Piaget (1968) and Michotte (1963) both studied children's perception of physical causality. While emphasizing perception, they deemphasized the role of thinking in these studies. Verbal thinking is characterized by using interpretation (modeling the reality) and prediction (dividing events on possible and impossible). The present study extends research by these authors by identifying types of verbal thinking in preschoolers on the basis of judgement of three fundamental physical laws (the first law of static, the law of impulse conservation, the law of energy conservation). 75 children (ages 4-6) enrolled in a Moscow public kindergarten watched a series of physical phenomena which either conformed or broke a physical law. Subjects described and explained what they saw. The data suggests that children use three types of verbal thinking when describing physical laws: *play, projective* and *scientific*. Results also reveal a developmental shift from play to projective interpretation with age.

AIMS OF THE STUDY

I. To define types and characteristics of children's verbal thinking.
II. To explore age differences in children's verbal thinking.
III. To study context differences in children's verbal thinking.

METHOD

Seventy five Moscow preschoolers, divided into three age groups (4 years old, 5 years old, 6 years old), watched a series of physical phenomena. Presentation of the material varied by its content and form. The content of the material was presented in two variants:

- as a phenomenon that is *possible* in nature (e.g. that is in accordance with physical laws, possible event);
- as a phenomenon that *violates* the laws (impossible event).

The form was presented also in two variants:

- as an event on a display (computer model);
- as the real physical event (real model).

Each subject was shown phenomena in all contents with all three laws (the first law of static (cf. Fig.1); the law of impulse conservation (cf. the top of Fig.2); the law of energy conservation (cf. the bottom of Fig.2), resulting in twelve trials.

The first law of static: If a body remains at rest it is acted on by an balanced external force.

The law of impulse conservation: The total linear momentum (impulse) of isolated system of bodies remains constant.

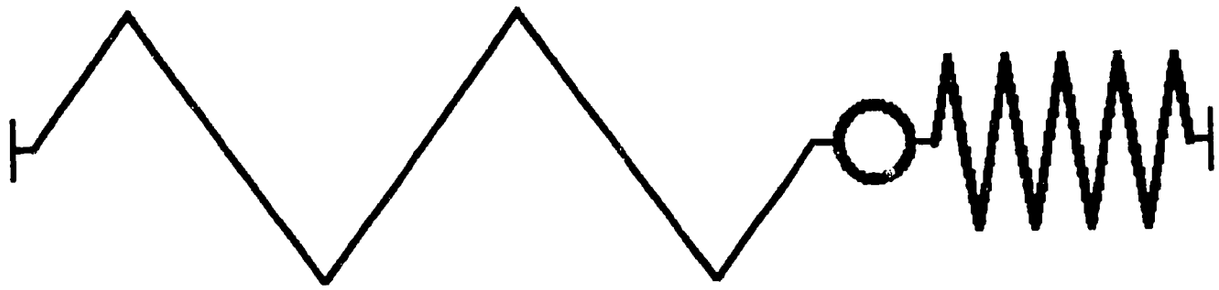
The law of energy conservation: The total amount of mechanical, thermal, chemical, electrical, and other energy in any isolated system remains constant. (Miller, 1982)

Forty five subjects were shown phenomena in computer model; thirty subjects were shown phenomena in real model. Subjects were asked to explain:

- what they saw,
- why what they saw happened,
- whether the phenomenon could happen in "real life".

THE FIRST LAW OF STATIC

A. possible event



B. impossible event

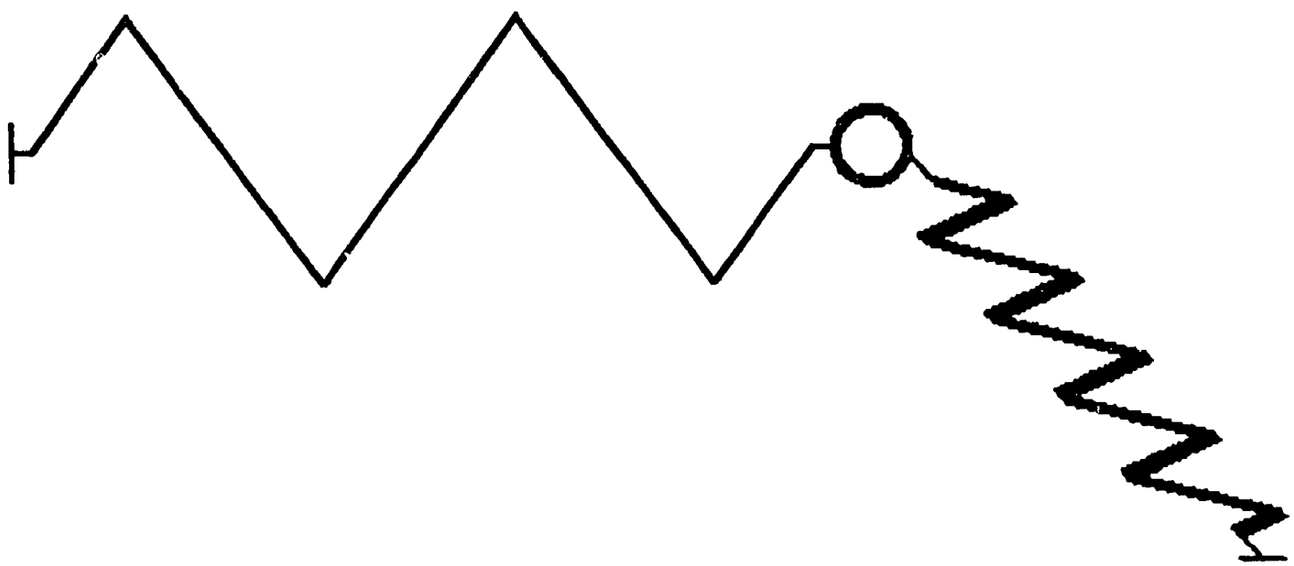


Fig.1

THE LAW OF IMPULSE CONSERVATION

A. possible event

B. impossible event

THE LAW OF ENERGY CONSERVATION

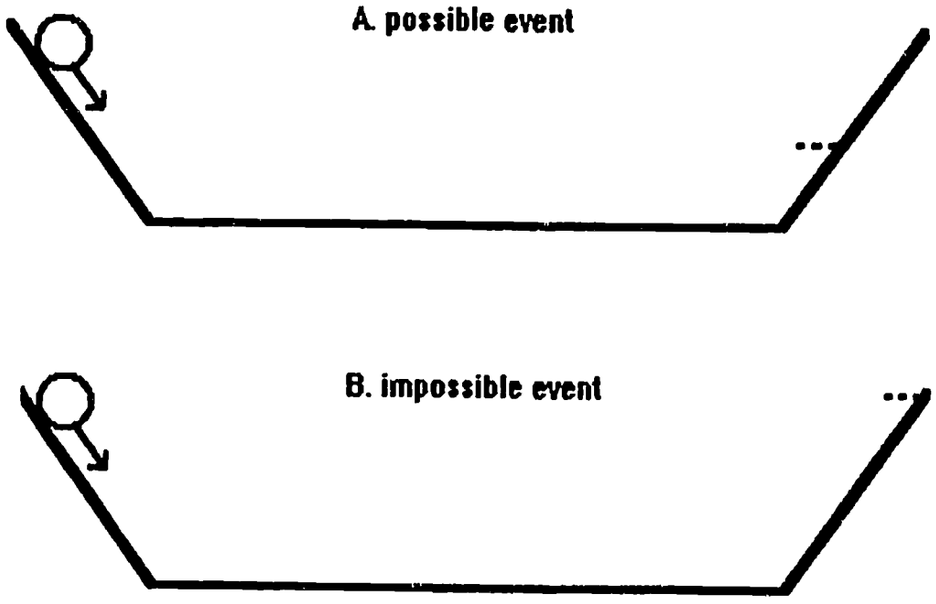


Fig.2

RESULTS

I. Children's responses to these questions were classified into the following three categories:

1. ***PLAY*** type of children's verbal thinking was related to children's reference to the context of human relations, human emotions and motivation ("wants", "was threaten" etc). For the children, physical and spacial-temporal relations between objects symbolized and modeled human relations.

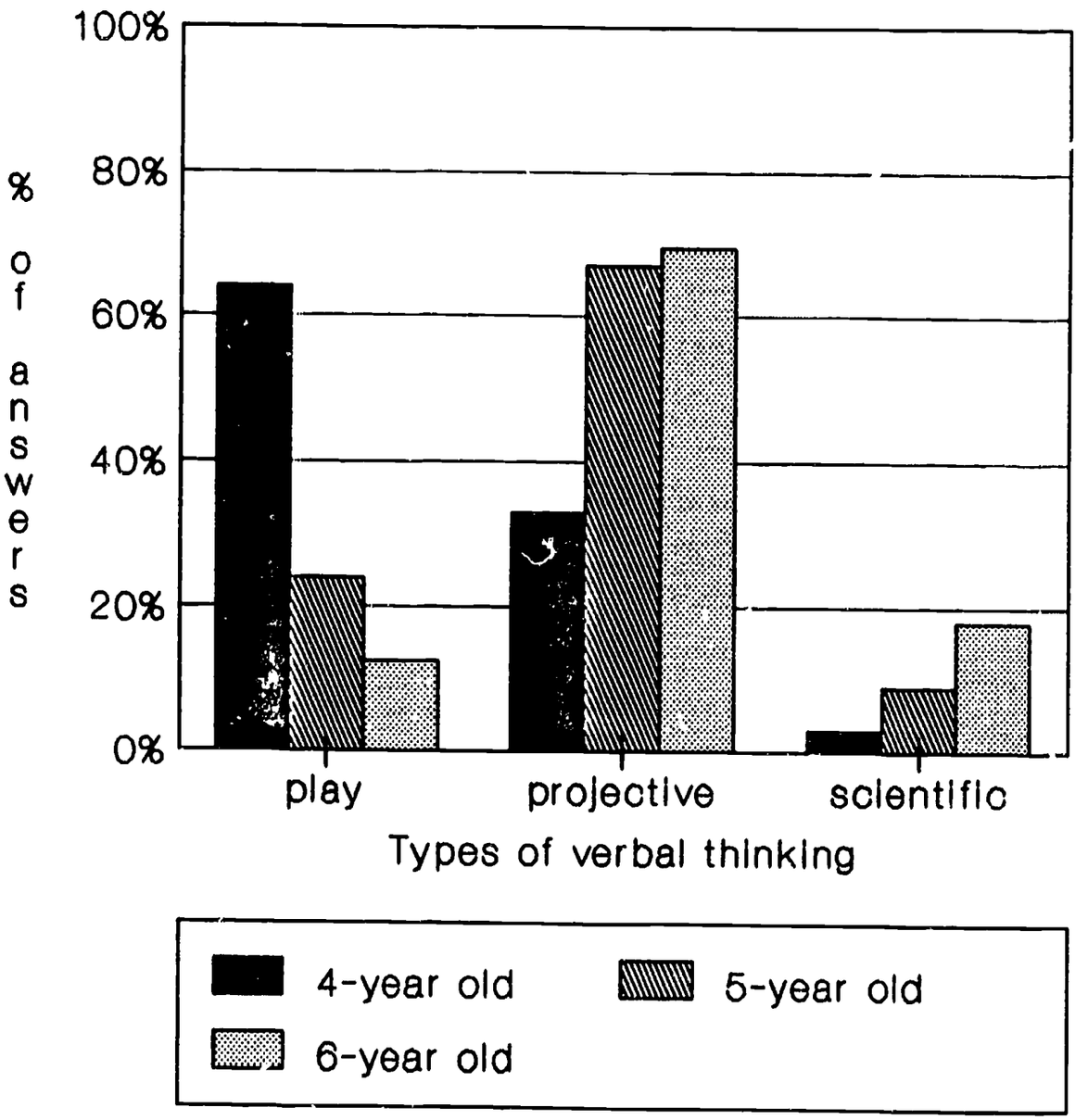
2. ***PROJECTIVE*** type of verbal thinking was characterized by: 1) a child attributing "activity" to one object and "passivity" to others, and 2) the object's activity not being determined by its action, but its inner state (e.g., stress, rapidness, heaviness). It appears that children identified themselves with one of the objects so that the object became a extension of the child's own body. In the course of *projective* interpretation the child endowed some object with a privileged position rather than considering the physical world as one of actions and counteractions.

3. ***SCIENTIFIC*** type of children's verbal thinking was characterized by the children's mention of equality of physical objects. There were no differences between cause and effect in children's physical interpretation, rather each action met a counteraction so that all interactions were reversible. This causal reversibility was an integral part of a *scientific* interpretation.

II. With regards to age differences, the results revealed that among 4-year old children a *play* interpretation was dominant, but at 5-years, a shift to a *projective* interpretation occurred. This interpretation was dominant until the age of 7 years. A *scientific* interpretation gradually increased with age.

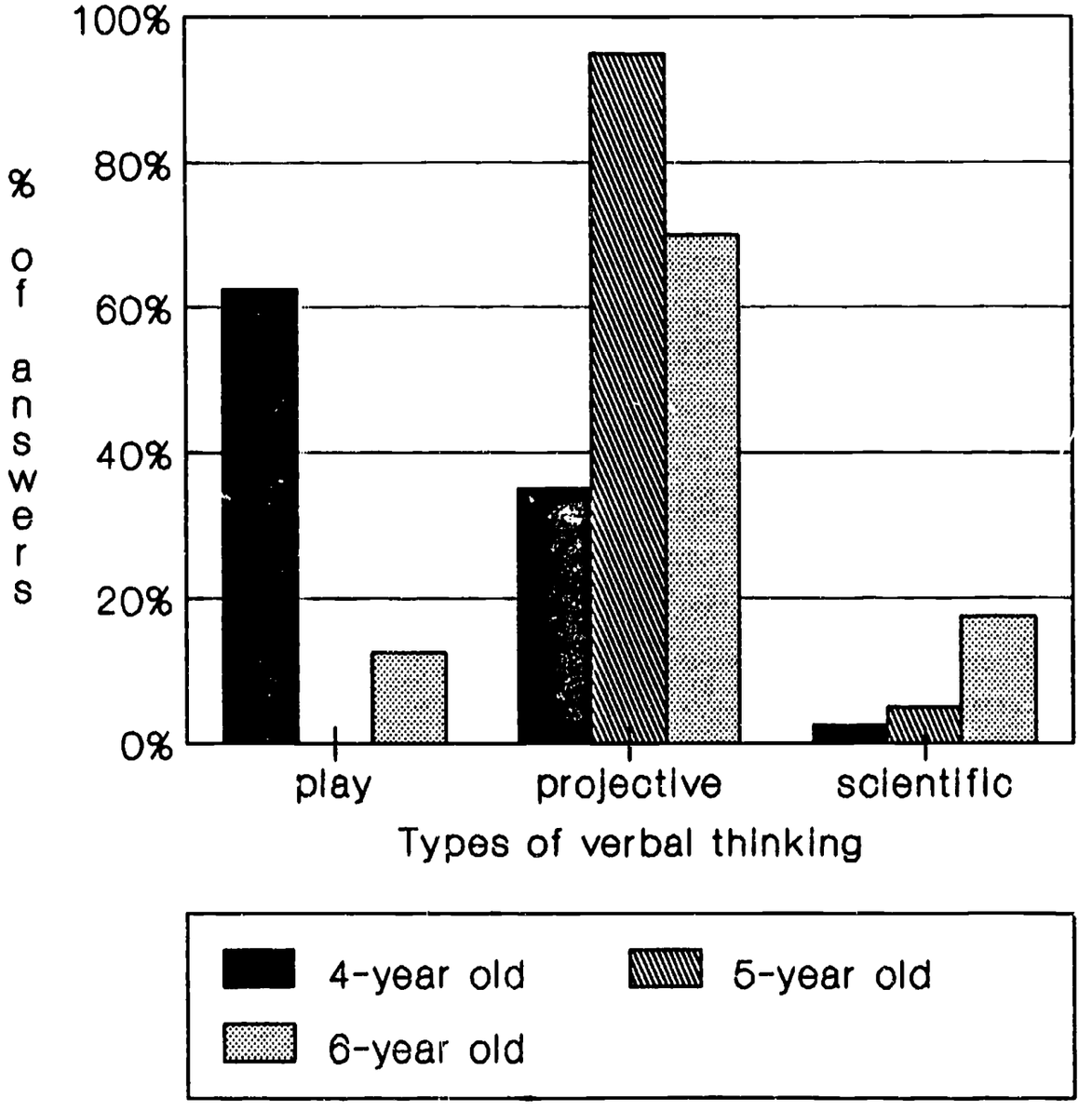
III. The results revealed that children of all three age groups treated real and computer models as equal regardless of the presentation context. Display modeled physical phenomena were perceived by children as real and not as symbolic (such as cartoons or movies). This finding suggests that it is possible to use computer modelling as a means of studying children's understanding of fundamental physical laws.

Age differences in types of verbal thinking in preschoolers (computer model)



Among 4-year old children a play type was dominant, but at 5 years, a shift to a projective type occurred.

Age differences in types of verbal thinking in preschoolers (real model)



Children treated real and computer models as equal regardless of the presentation context.

DISCUSSION

The results of study suggest that three types of interpretations of the physical reality relate not only to perception of causality as suggested by Piaget and Michotte but also to ingredients of verbal thinking such as a interpretation, presentation, prediction, and communication.

The question that might be addressed after the study is how the types of verbal thinking relate to child development. There are a few possible answers. Types of verbal thinking may characterize stages of child cognitive development like stages worked out by Piaget. In this case, it is reasonable to suggest that the three types of verbal thinking are sequential cognitive stages of child development. The *play* type is an earlier, unmatured stage; then, the *projective* type is the next stage; and the *scientific* type of verbal thinking is a higher, matured stage. The age shift from *play* to *projective* type revealed by the study could be used to back this hypothesis of developmental stages. However, the absence of the types' consistency in different physical events demonstrated by the study (though, it needs for a special exploration) makes such hypothesis unlikely.

A more likely hypothesis is that all three types of verbal thinking emerge at the same time in development. These types of verbal thinking are domain related, being used in different activity contexts. For example, in Western culture the *play* type of verbal thinking is used in the domain of art and literature for metaphoric presentation. The *projective* type of verbal thinking is used in the domain of interpersonal relations. The *scientific* type is used in the domain of natural sciences. There is an open question of whether or not there are other types of verbal thinking.

The shift to a *projective* verbal thinking at 5 years can be seen as a developmental change of domain application of the types of verbal thinking in the given culture.

Another question that can be addressed is whether or not children act according to the types of verbal thinking. To study that it is necessary to build special conditions that allow children to act according to different types of verbal thinking:

- shifting to playing, in the case of the *play* type;
- distribution of "activity" among objects, in the case of the *projective* type;
- setting scientific experiment, in the case of the *scientific* type.

This study can be worked out in the form of computer model because it is reliable and enables more material flexibility than real model.

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