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Preschoolers conceptual flexibility as a function of implicit and conceptual learning

Kotov Alexey[1], Kotova Tatyana[2]

1.Laboratory for cognitive research, National Research University “Higher School of Economics”, Moscow.

2. Cognitive research centre, Russian Academy for National Economy and Public Administration, Moscow.

Category learning

- Category learning is critically important for making sense of the world. Through categorization, individuals can organize existing knowledge and make predictions about new instances and events.

- Objects have large numbers of features, any of which might be useful individually or in combination with the other features.

- To complicate matters, individual features are rarely necessary and sufficient to classify an object (Rosch, 1973), and sometimes the features themselves must be constructed during learning rather than just observed (Schyns & Rodet, 1997; Kotov, Bangura, 2014).

Category learning

- One goal of category-learning studies has been to discover how we learn which features are important in the classification process.

- In a typical category-learning experiment, participants are asked to classify novel objects into one of several experimenter-defined categories.

- Participants gradually learn the appropriate classification by adapting their responses to the feedback provided by the experimenter, that is, by minimizing the error in their classifications.

Conceptual flexibility

- Consider the goal of distinguishing rose bushes from raspberry bushes. If the most diagnostic feature is the presence of berries, then the berry feature should receive the most attention (as both plants have thorns).

- However, when one must later distinguish raspberry from cranberry bushes, thorns are suddenly diagnostic, because although both have red berries, only the raspberry bush has thorns.

- In general, a feature's diagnosticity varies depending on the categories being contrasted.

Conceptual flexibility

- That effect was called the conceptual flexibility and became one of the central in the learning mechanisms, because it makes new category learning very fast – the information assimilated in one context can be used in different conditions.

- The conceptual flexibility effect contradicts the most of the classical conceptual learning models, which maintain that by increasing the knowledge about the new category the attention to the relevant features is to be increasing, and the attention to irrelevant ones is to be decreasing in accordance with the cognitive economy requirements (blocking effect).

Hoffman & Rehder, 2010

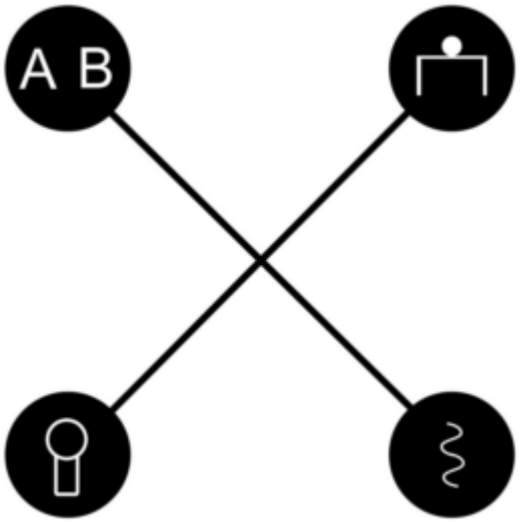
	Dimension		
Category	1	2	3
A	1	1	1
A	1	0	1
B	0	1	1
B	0	0	1
C	1	1	0
C	0	1	0
D	1	0	0
D	0	0	0

Conceptual flexibility

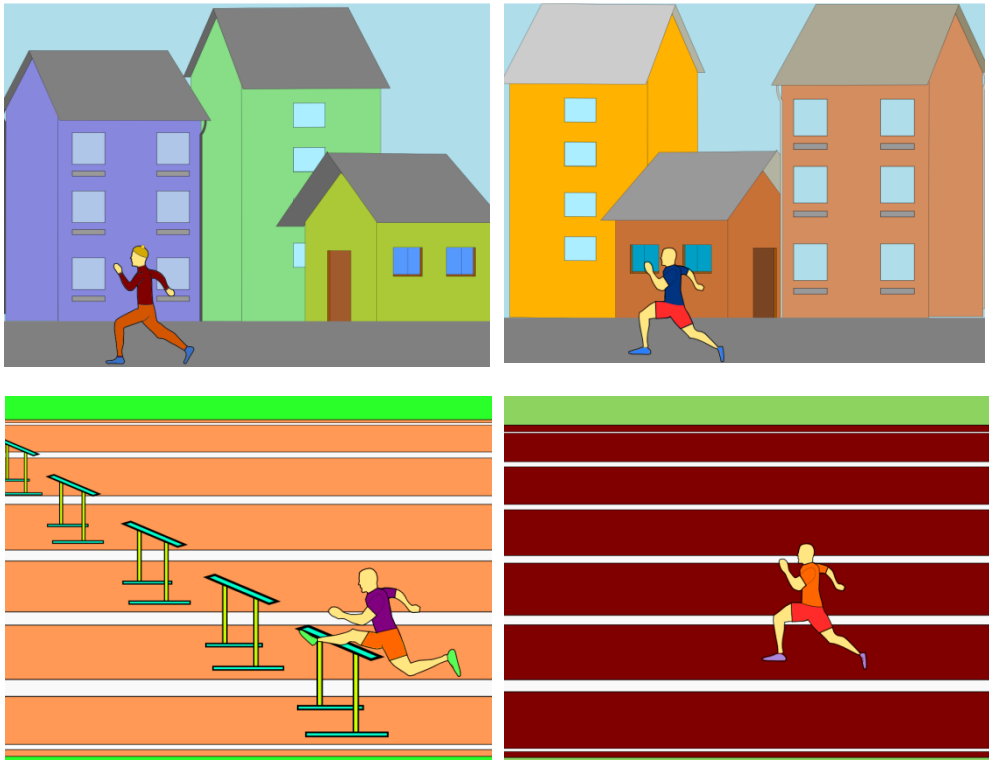
- While trying to remove this contradictory the researchers have found some important facts:

  - conceptual flexibility can be acquired only in inference task, but not in classification task (Yamauchi & Markman, 1998; Hoffman & Rehder, 2010),
  - flexibility effect could be found out in the classification task too if the stimuli would be functionally related objects and would be connected with semantic knowledge of subjects (Kotov & Dagaev, 2013).

Hoffman & Rehder, 2010



Kotov & Dagaev, 2013

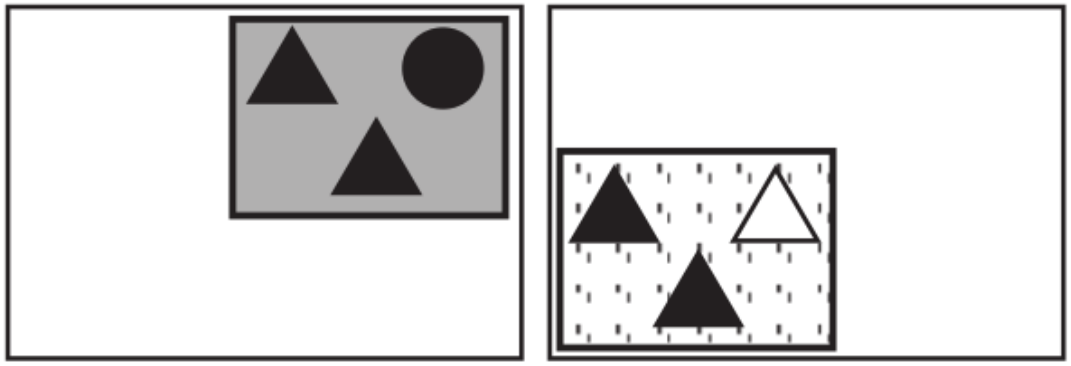


- Therefore, conceptual flexibility is not a function of implicit and statistical learning (theory irrelevant and data driven) in adults

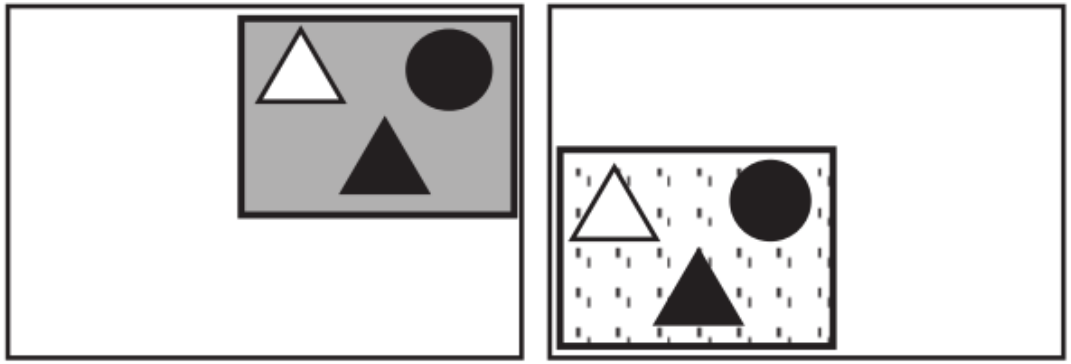
- What about children? Limitations on concept learning (Sloutsky, 2011):
  - Difficulties in cross-modal processing (<2)
  - Labels as features, not as signs (<3)
  - Immature executive function (<5)
  - Lack of control attention (< 7)

- Is conceptual flexibility in preschoolers a function of implicit learning which doesn't require concept learning?

Sloutsky & Fisher, 2008



A. Training Triad–Context A (Shape-relevant) B. Training Triad–Context B (Color-relevant)

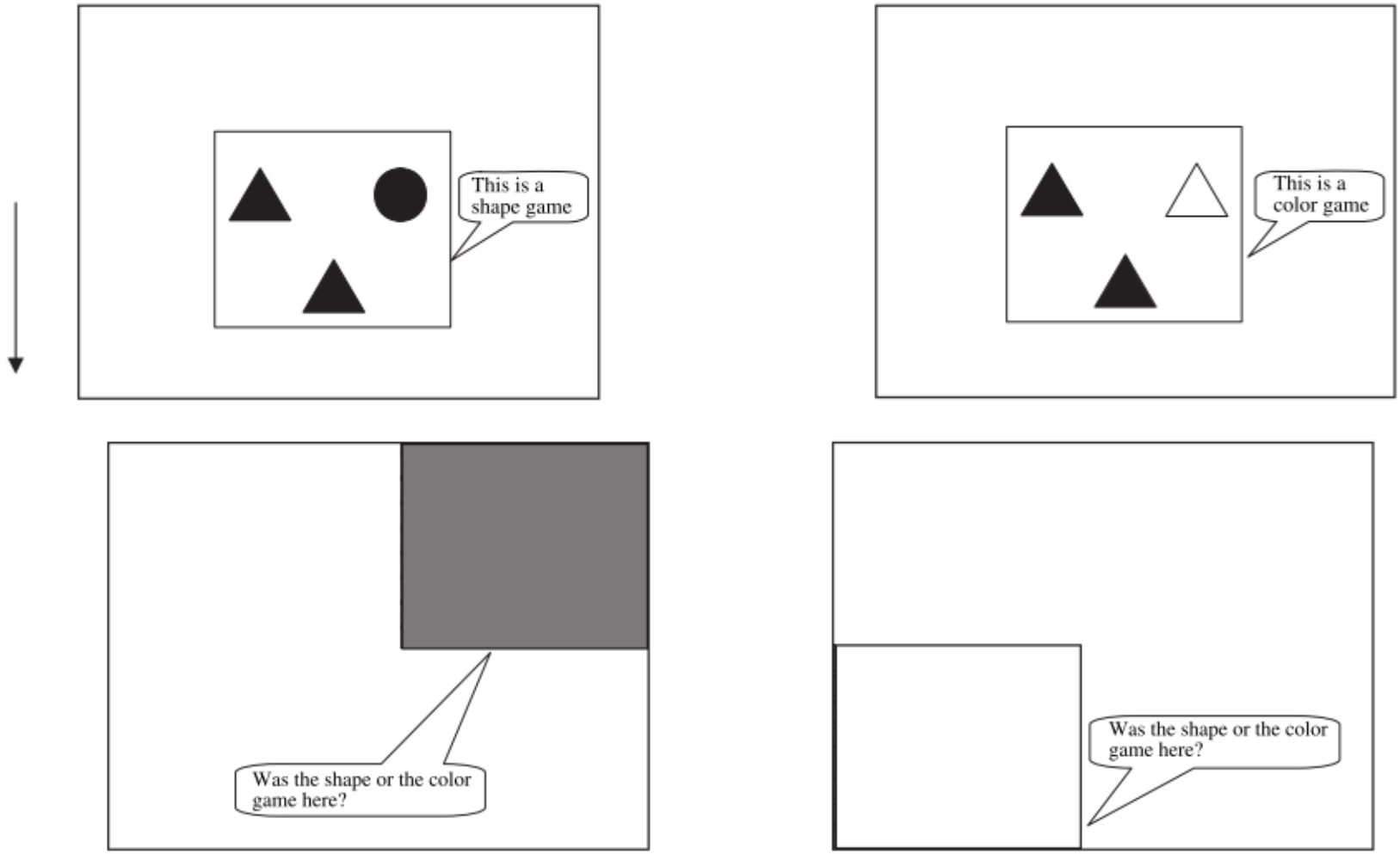


C. Test Triad presented in Context A D. Test Triad presented in Context B

Sloutsky&Fisher research demonstrated that conceptual flexibility in preschoolers can be acquired implicitly and it does not require conceptual knowledge

Sloutsky & Fisher, 2008

Lack of awareness



Critics of Sloutsky&Fisher Results

- Test only in one context (Hayes & Lim, 2013)
- Children could make the required match without attending to the context cue at all (Hayes & Lim, 2013)
- Meaningless material
- **All parts of context (location and color of background) didn’t change in different situations (training and test phases): Restricted conditions for conceptual flexibility**

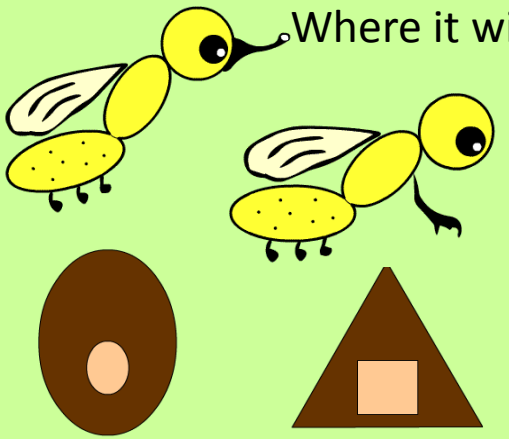
Experiment

- Participants: N=76, range 4.0 - 5.2 years
- Multiple context categorization task
- 3 experimental conditions
  - **Form + color change location**
  - **Form changes location**
  - **Color changes location**
- Control condition – without changes in context for replicating Sloutsky&Fisher effect
- Between-subject design
- Training phase and test phase

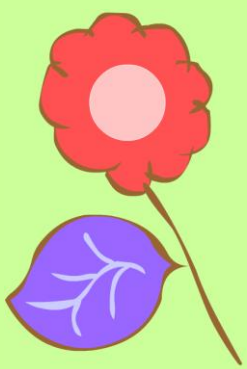
Materials

Training phase

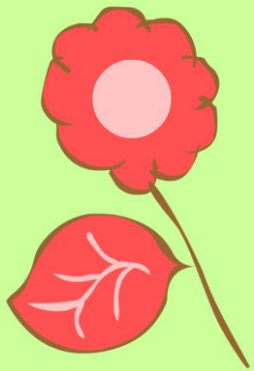
Where it will fly?



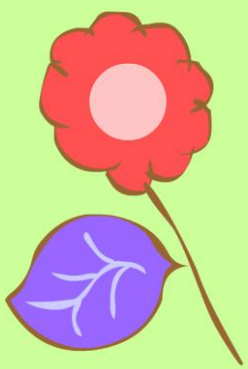
Form + color change location



Form changes location



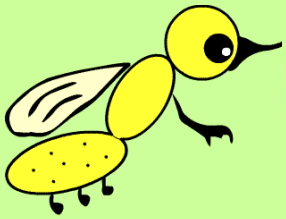
Color changes location

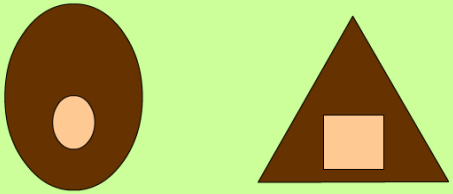


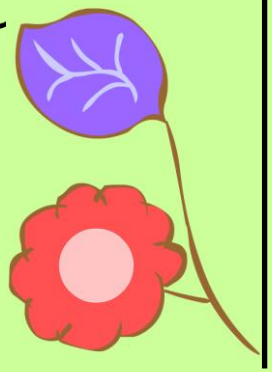
Test phase

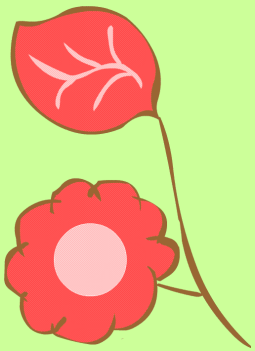
(transfer task)

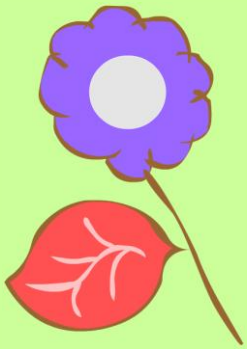
What house it lives?

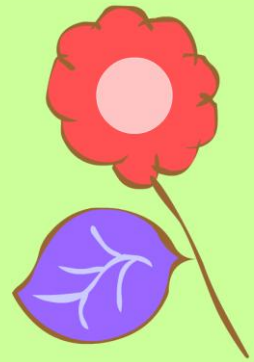










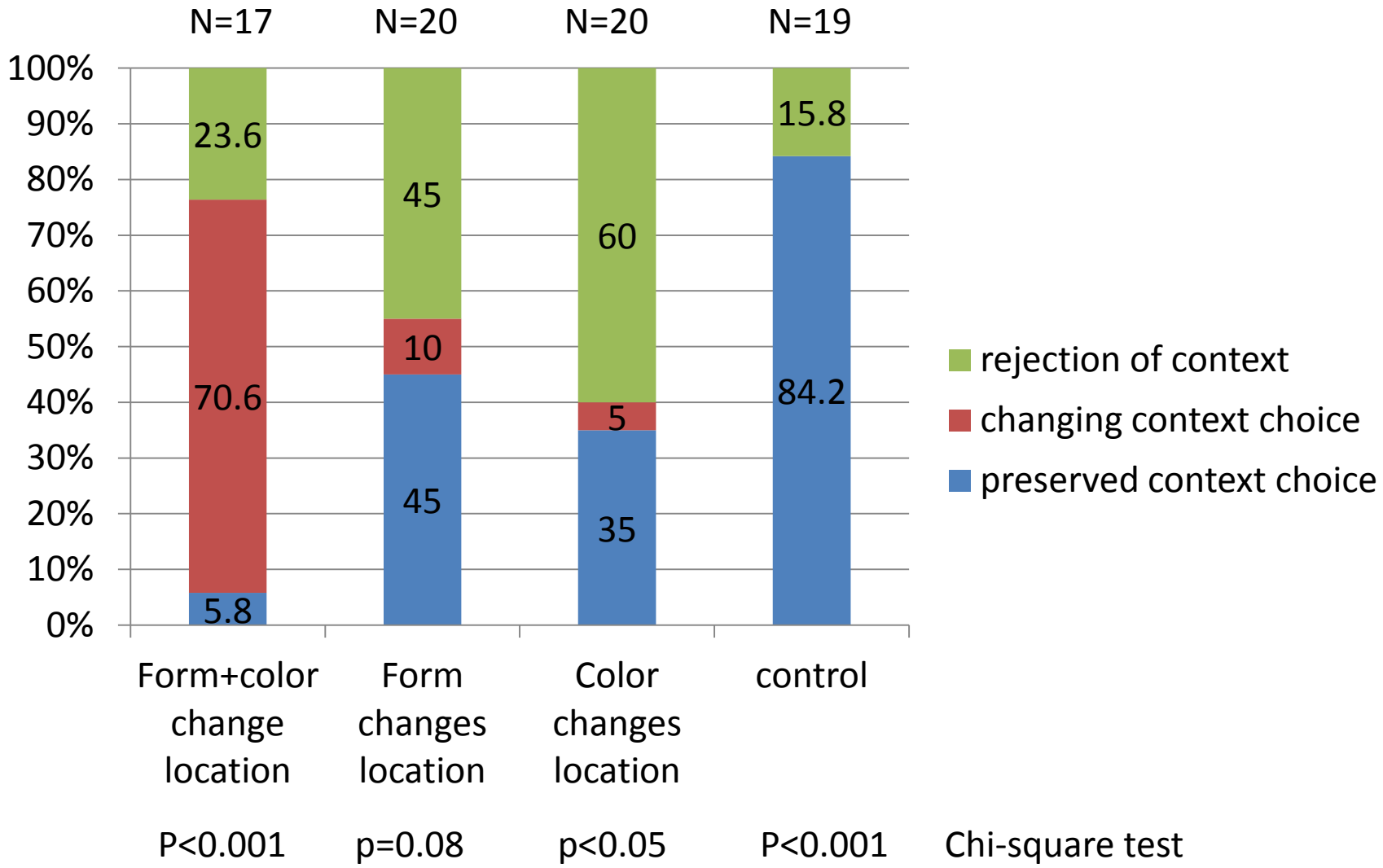


Control without changes

Procedure

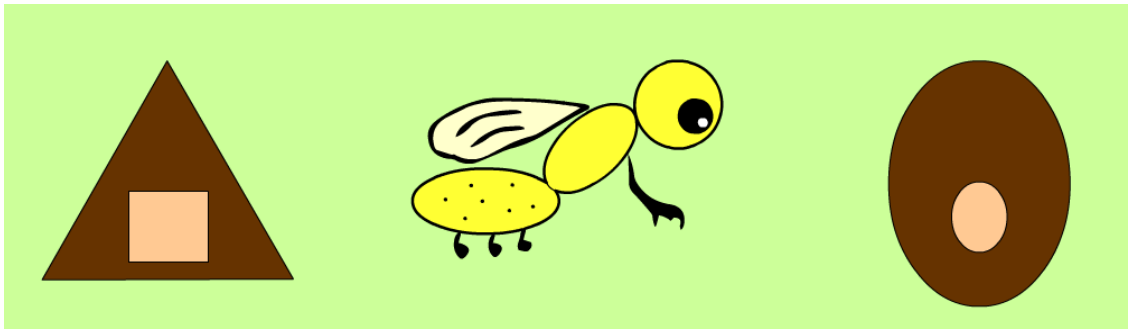
Condition	Training phase	Test phase (transfer task)
Form+color change location	4 trials in Mixed Context, 4 trials in Context A, 4 trials in Context B, 4 trials in Mixed Context (participants with accuracy score bellow 75% was rejected, N=4)	4 trials in Mixed Context
Form changes location		
Color changes location		
Control		

Results: transfer task



Results: indirect awareness test

- Question about correspondence between object (initial insect) and part of context (house) in absence of main context (flower)
- Indirect awareness test – participants didn't receive FB about this correspondence during training phase
- What house it lives? (8 trials)



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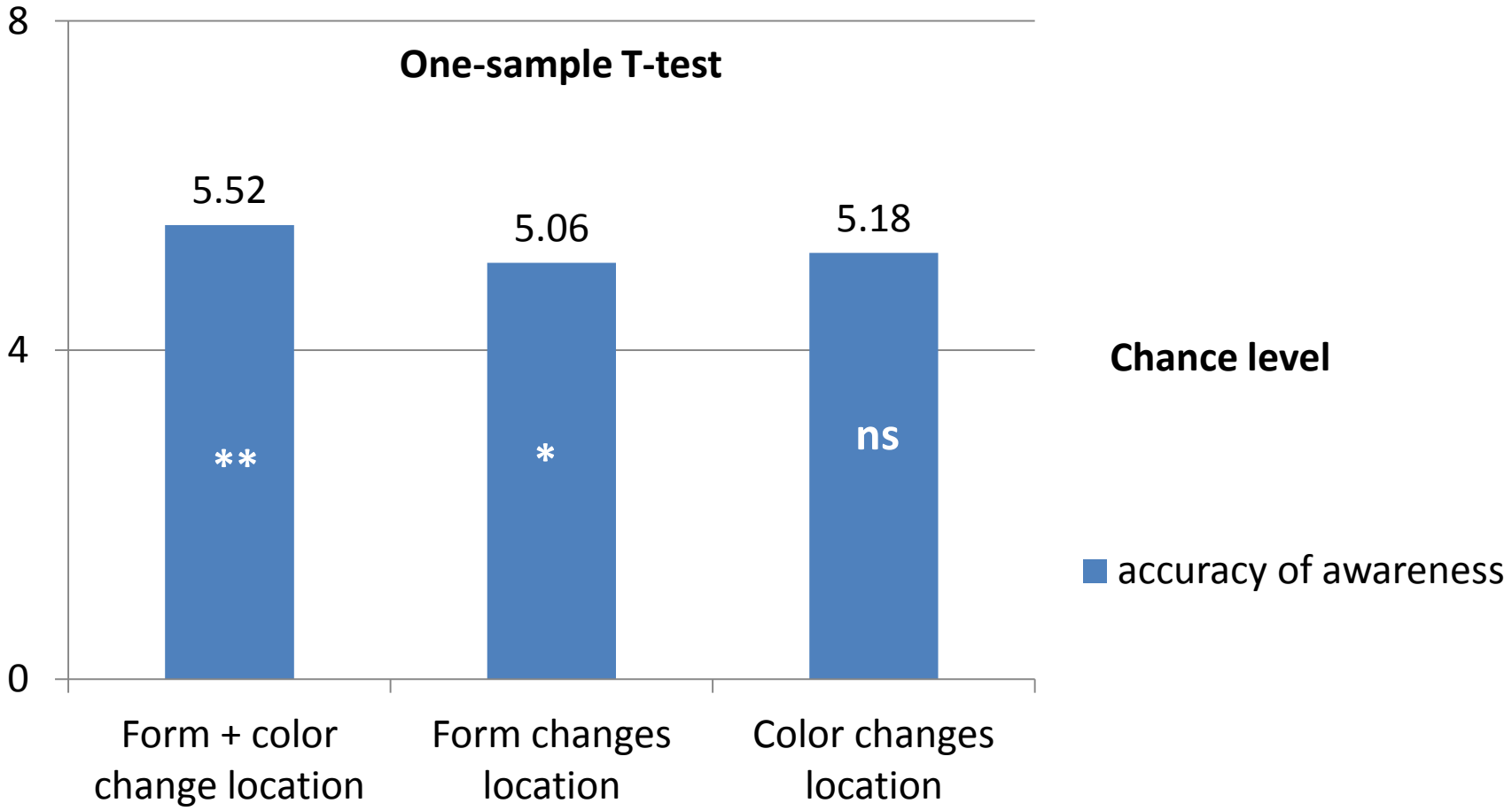

Discussion

- Preschoolers conceptual flexibility is a function of implicit learning only in condition without of context change (control)

- Selective conceptual flexibility (form+color change location): implicit learning or conceptual learning?

- Rejection-of-context effect (color change location): result of inconsistency between just learned conceptual knowledge and new context.

- Implicit learning / Rejection-of-context effect (form change location): in deficit of features variation within context conceptual knowledge couldn't be learned.

Summary

- Implicit learning on meaningful material is often supplemented by relying on conceptual knowledge

- Perhaps, with age increases the ability to selective conceptual flexibility

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1. al.kotov@gmail.com
2. tkotova@gmail.com

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The study was implemented in the framework of the Basic Research Program at the National Research University Higher School of Economics in 2014