Cooperative Categorization:

Coordination of Reference in Learning a Joint Prediction Task

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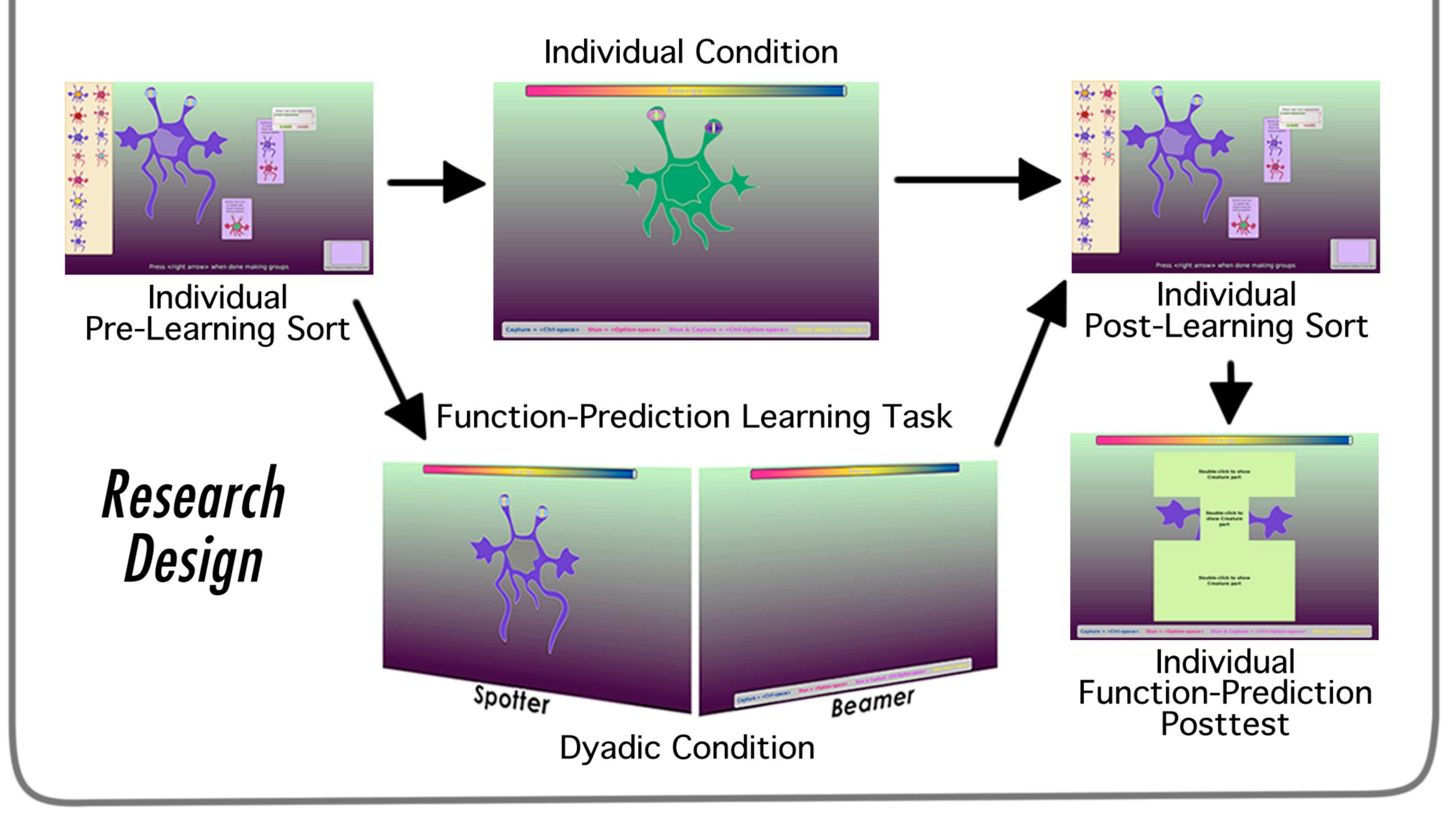
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We investigated the interaction of referential communication & perceptual structure on the joint processes of establishing reference & learning the functional significance of referents during indirect category learning. 56 participants worked individually or as cooperative dyads to learn 4 combinations of orthogonal functional features, ± nutritive & ± destructive, that implicitly defined 4 categories of fictional aliens.

EXEMPLAR	Observable Dimensions						Functional	
	Diagnostic				Non-Diagnostic		Dimensions	
	01	O2	О3	04	O5	O6	F1	F2
ND.1	1	1	1	1	1	random	1	1
ND.2	1	1	0	1	1	random	1	1
ND.3	1	0	1	1	0	random	1	1
ND.4	0	I	1	1	0	random	1	1
Nx.1	1	I	1	0	0	random	I	0
Nx.2	1	1	0	0	0	random	1	0
Nx.3	1	0	1	0	1	random	1	0
Nx.4	0	1	1	0	1	random	1	0
xD.1	1	0	0	1	1	random	0	1
xD.2	0	1	0	1	1	random	0	1
xD.3	0	0	1	1	0	random	0	1
xD.4	0	0	0	1	0	random	0	1
xx.1	1	0	0	0	0	random	0	0
xx.2	0	1	0	0	0	random	0	0
xx.3	0	0	1	0	1	random	0	0
xx.4	0	0	0	0	1	random	0	0

These categories possessed a complex perceptual structure: a unidimensional (or simple) rule predicted one function, while a family resemblance predicted the other function. In addition, each learner worked

individually to sort the creatures (pre- & post-learning) and to predict functional combinations in an individual posttest that yielded selective attention data.



References

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Markman, A.B. and Makin, V.S. (1998). Referential communication and category acquisition. *Journal of Experimental Psychology: General*, 127(4): 331-54.

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H1: Referential communication enhances category learning

a. Dyads predicted functional categories with greater accuracy than individuals

a. Change in Functional-Category Prediction Accuracy:

Dyadic vs. Individual Function Prediction Trials 1-320

1.0

0.8

0.6

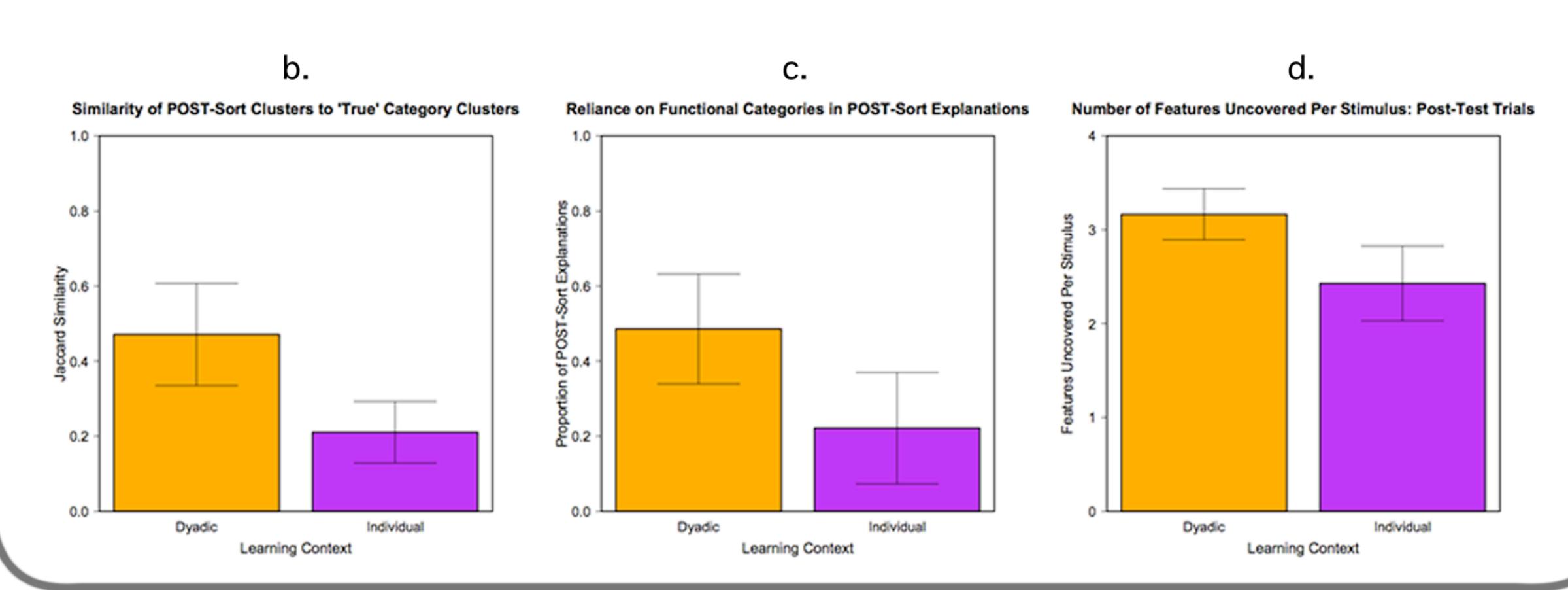
Dyadic

Dyadic

Individual

b. Dyadic learners produced sorts that better matched the true category clusters, c. they were more likely to explain sorts in terms of the functional categories, &

d. attended to a greater number of perceptual features when making predictions.



H3: Referential communication yields conceptual homogeneity ...both within dyads:

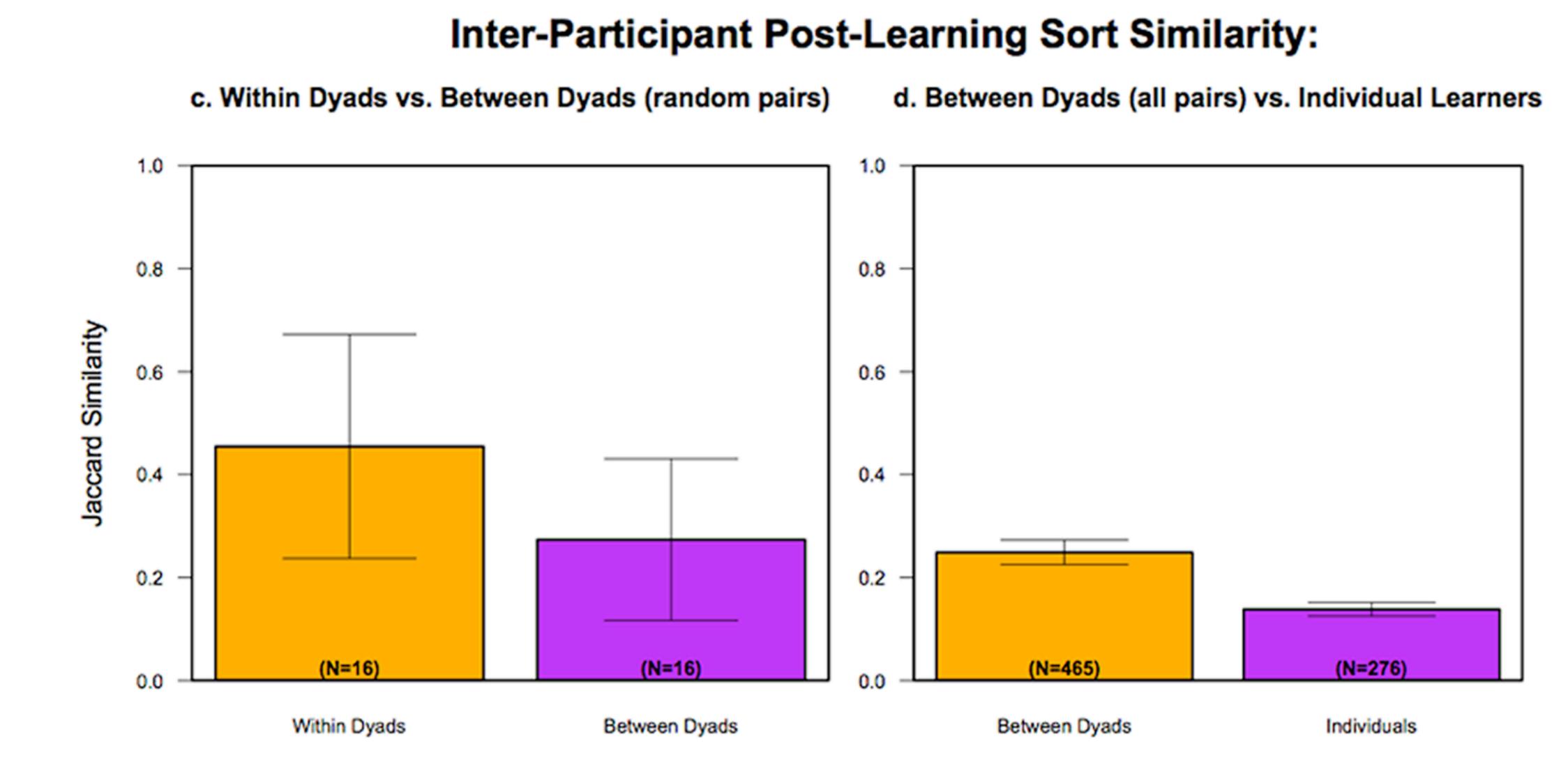
- a. Partners tended to reference the same features throughout the learning task:

 Each partner referenced perceptual features with highly correlated probabilities median $I\left(\frac{features\ mentioned\ trials\ 1-32\ partner\ A,\ partner\ B}\right) = .944$, median $I\left(\frac{features\ mentioned\ trials\ 289-320\ partner\ A,\ partner\ B}\right) = .955$, median $I\left(\frac{features\ mentioned\ trials\ 1-32\ trials\ 289-320\ partner\ A,\ partner\ B}\right) = .875$
- b. further, each partner attended to those same features when working alone:

 Each partner uncovered features with probabilities that correlated highly with referential tendencies median $\Gamma\left(\frac{\text{features mentioned trials 289-320}}{\text{featutres uncovered post-test}}\right) = .950$, median $\Gamma\left(\frac{\text{features uncovered post-test}}{\text{partner A, partner B}}\right) = .981$

...and between dyads:

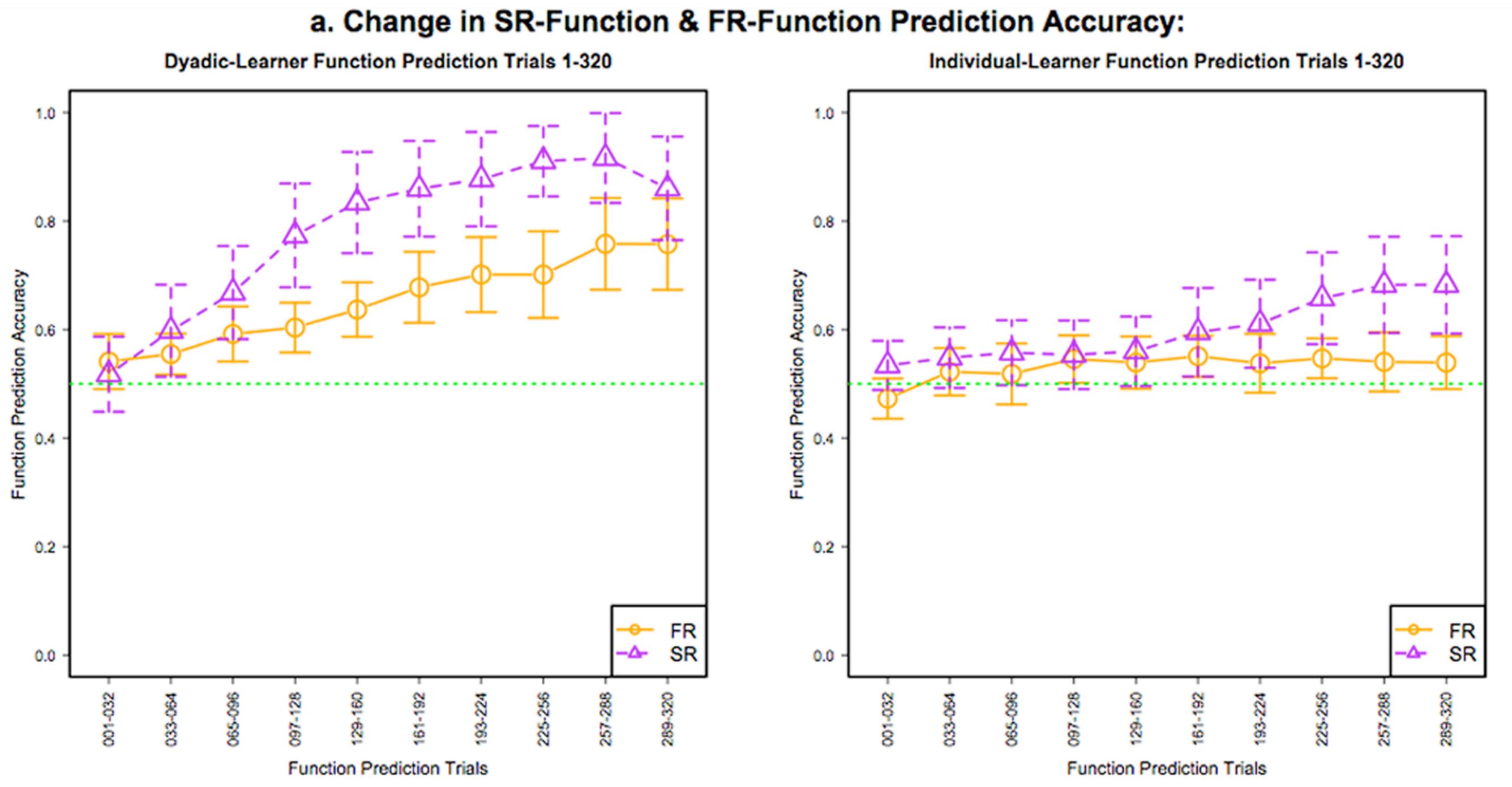
c. Dyadic learners sorted creatures like one another, both within & between dyads; d. their post-learning sorts were much more alike than those of individual learners.



Conceptual homogeneity emerges from (i) dyad-specific forces of establishing shared reference and attention, and (ii) better learning in the dyadic condition

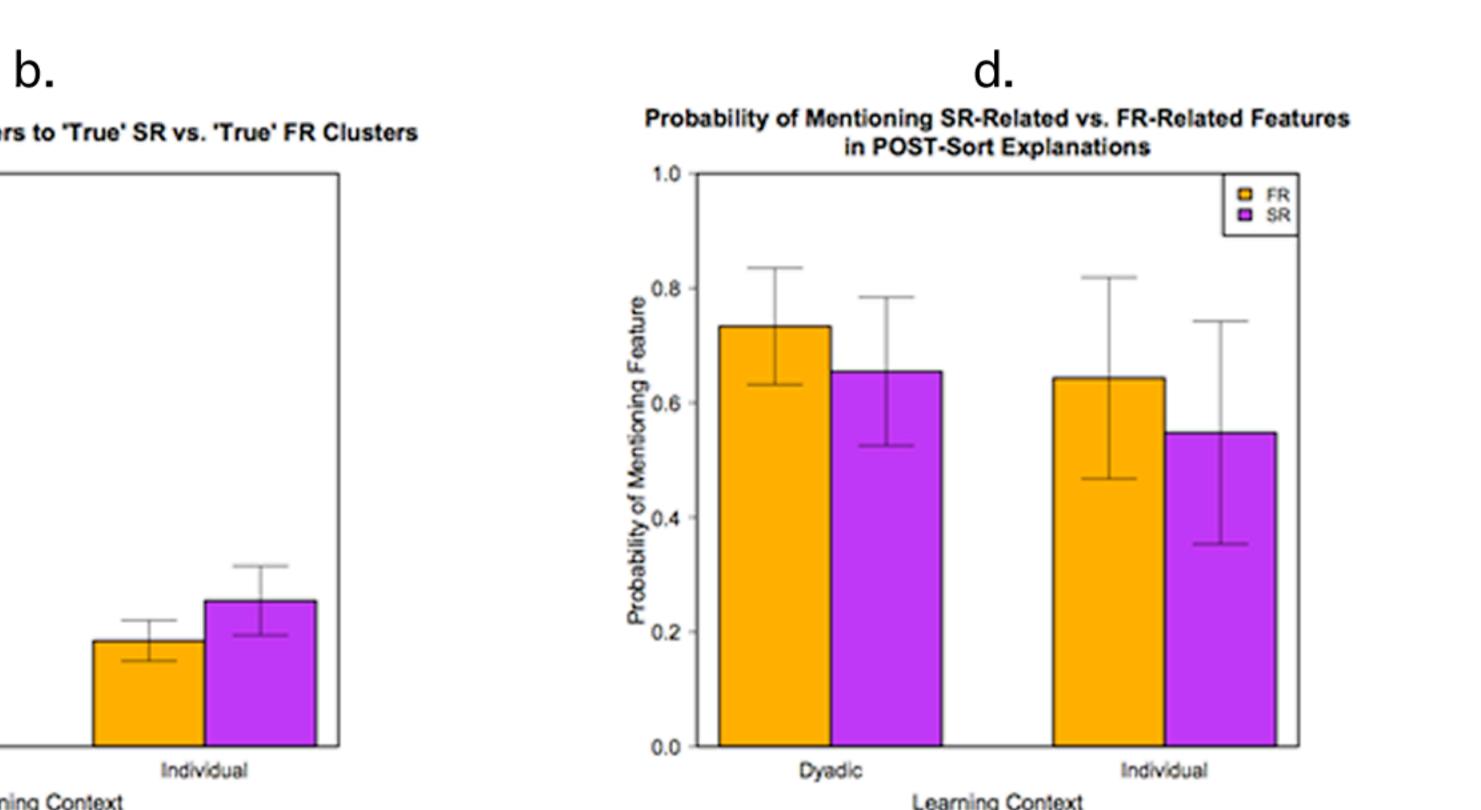
H2: Referential communication enhances simple-rule learning more than FR learning

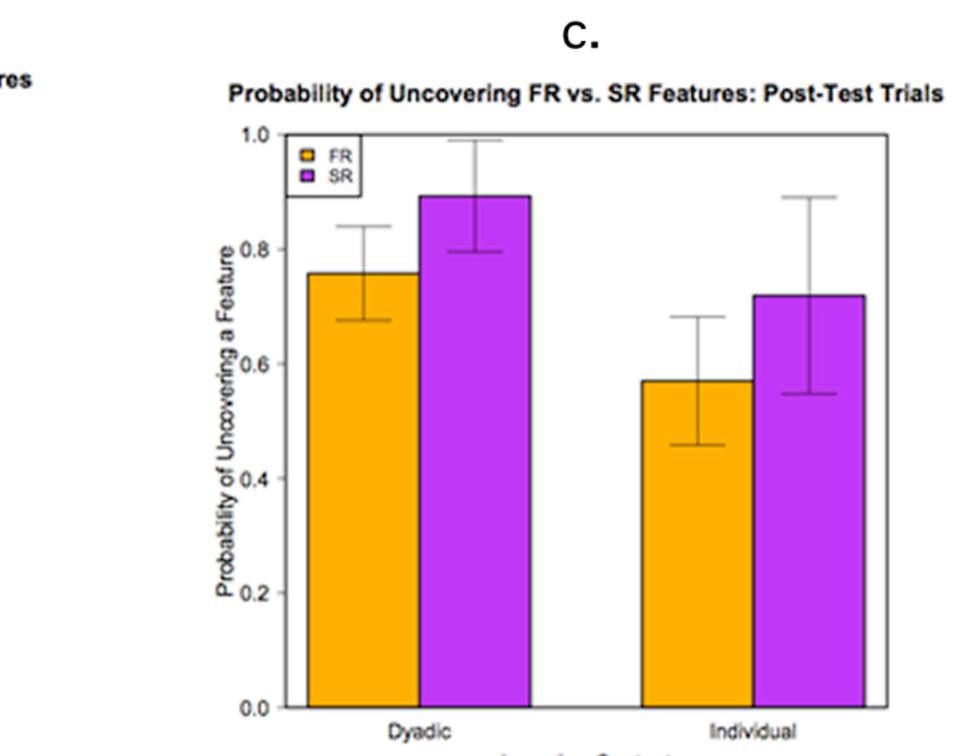
a. Dyadic advantage was significantly greater for simple-rule related predictions than for FR related predictions



b. Post-learning sorts correlated more with simple-rule defined clusters than with FR defined clusters, also c. participants were more likely to attend to simple-rule features than to FR features, when making predictions.

d. However, participants were more likely to <u>explain</u> sorts in terms of FR features than simple rule features





Discussion

- 1. Dyadic advantage may result in part from greater motivation:
 - a. But not merely social facilitation...
 - ...otherwise individuals should have benefited from observer and/or co-action effects.
 - b. Interdependence may elicit greater effort and/or discourage satisficing.
- 2. Dyadic advantage may result in part from linguistic encoding:
 - a. Verbalizing relationships between perception and intention may make them more memorable (Chiu, Krauss, & Lau, 1998)...
 - ...reference may simplify and concretize such complex relationships (cf. Clark, 2006).
 - b. Reference may provide an explicit "rule" for otherwise implicit judgements
 - ...this might also explain asymmetries in learning functions related to simple-rule vs. FR structure
- 3. Dyadic advantage may result in part from knowledge diversity:
 - a. Diverse partners may generate a greater number of alternative hypotheses...
 - ...competing hypotheses may yield better hypotheses
 - b. Diversity encourages simpler and more shareable hypotheses...
 - ...interlocutors try to minimize the joint effort of sharing beliefs (Clark & Wilkes-Gibbs, 1986).
- 4. Dyadic advantage may result in part from the coordination of reference:
 - a. A referential convention may reduce cognitive load...
 - ...conventional references are mutually expected and mutually understood,
 - ...conventional references may serve as semantic "entry-points" (cf. Jolicoeur et al., 1984).
 - b. Then again, converging on a "bad" convention can impair judgement...
 - ...conventional references may "overshadow" perceptual information (Schooler & Engster-Schooler, 1990).