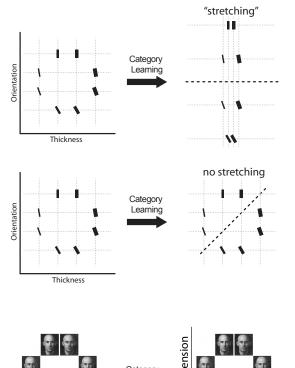
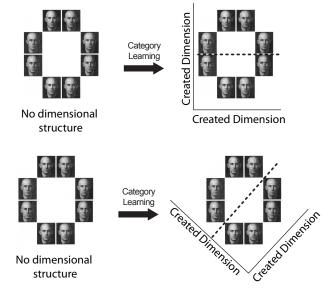


Category learning causes differentiation of psychological dimensions in dimensional but not polar morphspaces Jonathan R. Folstein, Isabel Gauthier, Thomas J. Palmeri

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Background: How does category learning change visual perception?





"Stretching" of object dimensions: Objects become more discriminable along relevant object dimensions.

No stretching with diagonal boundaries because both dimensions are relevant. Diagonal boundaries are harder than orthogonal boundaries in spaces with psychologically real dimensions. (e.g. Kruschke, 1993)

"Differentiation" of object dimensions: Category learning creates relevant and irrelevant dimensions that did not exist before.

The dimensions are always orthogonal to the category boundary. Diagonal boundaries and orthogonal boundaries are equally easy in arbitrary dimension spaces prior to differentiation. (Goldstone and Steyvers, (2001)

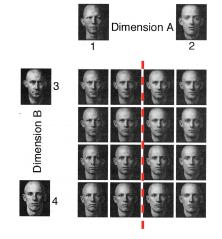
After differentiation, arbitrary dimension spaces start to behave more like separable dimension spaces. Diagonal boundaries relative to the created dimensions are harder than orthgonal boundaries.

What are the limits of differentiation?

Differentiation has been demonstrated in morphspaces of faces (Goldstone and Steyvers, 2001)... ...but differentiation is more difficult in other kinds of spaces (Op de Beeck et al. 2003) What properties of shape spaces drive these differences?

Potential role of morph-space structure

Dimensional spaces: 🗸 Stretching Golstone et al. 2001



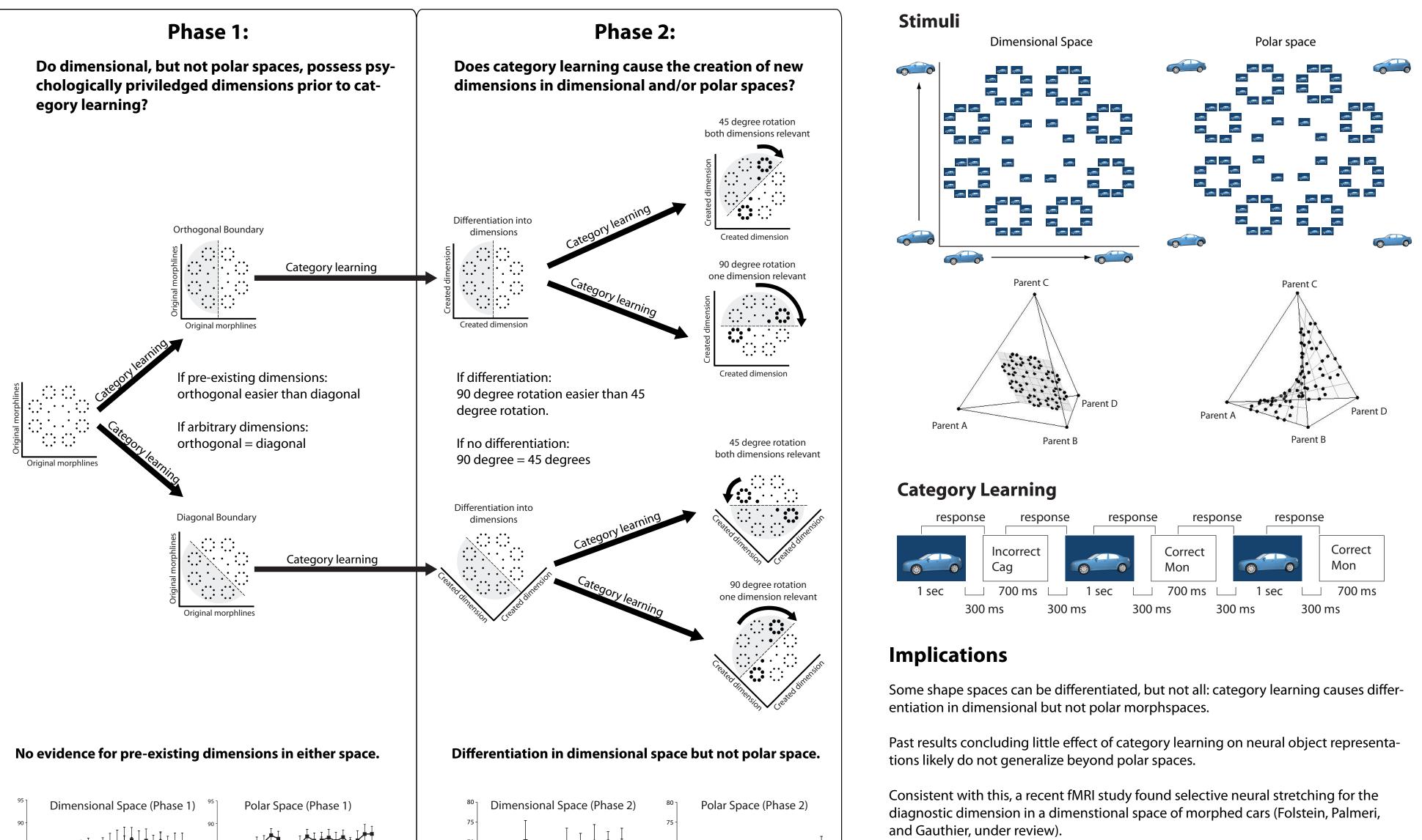
In dimensional spaces, two parents can be ignored. In polar spaces, all four parents must be attended for successful

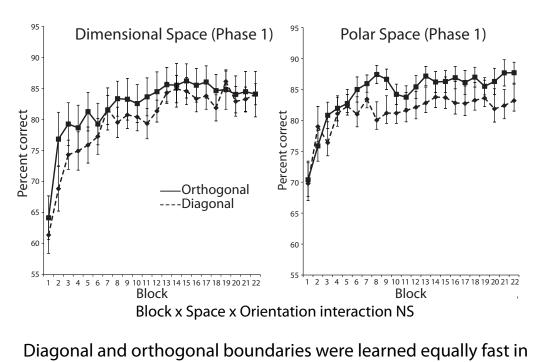
categorization

Jiang et al. 2007 **CO**-Category A 50. car 2 car 4 Category boundary Parent C 000 1000 Parent [

Polar spaces:

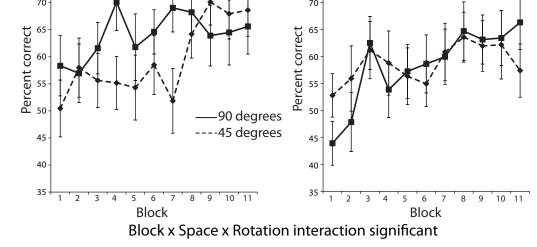
🗴 Stretching





both spaces.

If the morphlines used to create the dimensional space corresponded to psychologically priviledged dimensions (like curvature and aspect ratio), orthogonal boundaries should have been easier.



In the dimensional space, boundaries rotated by 90 degrees were easier to learn than boundaries rotated by 45 degrees. This advantage was not present in the polar space.

Something about the regular structure of the dimensional space facilitated differentiation into new dimensions as a result of category learning.

Future neural and behavioral studies using morphspaces should take morphspace structure into account when interpreting results.

Models of visual learning should account for differences between dimensional and polar spaces.

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