Supporting Information

Conditions conducive to optimal probabilistic categorization

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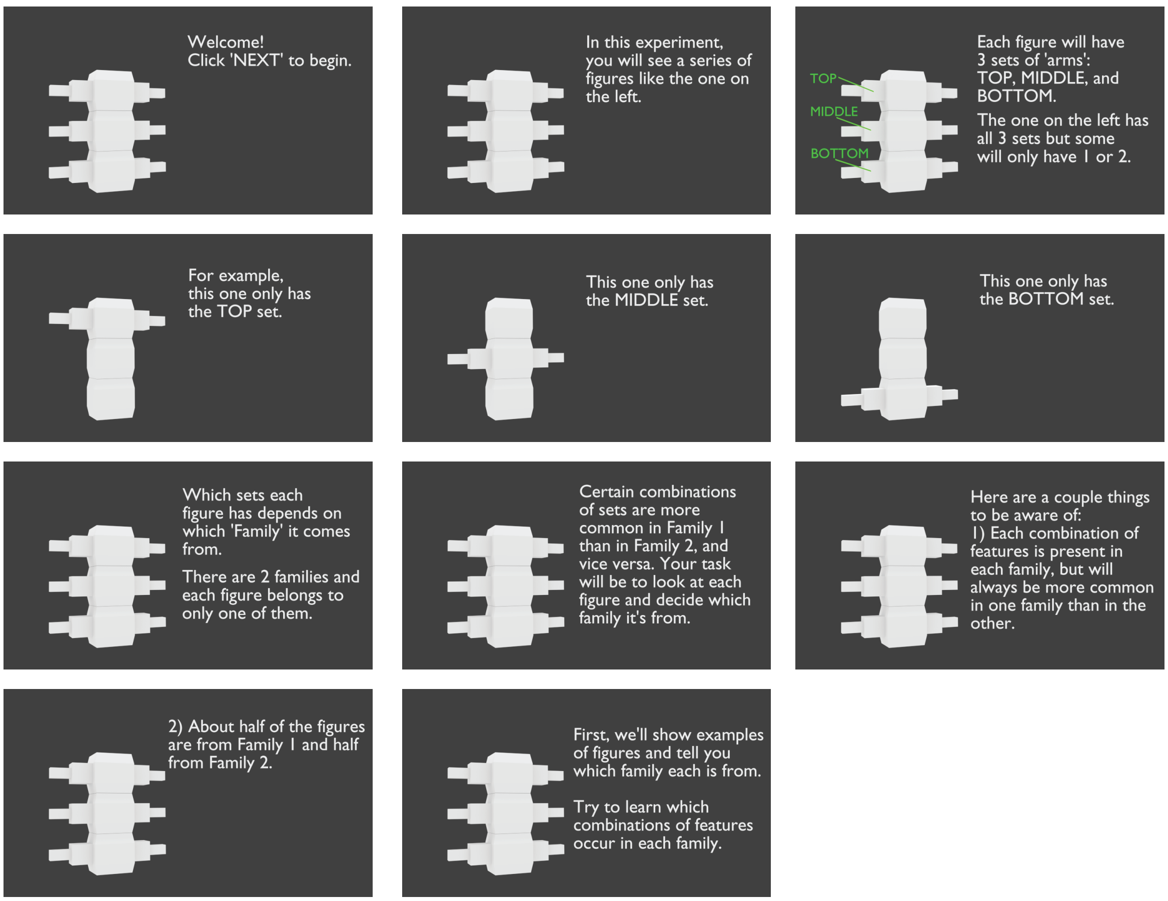
1 Experimental instructions and trial sequence

Below are descriptions of each phase of the experiment and example stimulus screens.

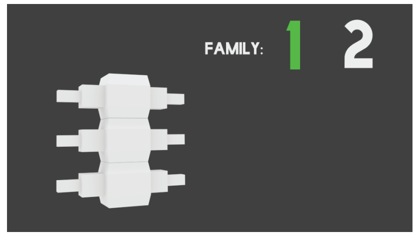
Training Instructions

Subjects viewed each instruction screen (in sequence from left to right starting at the top left) and advanced to the next screen by clicking a button labeled 'NEXT' that appeared at the lower right corner of the image.



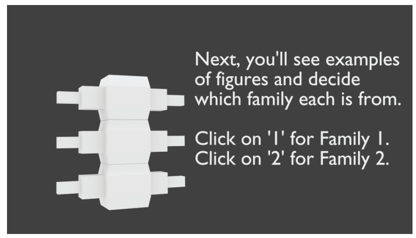
Training Block

200 trials. Subjects had unlimited time to view each stimulus and its true 'Family' label in green. They advanced to the next trial by clicking a 'NEXT' button at the lower right corner of the image.



Testing Instructions

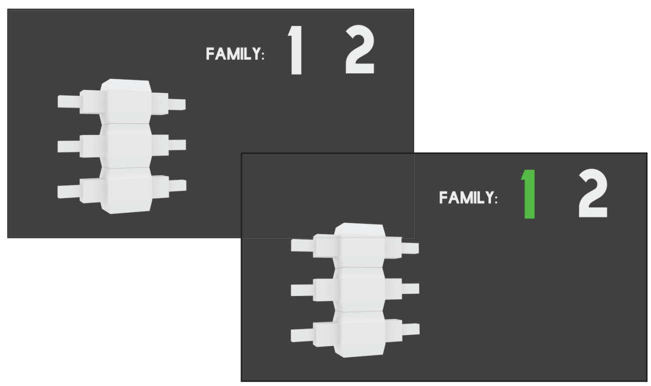
Subjects viewed a single screen and advanced to the Testing Block by clicking 'NEXT'.



Testing Block

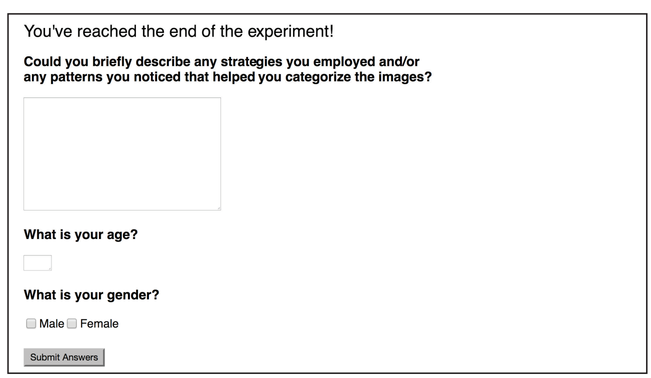
100 trials. Subjects had unlimited time to view each stimulus. They indicated their 'Family' choice by clicking '1' or '2'.

The number turned green for 100ms before automatically advancing to the next trial.



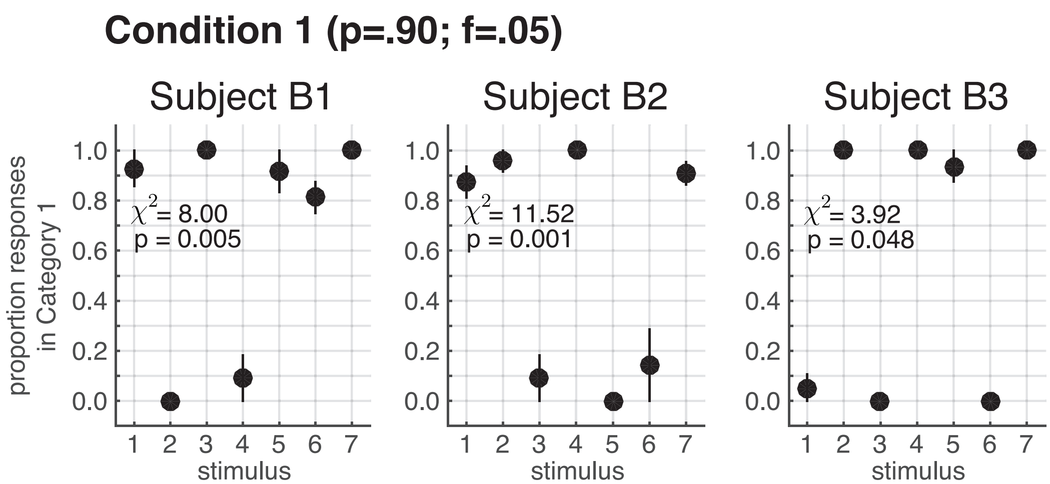
End Survey

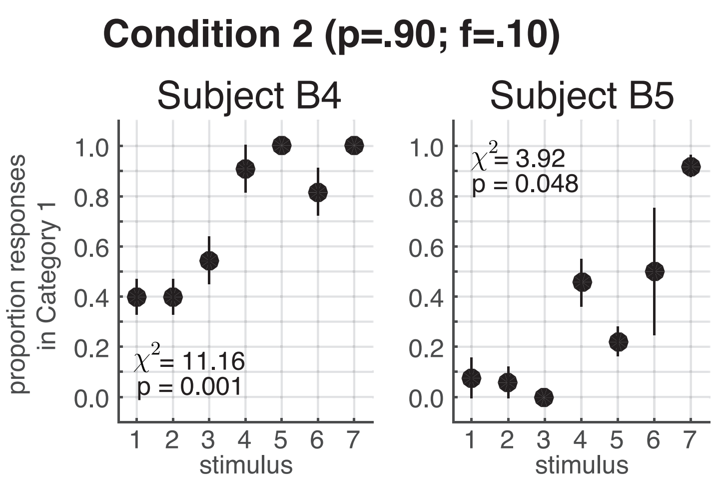
Subjects entered their reponses and clicked 'Submit Answers' to end the experiment.



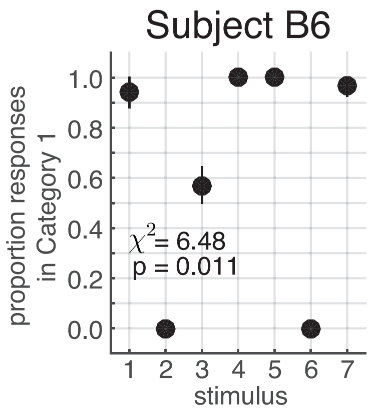
2 Response bias analyses

Our model predictions do not account for intrinsic response biases on the part of the subject. They assume that subjects' category choices in the Testing Block are based on an analyses of the stimuli in the Training Block, i.e. their probabilities, frequency, and similarity. If subjects adopted a categorization strategy which disregards these factors and instead chose categories based on a bias for selecting one category over another, this presents a potential confound to our conclusions. Thus we identified subjects with significant response biases and excluded them from subsequent analyses. Significance was determined by means of a χ^2 test comparing the proportions of trials on which each subject chose Family 1 or Family 2 to the expected proportion of .5 (i.e.,the category prior probability made known explicitly to the subjects in the instructions). 33 out of 240 subjects had a significant bias. Each subject's proportion of responses in Category 1 for each stimulus and their χ^2 statistics are shown below. In each plot, the Training Block condition is indicated. "p" refers to the Probability Condition, i.e. the posterior probability of Stimulus 7 occurring in Category 1. "f" refers to the Frequency Condition, i.e. the proportion of trials in which Stimulus 7 is observed in the Training Block. Each subject is indicated by number. "B" indicates that they were one of the 33 subjects excluded for a significant bias. Error bars show the central 50^{th} percentile of a binomial distribution over the response proportion.

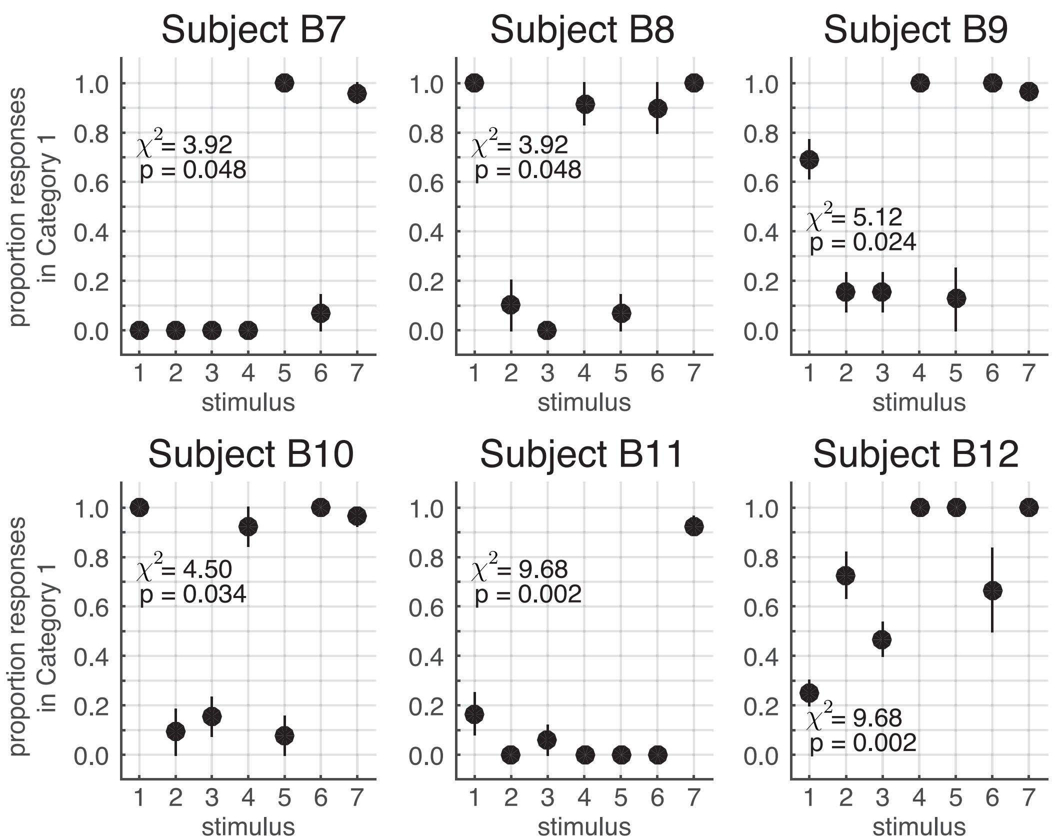




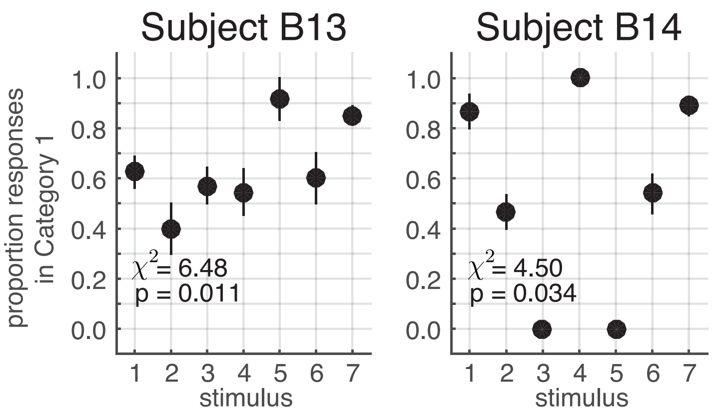
Condition 3 (p=.90; f=.20)



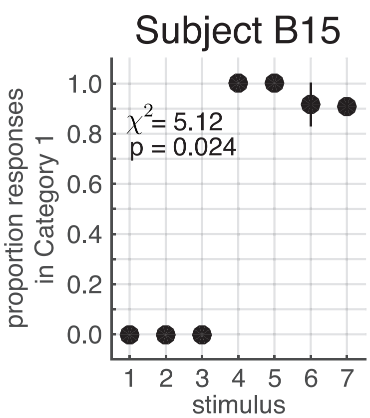
Condition 4 (p=.90; f=.40)



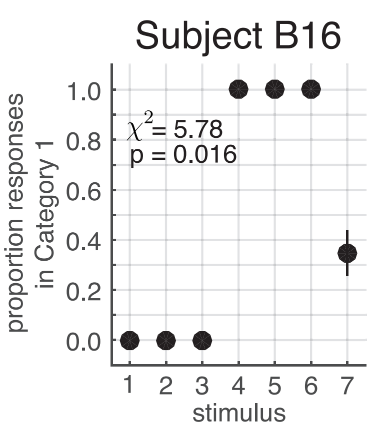
Condition 5 (p=.75; f=.05)



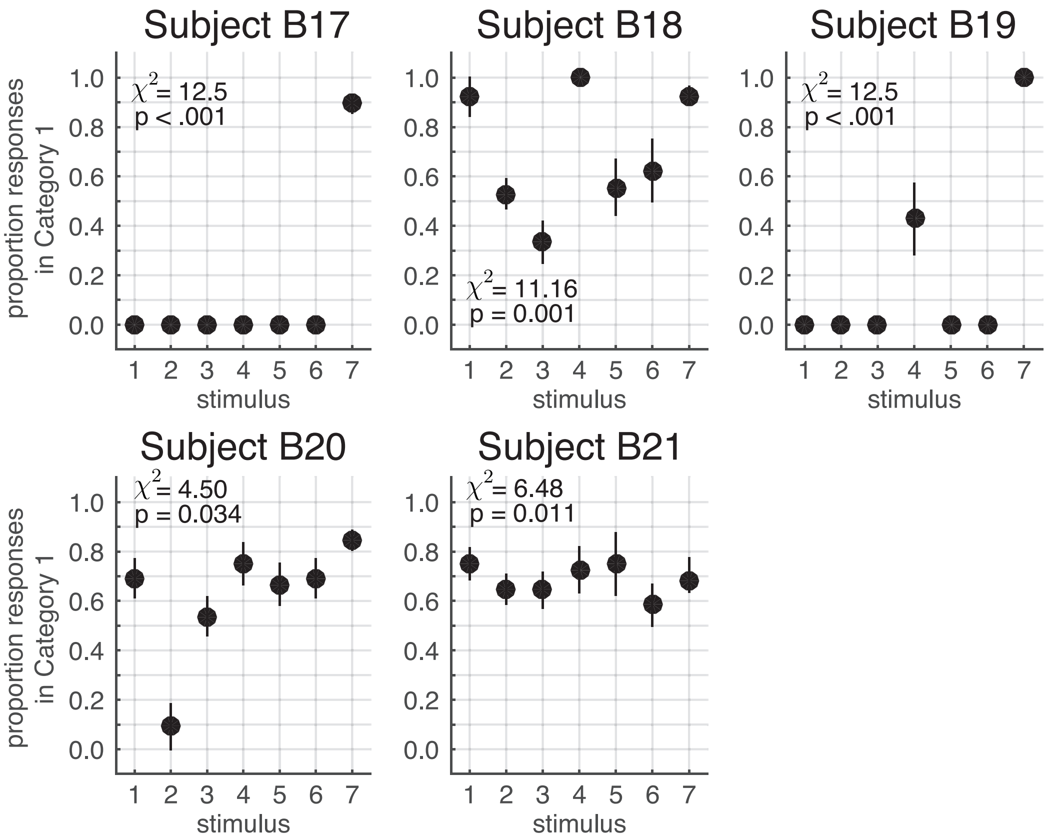
Condition 6 (p=.75; f=.10)



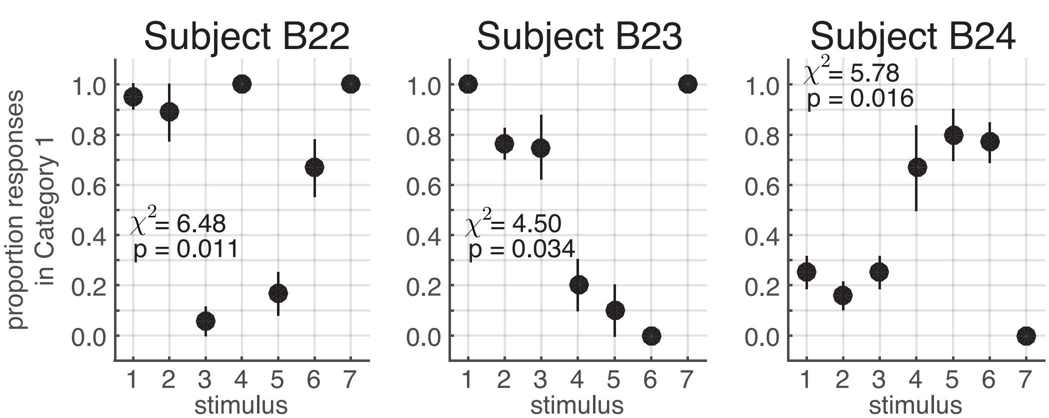
Condition 7 (p=.75; f=.20)



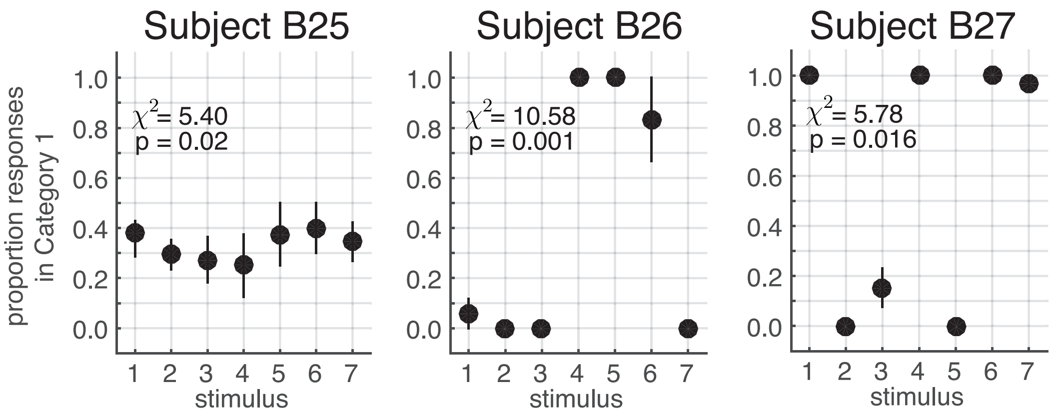
Condition 8 (p=.75; f=.40)



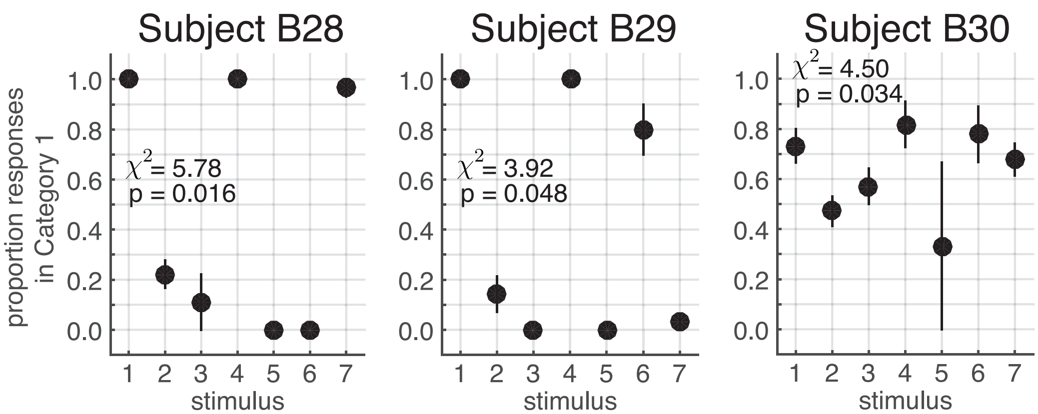
Condition 9 (p=.60; f=.05)



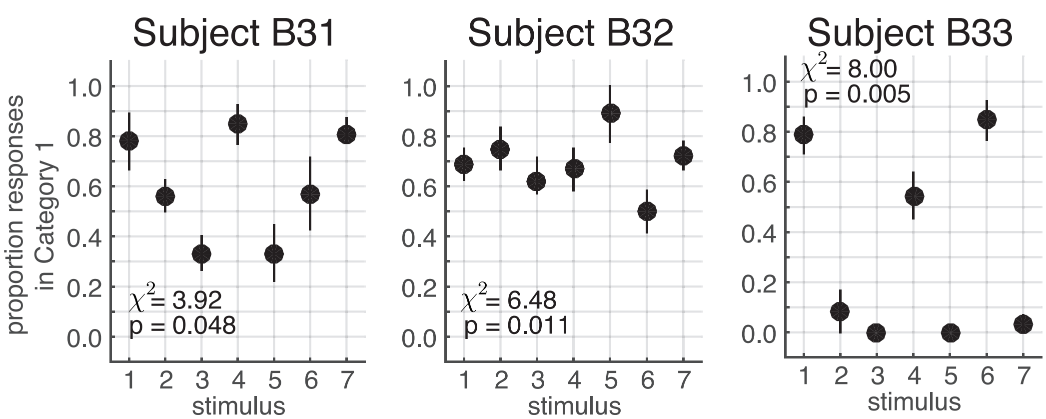
Condition 10 (p=.60; f=.10)



Condition 11 (p=.60; f=.20)



Condition 12 (p=.60; f=.40)



While category base rates were always approximately .5 in the Testing Block, altering the frequency of the stimuli and the probability of Stimulus 7 across the 12 Training Block conditions altered the category base rates in the Training Block (Fig. S1 A). We investigated whether this may have led to the significant response biases in the Testing Block. Out of the 33 subjects that had a significant response bias, 21 had a bias for choosing Category 1. The proportion of subjects in each of the 12 Training Block conditions who had a significant bias for choosing Category 1 as a function of the Category 1 base in that condition (as shown in the figures above) is shown in Fig. S1 B. The greatest proportion of subjects (4 out of 20) with a significant bias for choosing Category 1 occurred in Condition 4 (p = .90; f=.40). The regression of proportion of subjects with a significant bias onto Category 1 base rate is shown in S1 B. The slope is not significantly different from 0. Thus, while there is a trend to suggest the high base rate in that condition led to greater response, the effect is not significant. Next we examined the proportion of responses in Category 1 as a function of Category 1 base rate in the Training Block for each of the 33 subjects with significant biases. We regressed the proportion of responses in Category 1 onto the Category 1 base rates and found that the slope is not significantly different from 0 (Fig. S1 C). The bias for choosing Category 1 among these subjects does not seem to be related to an increase in the base rate.

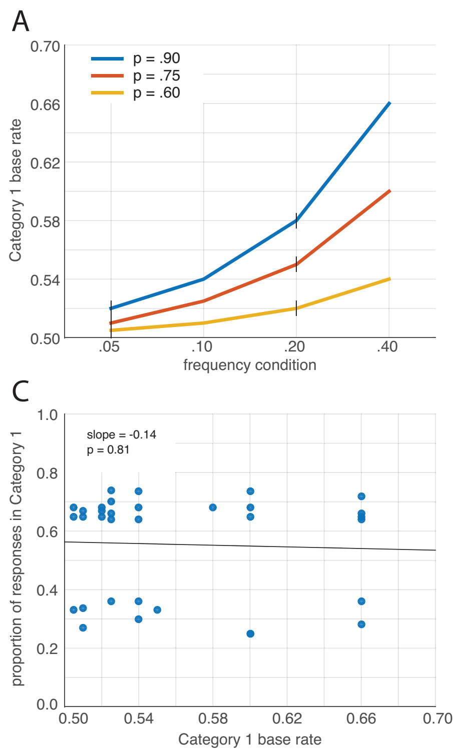


Figure S1: **A** Category 1 base rates for each Training Block condition. The horizontal axis shows the Frequency conditon (i.e., the proportion of trials on which Stimulus 7 was observed). Lines show the median base rate, across subjects, for each of the Probability conditions (i.e., the probability of observing Stimulus 7 in Category 1). Error bars show the centrall 95^{th} percentile. **B** The proportion of subjects in each Training Block condition that had a significant bias for chosing Category 1 as a function of the condition's median base rate (as shown in **A**). The regression line is shown in black with the slope and p value for the test for a significant difference from 0. The effect is not significant, although the trend suggests that the highest base rates (.60 and .66) may be predictive of significant response bias. **C** The proportion of responses in Category 1 for each of the 33 biased subjects as a function of Category 1 base rate in the Training Block with the regression line, slope, and p-value. The insignificant slope indicates that base rate is not predictive of response bias.

3 PFS Model implementation

As described in the text, a genetic algorithm was used to fit each subject's membership function, $m(\mathbf{s}_k, d)$ (see text Eq. 10), where $k = \{1, \ldots, 7\}$ indexes each of the seven stimuli, and d indexes the d^{th} set in the domain of the subject's subjective similarity space, $\mathcal{S}$. For a given stimulus, m can take on a range of 7 possible vector values:

$$
\begin{array}{llll}
1) & 1 & 0 & 0 \\
2) & 0 & 1 & 0 \\
3) & 0 & 0 & 1 \\
4) & \frac{1}{2} & \frac{1}{2} & 0 \\
5) & \frac{1}{2} & 0 & \frac{1}{2} \\
6) & 0 & \frac{1}{2} & \frac{1}{2} \\
7) & \frac{1}{3} & \frac{1}{3} & \frac{1}{3}
\end{array}
$$

Each 'individual' generated by the genetic algorithm consists of a 1×8 vector, $\mathbf{v}$, of the indices of these seven vector values, one index for each of the seven stimuli, and the probability weighting parameter γ. For example, an individual $\mathbf{v} = [1\ 1\ 1\ 2\ 2\ 2\ 3\ .8]$ corresponds to membership function:

$$
m = \begin{bmatrix}
1 & 0 & 0 \\
1 & 0 & 0 \\
1 & 0 & 0 \\
0 & 1 & 0 \\
0 & 1 & 0 \\
0 & 1 & 0 \\
0 & 0 & 1
\end{bmatrix}
$$

and indicates that stimuli 1 - 3 are members of set $\mathcal{S}_1$, stimuli 4 - 6 are members of set $\mathcal{S}_2$, stimulus 7 is a members of set $\mathcal{S}_3$, with a probability weighting parameter of .8. An individual $\mathbf{v} = [4\ 4\ 4\ 6\ 6\ 6\ 6\ .8]$ corresponds to membership function:

$$
m = \begin{bmatrix}
\frac{1}{2} & \frac{1}{2} & 0 \\
\frac{1}{2} & \frac{1}{2} & 0 \\
\frac{1}{2} & \frac{1}{2} & 0 \\
0 & \frac{1}{2} & \frac{1}{2} \\
0 & \frac{1}{2} & \frac{1}{2} \\
0 & \frac{1}{2} & \frac{1}{2} \\
0 & \frac{1}{2} & \frac{1}{2}
\end{bmatrix}
$$

and indicates that stimuli 1 - 3 are members of set $\mathcal{S}_1$ and $\mathcal{S}_2$, and stimuli 4 - 7 are members of set $\mathcal{S}_2$ and $\mathcal{S}_3$, etc.

The genetic algorithm was implemented in Matlab using function *ga*. The initial population of individuals was generated at random. The population size was 200. The algorithm created 200 generations. On each generation, offspring were generated by selecting 2 individuals that minimized the fitness function described below. The remainder of the successive population consisted of 80% crossover (combination of pairs of 'parent' individuals) and the remainder were mutations (modification of single parents). Probability weighting parameters were constrained such that $0 < \gamma \leq 1$.

The fitness function minimized the negative log likelihood of the subject's responses given the estimated membership function. On every generation, the algorithm translated the index vector $\mathbf{v}$ into the 7×3

estimate, $\hat{m}$, of the membership function, m. It then derived the rule posterior, $p(R_n|\mathcal{S}, \hat{m})$, as in Eq. 11 of the text. 100 runs of the experiment were simulated by sampling from the rule posterior as described in the text. On each simulated run, the model generated category responses with respect to the stimuli viewed by the subject on each trial of the experiment by drawing a single sample from the rule posterior over decision rules and responding in accordance with the sampled rule. The result of each simulation is the counts, $\hat{N}_{k,C_1}$ and $\hat{N}_{k,C_2}$, representing the number of trials on which the model selected Category 1 for the k^{th} stimulus and Category 2 for the k^{th} stimulus, respectively. We assume the response counts to follow a binomial distribution across the 100 simulated runs of the experiment and derive the maximum likelihood estimate, $\hat{p}(C_1|k, \hat{m})$, of the probability that the model will select Category 1 for the k^{th} stimulus given the estimated membership function. The fitness function's best fitting estimate of the membership function is derived by minimizing the negative log likelihood of the subject's observed category choices given the model estimates:

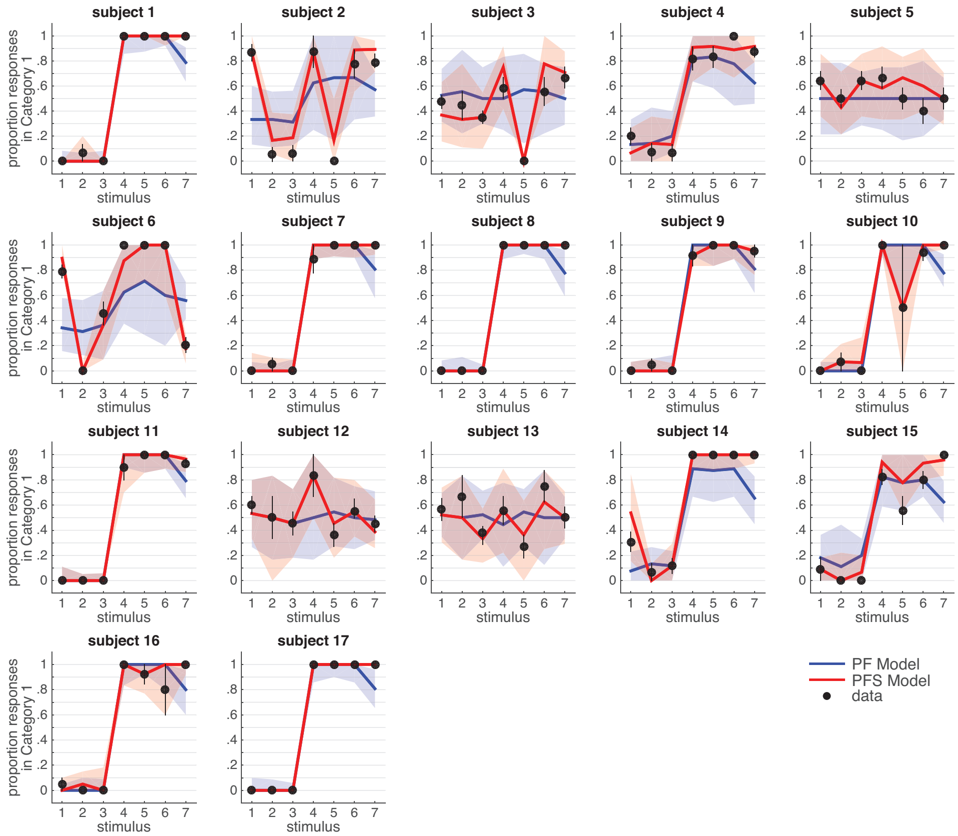
$$\arg\min_{\hat{m}} \left(-\sum_k N_{k,C_1} \ln\left(\hat{p}(C_1|k, \hat{m})\right) + N_{k,C_2} \ln\left(1 - \hat{p}(C_1|k, \hat{m})\right) \right),$$

where N_{k,C_1} and N_{k,C_2} are the number of trials on which the subject chose Category 1 for the k^{th} stimulus and Category 2 for the k^{th} stimulus, respectively.

4 Subject data and model predictions

The figures below show the proportion of trials on which each subject selected Category 1 for each of the 7 stimuli. Subjects are grouped by their respective Training Block condition. The predictions of the PF and PFS models are shown in blue and red, respectively. Error bars on the subjects' data show the central 50^{th} percentile of a binomial distribution given their observed proportions and the number trials on which each stimulus was observed in the Testing Block. Shaded error regions on the model predictions show the central 95^{th} percentile of the proportions derived from the model simulations. The lower part of the figure for each condition shows each subject's fitted parameters from the PFS model. m is the estimated membership function as described above. γ is the estimated probability weighting function parameter.

Condition 1 (p=.90; f=.05)



subject 1

$$m = \begin{matrix} 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.85

subject 2

$$m = \begin{matrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.85

subject 3

$$m = \begin{matrix} 0.5 & 0 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.92

subject 4

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.78

subject 5

$$m = \begin{matrix} 0 & 1 & 0 \\ 0.5 & 0 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \\ 0.33 & 0.33 & 0.33 \end{matrix}$$

$\gamma =$ 0.82

subject 6

$$m = \begin{matrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{matrix}$$

$\gamma =$ 0.86

subject 7

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.8

subject 8

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.98

subject 9

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.81

subject 10

$$m = \begin{matrix} 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.83

subject 11

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.83

subject 12

$$m = \begin{matrix} 0.5 & 0 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0.5 & 0.5 & 0 \end{matrix}$$

$\gamma =$ 0.83

subject 13

$$m = \begin{matrix} 0.33 & 0.33 & 0.33 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0.33 & 0.33 & 0.33 \end{matrix}$$

$\gamma =$ 0.79

subject 14

$$m = \begin{matrix} 0.5 & 0 & 0.5 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.84

subject 15

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.79

subject 16

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

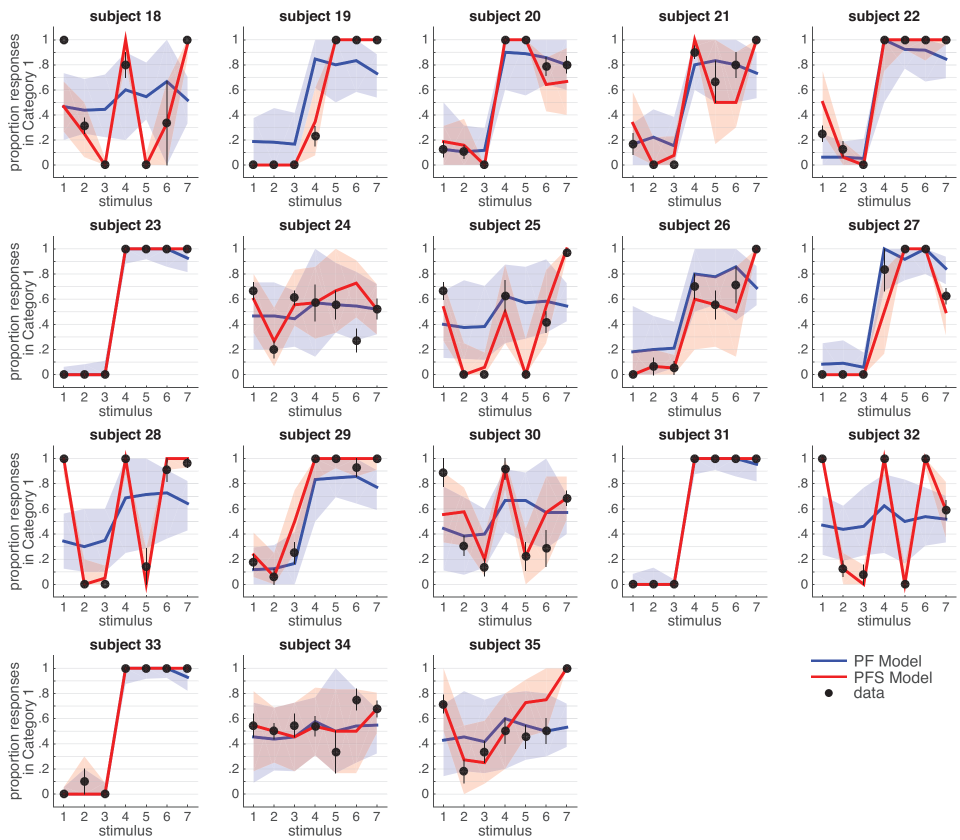
$\gamma =$ 0.8

subject 17

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.97

Condition 2 (p=.90; f=.10)



subject 18

$$m = \begin{matrix} 0.5 & 0 & 0.5 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.99

subject 19

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.99

subject 20

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.88

subject 21

$$m = \begin{matrix} 0.33 & 0.33 & 0.33 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.85

subject 22

$$m = \begin{matrix} 0.5 & 0 & 0.5 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.85

subject 23

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.97

subject 24

$$m = \begin{matrix} 0.33 & 0.33 & 0.33 \\ 1 & 0 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0 & 0.5 \end{matrix}$$

$\gamma =$ 0.78

subject 25

$$m = \begin{matrix} 0 & 0.5 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 1 & 0 \\ 0.5 & 0 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.9

subject 26

$$m = \begin{matrix} 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0 & 0.5 \\ 0.5 & 0 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.9

subject 27

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0.5 & 0 & 0.5 \end{matrix}$$

$\gamma =$ 0.97

subject 28

$$m = \begin{matrix} 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.87

subject 29

$$m = \begin{matrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0.5 & 0 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.81

subject 30

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0.5 & 0 & 0.5 \\ 0.33 & 0.33 & 0.33 \end{matrix}$$

$\gamma =$ 0.98

subject 31

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.94

subject 32

$$m = \begin{matrix} 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.95

subject 33

$$m = \begin{matrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.89

subject 34

$$m = \begin{matrix} 0 & 1 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0.5 & 0 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0 & 0.5 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

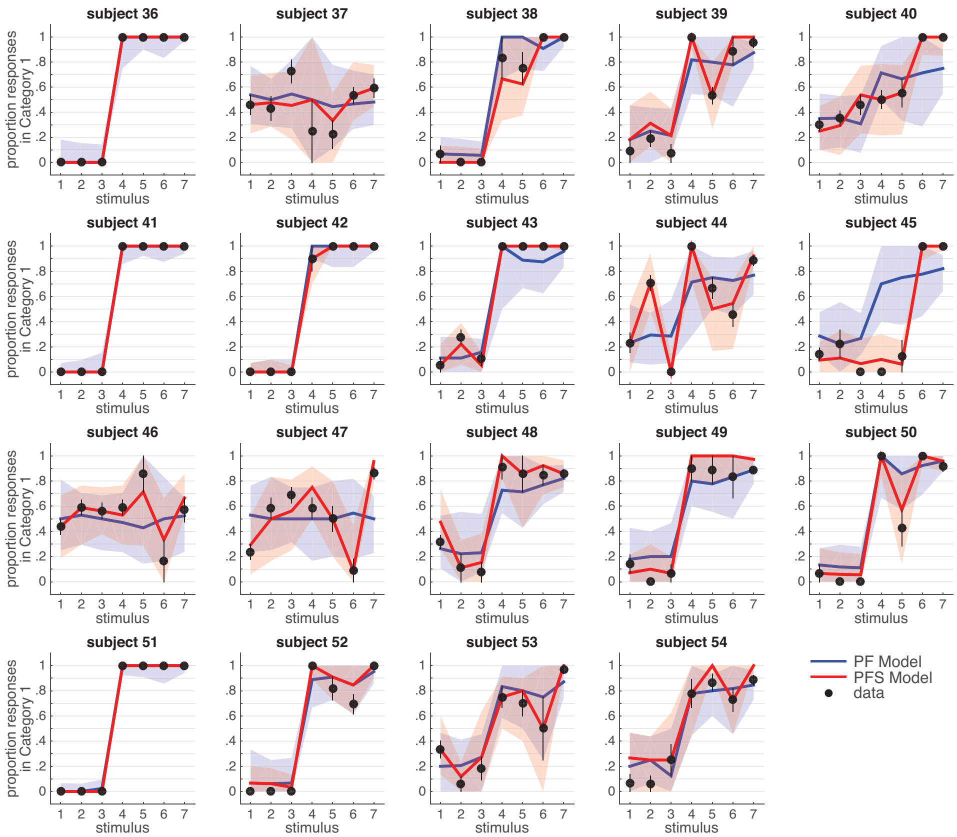
$\gamma =$ 0.8

subject 35

$$m = \begin{matrix} 0 & 0.5 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.91

Condition 3 (p=.90; f=.20)



subject 36

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.92

subject 37

$$m = \begin{matrix} 0.5 & 0 & 0.5 \\ 0.33 & 0.33 & 0.33 \\ 0.33 & 0.33 & 0.33 \\ 0.33 & 0.33 & 0.33 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.8

subject 38

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.96

subject 39

$$m = \begin{matrix} 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.79

subject 40

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 0.33 & 0.33 & 0.33 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.83

subject 41

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.92

subject 42

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.85

subject 43

$$m = \begin{matrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.82

subject 44

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.85

subject 45

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.89

subject 46

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0.33 & 0.33 & 0.33 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.79

subject 47

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0.5 & 0.5 \\ 0.33 & 0.33 & 0.33 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.86

subject 48

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.78

subject 49

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 1 & 0 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.79

subject 50

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.82

subject 51

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 1

subject 52

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.8

subject 53

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

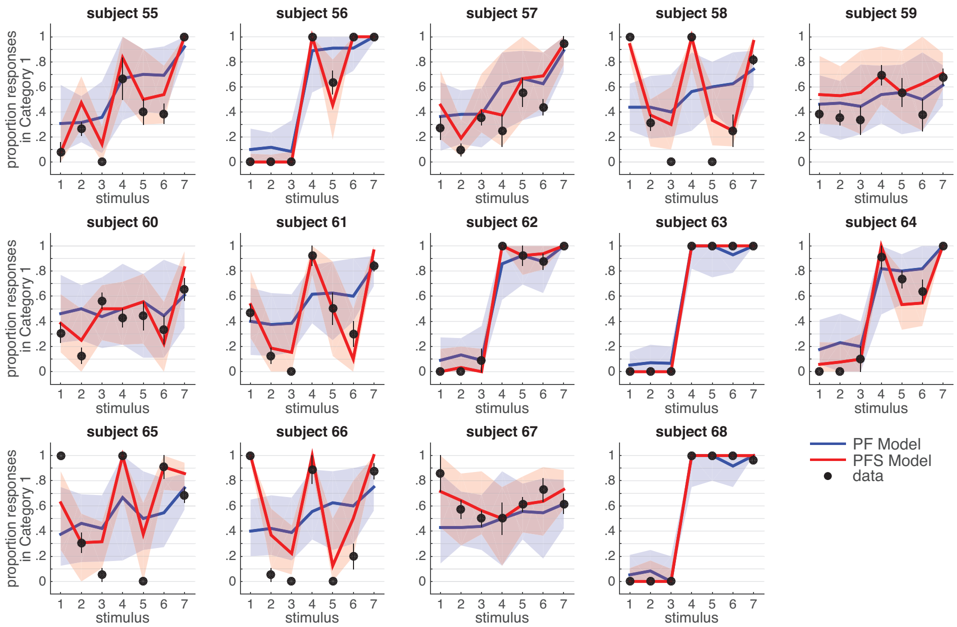
$\gamma =$ 0.8

subject 54

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0.5 & 0.5 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.81

Condition 4 (p=.90; f=.40)



subject 55

$$m = \begin{matrix} 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0 & 0.5 \\ 0.5 & 0 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.97

subject 56

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.99

subject 57

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.8

subject 58

$$m = \begin{matrix} 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.96

subject 59

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 1 & 0 \\ 0.5 & 0 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.77

subject 60

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.79

subject 61

$$m = \begin{matrix} 0.33 & 0.33 & 0.33 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.81

subject 62

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.83

subject 63

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 1

subject 64

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0 & 0.5 \\ 0.5 & 0 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.96

subject 65

$$m = \begin{matrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.97

subject 66

$$m = \begin{matrix} 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.85

subject 67

$$m = \begin{matrix} 0 & 0 & 1 \\ 0.5 & 0 & 0.5 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

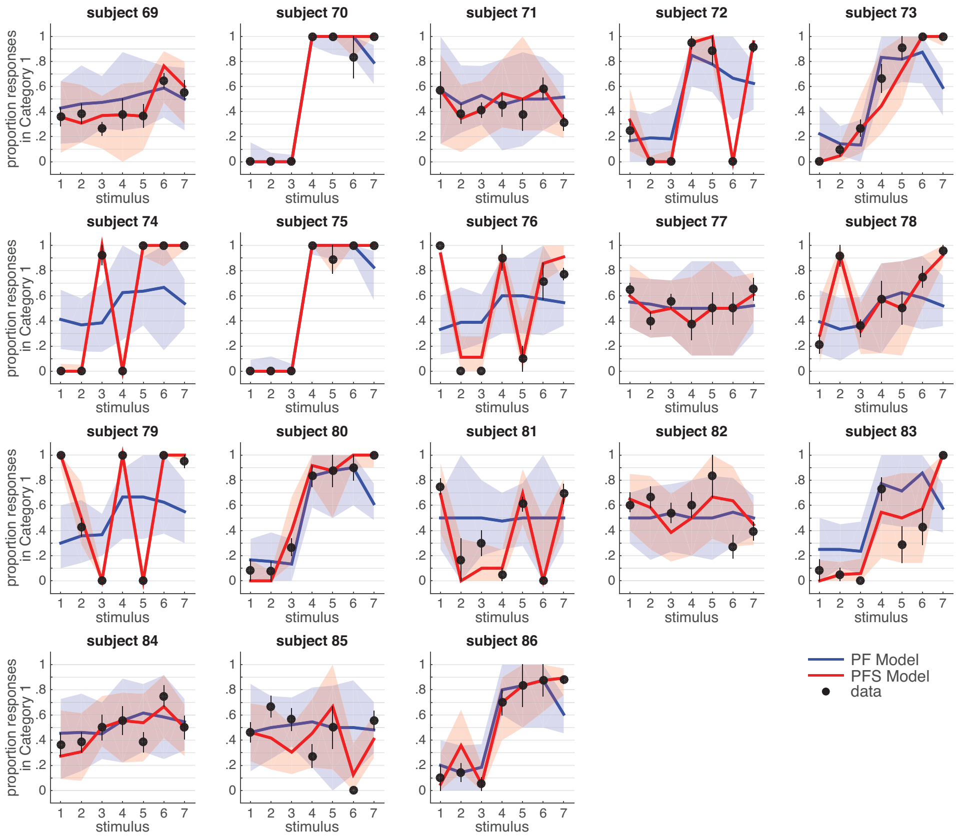
$\gamma =$ 0.79

subject 68

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.85

Condition 5 (p=.75; f=.05)



subject 69

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0 & 0.5 \end{matrix} \qquad \gamma = 0.84$$

subject 70

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix} \qquad \gamma = 0.88$$

subject 71

$$m = \begin{matrix} 0.33 & 0.33 & 0.33 \\ 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 1 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0.5 & 0 & 0.5 \\ 1 & 0 & 0 \end{matrix} \qquad \gamma = 0.8$$

subject 72

$$m = \begin{matrix} 0.33 & 0.33 & 0.33 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix} \qquad \gamma = 0.85$$

subject 73

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix} \qquad \gamma = 0.82$$

subject 74

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix} \qquad \gamma = 0.94$$

subject 75

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix} \qquad \gamma = 0.89$$

subject 76

$$m = \begin{matrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix} \qquad \gamma = 0.84$$

subject 77

$$m = \begin{matrix} 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 0.33 & 0.33 & 0.33 \\ 1 & 0 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix} \qquad \gamma = 0.84$$

subject 78

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 0 & 1 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix} \qquad \gamma = 0.85$$

subject 79

$$m = \begin{matrix} 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \end{matrix} \qquad \gamma = 0.96$$

subject 80

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix} \qquad \gamma = 0.8$$

subject 81

$$m = \begin{matrix} 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix} \qquad \gamma = 0.86$$

subject 82

$$m = \begin{matrix} 0 & 1 & 0 \\ 0.5 & 0 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 1 & 0 \\ 0.5 & 0.5 & 0 \end{matrix} \qquad \gamma = 0.82$$

subject 83

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix} \qquad \gamma = 0.88$$

subject 84

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0 & 0.5 \end{matrix} \qquad \gamma = 0.81$$

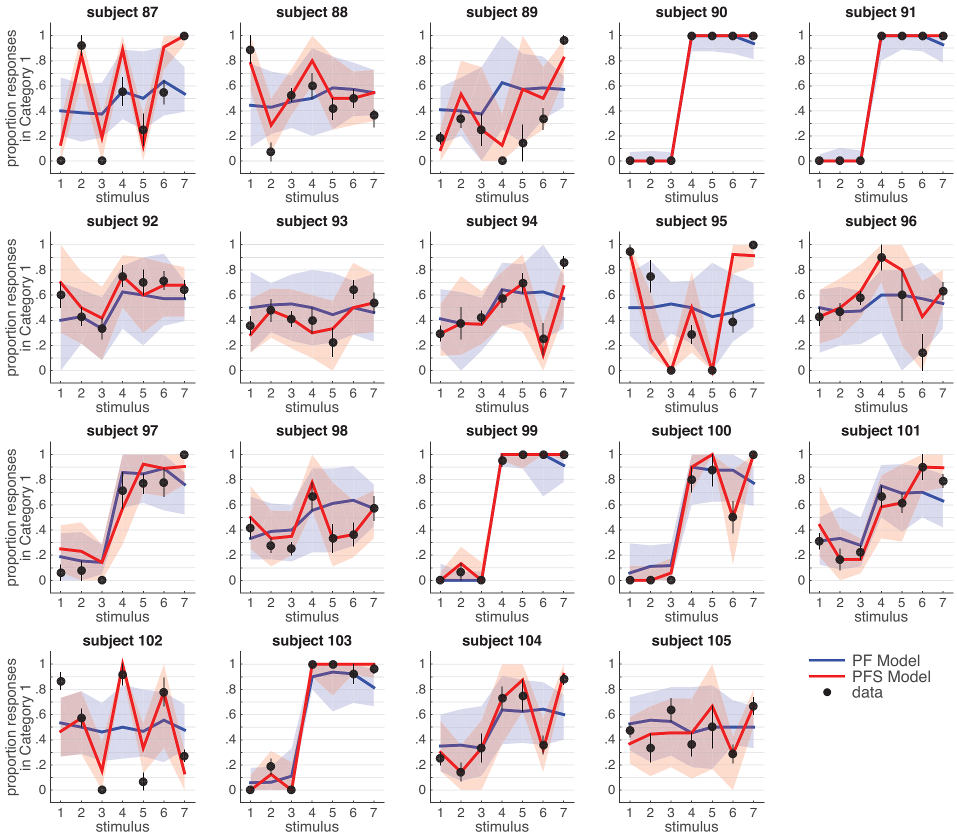
subject 85

$$m = \begin{matrix} 0.5 & 0 & 0.5 \\ 0.5 & 0 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0.5 & 0 & 0.5 \end{matrix} \qquad \gamma = 0.9$$

subject 86

$$m = \begin{matrix} 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix} \qquad \gamma = 0.79$$

Condition 6 (p=.75; f=.10)



subject 87

$$m = \begin{matrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.83

subject 88

$$m = \begin{matrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0 & 1 \\ 0.5 & 0 & 0.5 \\ 0 & 1 & 0 \\ 0.5 & 0 & 0.5 \end{matrix}$$

$\gamma =$ 0.88

subject 89

$$m = \begin{matrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.88

subject 90

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.99

subject 91

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.95

subject 92

$$m = \begin{matrix} 0 & 0.5 & 0.5 \\ 0.5 & 0 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.78

subject 93

$$m = \begin{matrix} 1 & 0 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.78

subject 94

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 0.5 & 0 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.8

subject 95

$$m = \begin{matrix} 0 & 0 & 1 \\ 0.33 & 0.33 & 0.33 \\ 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.96

subject 96

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0 & 1 & 0 \\ 0.5 & 0 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \end{matrix}$$

$\gamma =$ 0.82

subject 97

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.78

subject 98

$$m = \begin{matrix} 0.5 & 0 & 0.5 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0.5 & 0 & 0.5 \end{matrix}$$

$\gamma =$ 0.83

subject 99

$$m = \begin{matrix} 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.82

subject 100

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0.5 & 0 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.83

subject 101

$$m = \begin{matrix} 0.33 & 0.33 & 0.33 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.79

subject 102

$$m = \begin{matrix} 0 & 1 & 0 \\ 0.33 & 0.33 & 0.33 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \end{matrix}$$

$\gamma =$ 1

subject 103

$$m = \begin{matrix} 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.81

subject 104

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \end{matrix}$$

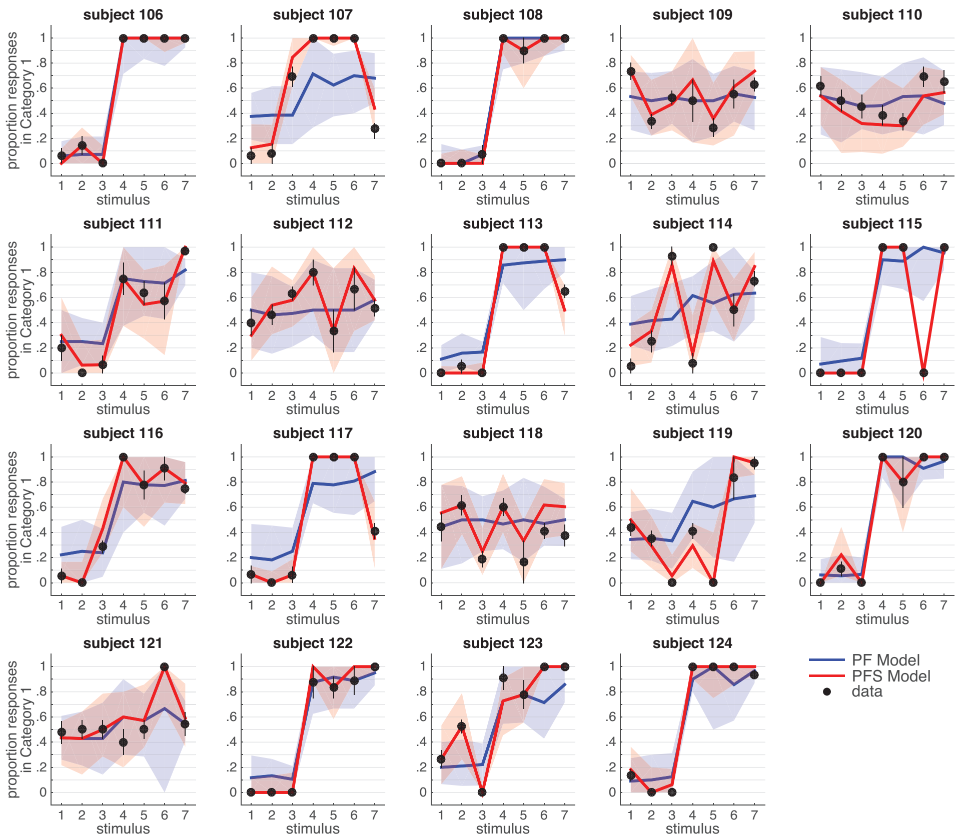
$\gamma =$ 0.79

subject 105

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.8

Condition 7 (p=.75; f=.20)



subject 106

$$m = \begin{matrix} 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.82

subject 107

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \end{matrix}$$

$\gamma =$ 0.93

subject 108

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.82

subject 109

$$m = \begin{matrix} 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.79

subject 110

$$m = \begin{matrix} 0 & 0 & 1 \\ 0.33 & 0.33 & 0.33 \\ 0.5 & 0.5 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.79

subject 111

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0 & 0.5 \\ 0.5 & 0 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.88

subject 112

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0 & 0.5 \end{matrix}$$

$\gamma =$ 0.89

subject 113

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0.5 & 0 & 0.5 \end{matrix}$$

$\gamma =$ 0.9

subject 114

$$m = \begin{matrix} 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.82

subject 115

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 1

subject 116

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{matrix}$$

$\gamma =$ 0.81

subject 117

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0.33 & 0.33 & 0.33 \end{matrix}$$

$\gamma =$ 0.94

subject 118

$$m = \begin{matrix} 0.33 & 0.33 & 0.33 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.81

subject 119

$$m = \begin{matrix} 0.5 & 0 & 0.5 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.91

subject 120

$$m = \begin{matrix} 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 1

subject 121

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 0.5 & 0 & 0.5 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{matrix}$$

$\gamma =$ 0.83

subject 122

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.81

subject 123

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

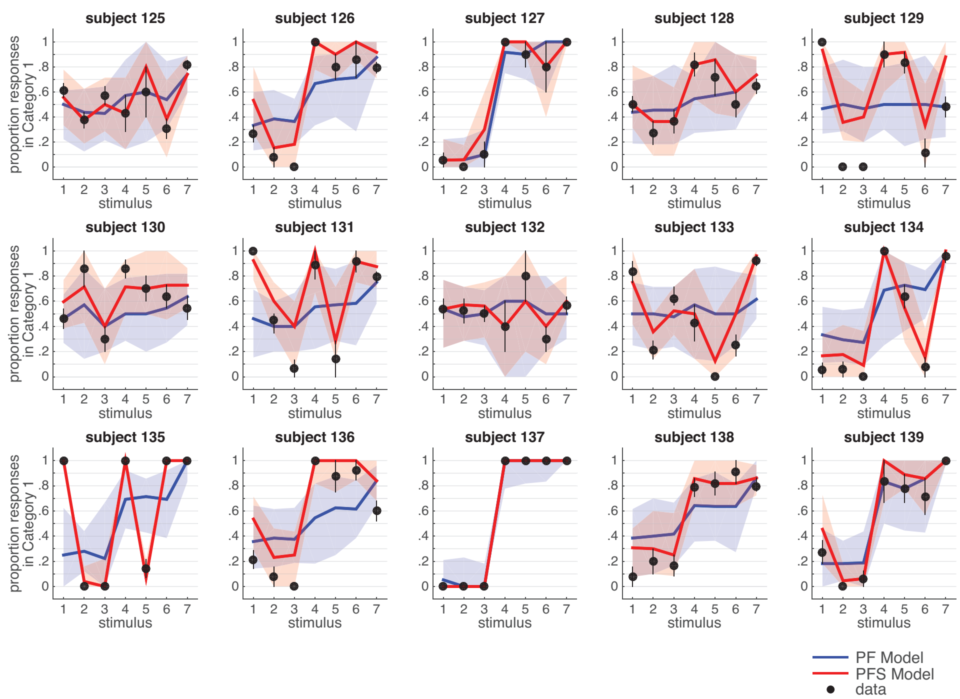
$\gamma =$ 0.9

subject 124

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.8

Condition 8 (p=.75; f=.40)



subject 125

$$m = \begin{matrix} 0 & 0.5 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.78

subject 126

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.79

subject 127

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.82

subject 128

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.77

subject 129

$$m = \begin{matrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{matrix}$$

$\gamma =$ 0.94

subject 130

$$m = \begin{matrix} 0.33 & 0.33 & 0.33 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.77

subject 131

$$m = \begin{matrix} 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{matrix}$$

$\gamma =$ 0.92

subject 132

$$m = \begin{matrix} 0.33 & 0.33 & 0.33 \\ 0.33 & 0.33 & 0.33 \\ 0.33 & 0.33 & 0.33 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.78

subject 133

$$m = \begin{matrix} 0 & 0.5 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.88

subject 134

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0.5 & 0 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.88

subject 135

$$m = \begin{matrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.98

subject 136

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.8

subject 137

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 1

subject 138

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \end{matrix}$$

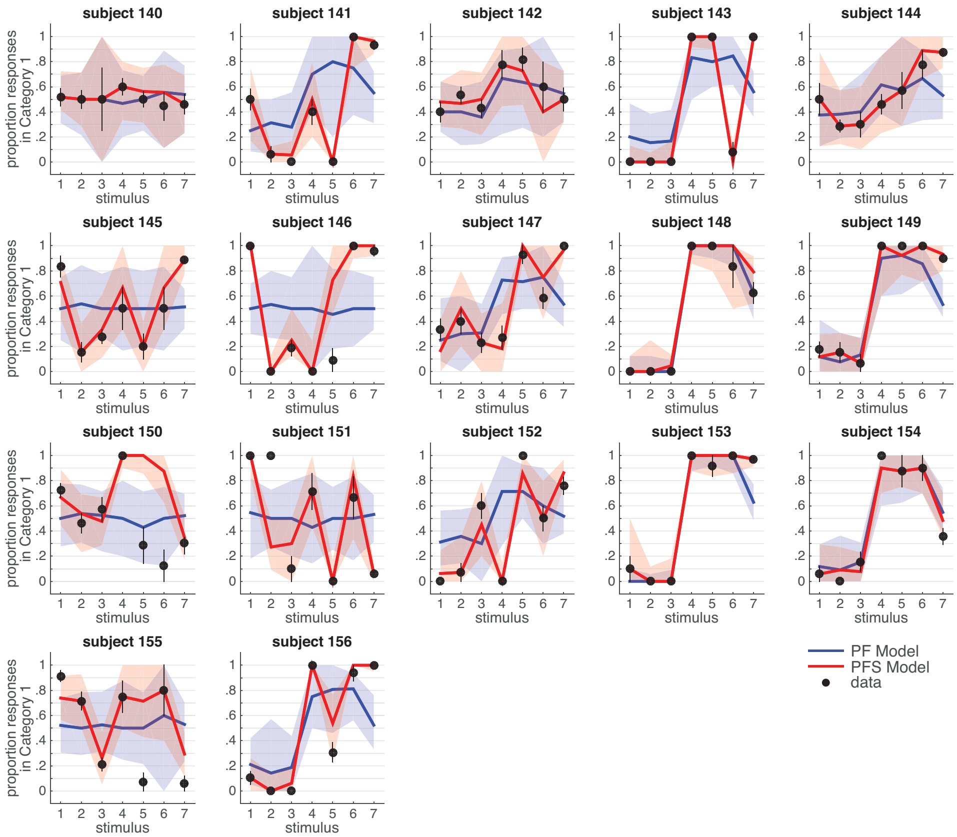
$\gamma =$ 0.77

subject 139

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.82

Condition 9 (p=.60; f=.05)



subject 140

$$m = \begin{matrix} 0.5 & 0 & 0.5 \\ 0 & 1 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0.5 & 0.5 \\ 0.33 & 0.33 & 0.33 \\ 0.5 & 0 & 0.5 \\ 0 & 1 & 0 \end{matrix}$$

$\gamma =$ 0.77

subject 141

$$m = \begin{matrix} 0.5 & 0 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.87

subject 142

$$m = \begin{matrix} 0 & 1 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0.5 & 0 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0 & 0.5 \\ 0.5 & 0 & 0.5 \end{matrix}$$

$\gamma =$ 0.95

subject 143

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.85

subject 144

$$m = \begin{matrix} 0.5 & 0 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.79

subject 145

$$m = \begin{matrix} 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.83

subject 146

$$m = \begin{matrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.94

subject 147

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.89

subject 148

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 1 & 0 \end{matrix}$$

$\gamma =$ 0.8

subject 149

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.79

subject 150

$$m = \begin{matrix} 0 & 1 & 0 \\ 0.5 & 0 & 0.5 \\ 0.5 & 0 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0.5 & 0 \end{matrix}$$

$\gamma =$ 1

subject 151

$$m = \begin{matrix} 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \end{matrix}$$

$\gamma =$ 0.9

subject 152

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.83

subject 153

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.8

subject 154

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0.5 & 0 \end{matrix}$$

$\gamma =$ 0.79

subject 155

$$m = \begin{matrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{matrix}$$

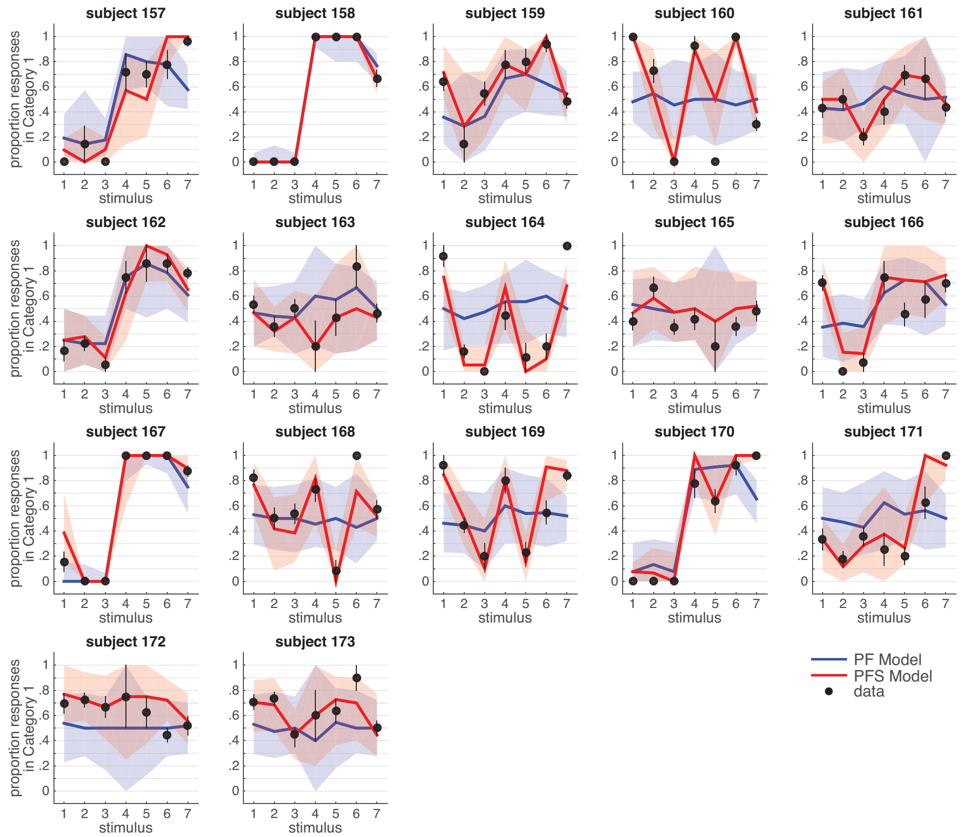
$\gamma =$ 0.8

subject 156

$$m = \begin{matrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.85

Condition 10 (p=.60; f=.10)



subject 157

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0.5 & 0 & 0.5 \\ 0.5 & 0 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.88

subject 158

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.88

subject 159

$$m = \begin{matrix} 0 & 0.5 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0.5 & 0 & 0.5 \end{matrix}$$

$\gamma =$ 0.89

subject 160

$$m = \begin{matrix} 0 & 0 & 1 \\ 0.33 & 0.33 & 0.33 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0 & 0.5 \\ 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \end{matrix}$$

$\gamma =$ 1

subject 161

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0 & 0.5 \end{matrix}$$

$\gamma =$ 0.79

subject 162

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.79

subject 163

$$m = \begin{matrix} 0 & 0.5 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.79

subject 164

$$m = \begin{matrix} 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.89

subject 165

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 0 & 1 & 0 \\ 0.5 & 0 & 0.5 \\ 0.33 & 0.33 & 0.33 \end{matrix}$$

$\gamma =$ 0.76

subject 166

$$m = \begin{matrix} 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.79

subject 167

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 1

subject 168

$$m = \begin{matrix} 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0.33 & 0.33 & 0.33 \end{matrix}$$

$\gamma =$ 1

subject 169

$$m = \begin{matrix} 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.82

subject 170

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.82

subject 171

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.85

subject 172

$$m = \begin{matrix} 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \end{matrix}$$

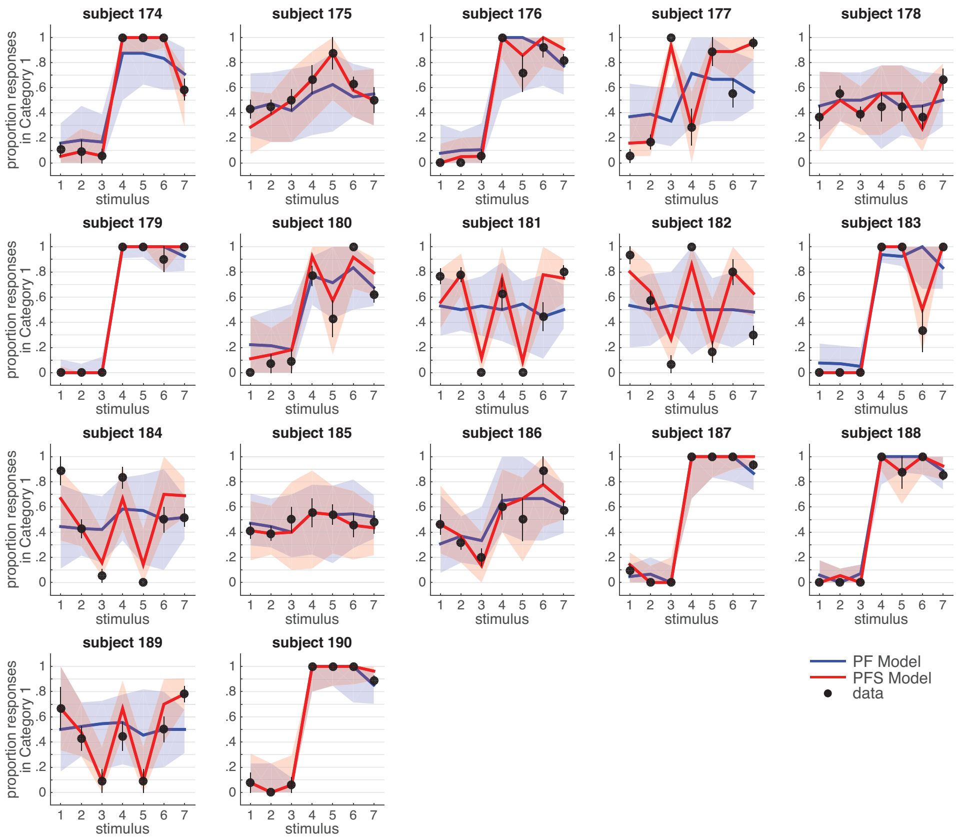
$\gamma =$ 0.8

subject 173

$$m = \begin{matrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \end{matrix}$$

$\gamma =$ 0.79

Condition 11 (p=.60; f=.20)



subject 174

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.8

subject 175

$$m = \begin{matrix} 0 & 1 & 0 \\ 0.5 & 0.5 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0.5 & 0 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0.33 & 0.33 & 0.33 \end{matrix}$$

$\gamma =$ 0.78

subject 176

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.8

subject 177

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.84

subject 178

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.77

subject 179

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.87

subject 180

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{matrix}$$

$\gamma =$ 0.79

subject 181

$$m = \begin{matrix} 0.33 & 0.33 & 0.33 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.87

subject 182

$$m = \begin{matrix} 0 & 0.5 & 0.5 \\ 0.33 & 0.33 & 0.33 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0.33 & 0.33 & 0.33 \end{matrix}$$

$\gamma =$ 0.89

subject 183

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 1

subject 184

$$m = \begin{matrix} 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.83

subject 185

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \\ 0.5 & 0 & 0.5 \\ 0.5 & 0 & 0.5 \end{matrix}$$

$\gamma =$ 0.78

subject 186

$$m = \begin{matrix} 0.33 & 0.33 & 0.33 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.78

subject 187

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.81

subject 188

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.81

subject 189

$$m = \begin{matrix} 0 & 0.5 & 0.5 \\ 0.33 & 0.33 & 0.33 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

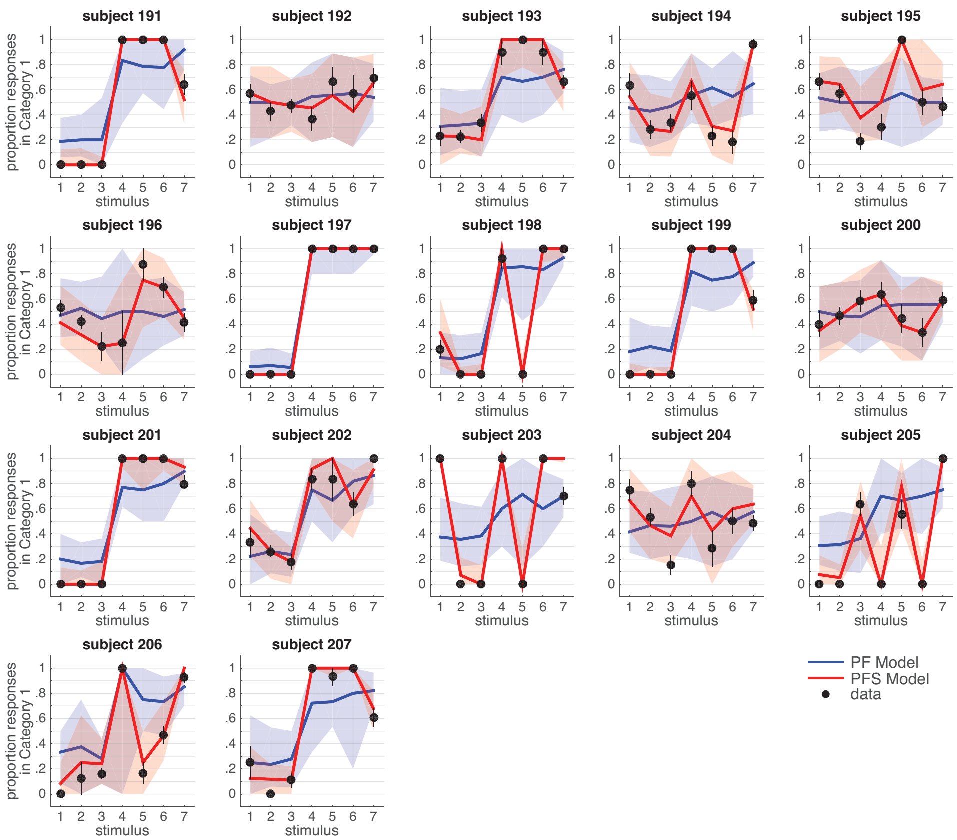
$\gamma =$ 0.85

subject 190

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.8

Condition 12 (p=.60; f=.40)



subject 191

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0.5 & 0 & 0.5 \end{matrix}$$

$\gamma =$ 1

subject 192

$$m = \begin{matrix} 0.33 & 0.33 & 0.33 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.78

subject 193

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.79

subject 194

$$m = \begin{matrix} 0.33 & 0.33 & 0.33 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.93

subject 195

$$m = \begin{matrix} 0.5 & 0 & 0.5 \\ 0.5 & 0 & 0.5 \\ 0.5 & 0.5 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0.5 & 0 & 0.5 \\ 0.5 & 0 & 0.5 \end{matrix}$$

$\gamma =$ 1

subject 196

$$m = \begin{matrix} 0.33 & 0.33 & 0.33 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{matrix}$$

$\gamma =$ 0.8

subject 197

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 1

subject 198

$$m = \begin{matrix} 0.33 & 0.33 & 0.33 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.89

subject 199

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 1

subject 200

$$m = \begin{matrix} 0.5 & 0.5 & 0 \\ 0.33 & 0.33 & 0.33 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.79

subject 201

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.83

subject 202

$$m = \begin{matrix} 0.33 & 0.33 & 0.33 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.79

subject 203

$$m = \begin{matrix} 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 1

subject 204

$$m = \begin{matrix} 0 & 0.5 & 0.5 \\ 0.5 & 0.5 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0.5 & 0.5 \end{matrix}$$

$\gamma =$ 0.79

subject 205

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0.33 & 0.33 & 0.33 \\ 1 & 0 & 0 \\ 0 & 0.5 & 0.5 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.98

subject 206

$$m = \begin{matrix} 1 & 0 & 0 \\ 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \\ 0 & 0 & 1 \\ 0.5 & 0.5 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

$\gamma =$ 0.86

subject 207

$$m = \begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \\ 0.33 & 0.33 & 0.33 \end{matrix}$$

$\gamma =$ 0.87

5 Model likelihood distributions

Below are the empirical likelihood distributions of each model's predicted proportion optimal compared to the subjects' observed proportion optimal (see text under 'Model Predictions').

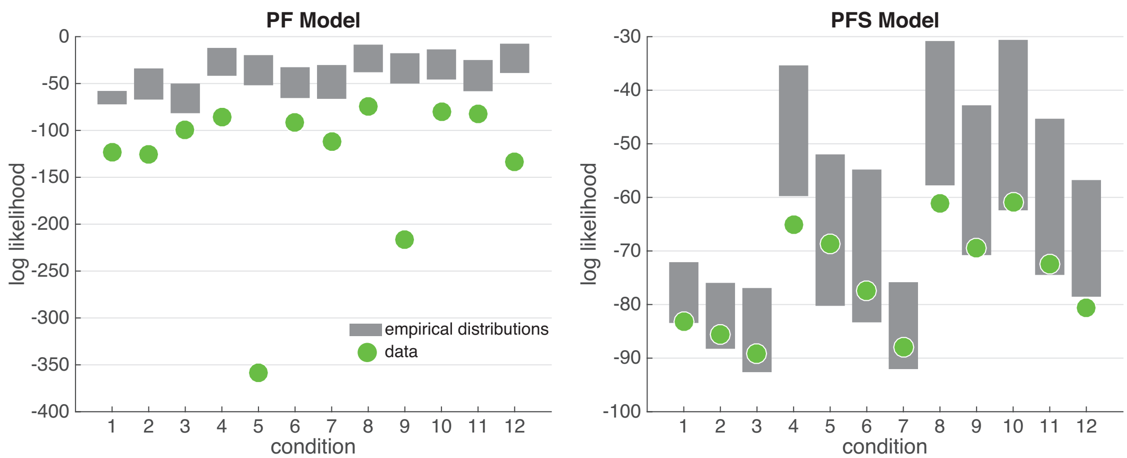


Figure S2: Log likelihood of proportion optimal for the PF (Left panel) and PFS (Right panel) models. Green circles show the likelihood of the subject data given the models. Grey regions show the upper 95^{th} percentile of the models' empirical likelihood distributions (see text). Data points falling within the gray regions indicate that the observed data and model predictions are not significantly different.

6 Probability weighting function parameter analyses

The degree to which each subject subjectively weights the relevant probabilities of the task should not depend on the experimental condition that they participated in. If the fitted probability weighting parameters, γ, are found to vary significantly between the 12 conditions of the experiment, this would suggest that the model predictions are artifactual. The distributions of γ for each model and each condition of the experiment are shown in Fig. S3 A. As described in the text, we calculated a 1-way ANOVA comparing each model's fit values of γ across the 12 conditions of the experiment. We found no significant effect of experimental condition on the value of γ for either model (PF Model: $F(11, 195) = 1.5$, $p = .13$, mean = .83, SD = .08; PFS Model: $F(11, 195) = 1.56$, $p = .11$, mean = .86, SD = .07).

In addition, we expect each subject's two estimated values of γ (one for each model) to be significantly correlated. We calculated Pearson's ρ for the correlation of γ estimates for each model. The resulting $\rho = .23$ and the correlation is significant ($t(205) = 3.32$, $p = .0011$). Each subject's values of γ from each model are shown in Fig. S3 B.

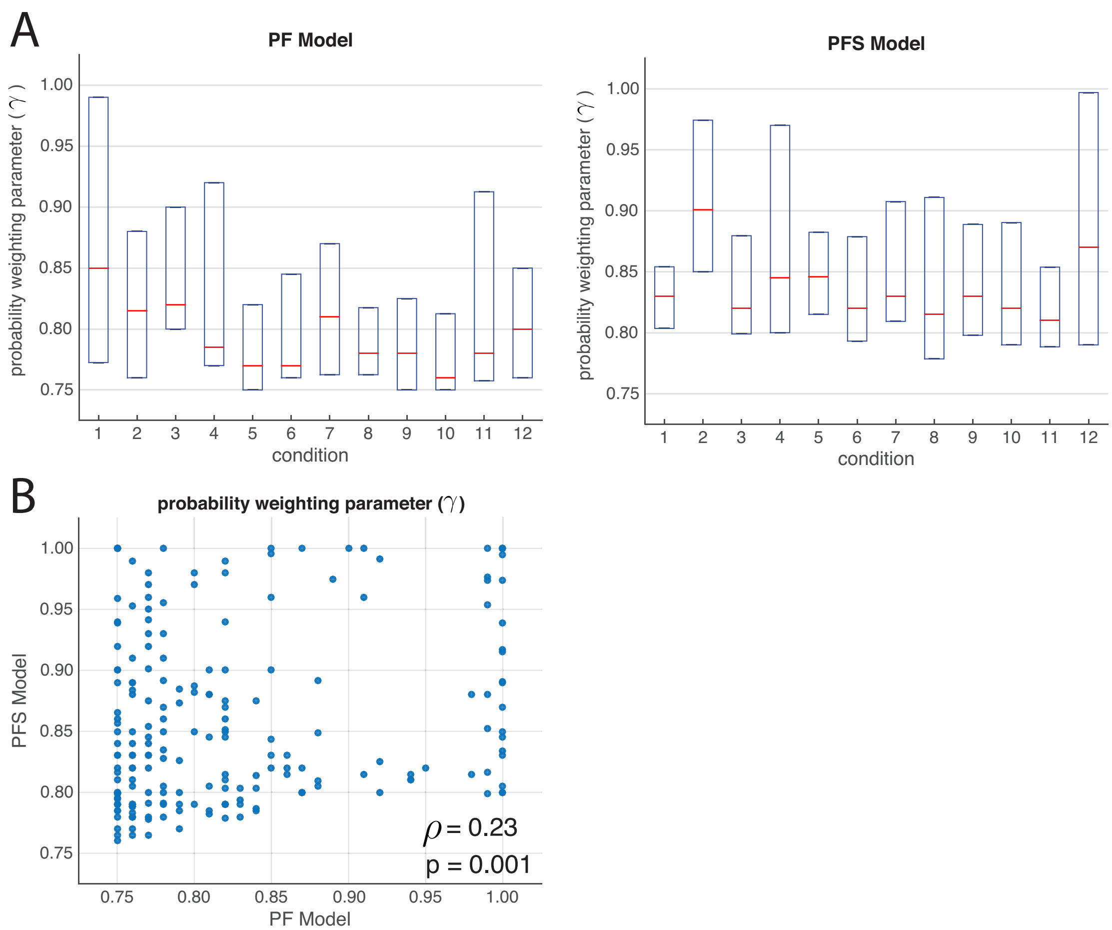


Figure S3: Probability weighting function parameter, γ. **A** Distributions of γ estimates from the PF Model (left panel) and PFS Model fits, for each Training Block condition. Red lines show the median. Boxes show the central 50^{th} percentile. **B** γ estimates for each model. Each dot represents the pair of fitted estimates for 1 subject. Pearson's ρ and the p value for the test of a significant non-zero correlation are shown. There is a weak but significant correlation between the fitted estimates.

7 Effects of changes in probability, frequency, and similarity on Relative Uncertainty

Relative Uncertainty, U, is a measure that enables predicting changes in the likelihood that an observer will adopt an optimal categorization strategy from changes in the relevant probability, frequency, and similarity parameters (see text under "Predicting optimality using Relative Uncertainty"). Here we give examples of changes in U over a range of parameter values. In the present study, each of the 3 stimulus features, F (i.e., the top, middle, and bottom set of 'arms'), had an independent and equal probability, $p = p(F_1|C_1) = p(F_2|C_1) = p(F_3|C_1) = .8$, of occurring in Category 1 (and a probability of $1 - p$ of occurring in Category 2). The likelihood that each stimulus, $\mathbf{s}_k$ will occur in each category is given by:

$$p(\mathbf{s}_k|C_i) = \frac{\prod_j p(s_{k,j}|C_i)}{\sum_k \prod_j p(s_{k,j}|C_i)}$$

$$p(s_{k,j}|C_i) = \begin{cases} p(F_j|C_i) & s_{k,j} = 1 \\ 1 - p(F_j|C_i) & s_{k,j} = 0 \end{cases}$$

where $\mathbf{s}_k = [s_1 \ s_2 \ s_3]$ is a vector indicating the presence or absence of each feature, F_j, such that $s_j = 1$ when F_j is present and 0 otherwise (see text).

The posterior probability that each category is true given each stimulus is:

$$p(C_i|\mathbf{s}_k) = \frac{p(s_k|C_i)p(C_i)}{\sum_i p(s_k|C_i)p(C_i)}.$$

The expected frequency with which the observer will encounter each stimulus, N_k, is determined by the probability structure: $N_k = N_T \sum_i p(s_k|C_i)p(C_i)$, where N_T is the total number of trials and $p(C_i) = .5$ is the prior probability of each category being the true category on a given trial.

As explained in the text, U is given by:

$$U = \frac{1}{\sum_i \sum_k E_{k,i}}$$

$$E_{k,i} = \sum_n \mathbf{D}_{k,n} \frac{\sqrt{N_{n,i}} P_{n,i}^{N_{n,i}}}{\sigma_{n,i}},$$

where $N_{n,i}$ is the expected frequency with which stimulus n will occur in category i and $P_{n,i} = p(C_i|\mathbf{s}_n)$ is the posterior probability that Category i is the true category given stimulus n.

$\mathbf{D}_{k,n}$ represents the similarity between stimuli k and n. Each element of $\mathbf{D}_{k,n}$ (for $k, n = \{1, ..., K\}$) equals $\frac{1}{1+\Delta_{k,n}}$, where Δ is the appropriate distance metric, in this case, the $L1$ distance given by:

$$\Delta_{k,n} = \sum_j |\mathbf{s}_{k,j} - \mathbf{s}_{n,j}|,$$

where the sum is over the j dimensions of the stimuli. The present study employed 7 stimuli in 3 dimensions (see Fig. 4 of the text). The associated matrix $\mathbf{D}_{k,n}$ is given by:

$$\mathbf{D}_{k,n} = \begin{bmatrix} 1 & 1 & 1 & \frac{2}{3} & \frac{2}{3} & \frac{2}{3} & \frac{1}{3} \\ 1 & 1 & 1 & \frac{2}{3} & \frac{2}{3} & \frac{2}{3} & \frac{1}{3} \\ 1 & 1 & 1 & \frac{2}{3} & \frac{2}{3} & \frac{2}{3} & \frac{1}{3} \\ \frac{2}{3} & \frac{2}{3} & \frac{2}{3} & 1 & 1 & 1 & \frac{2}{3} \\ \frac{2}{3} & \frac{2}{3} & \frac{2}{3} & 1 & 1 & 1 & \frac{2}{3} \\ \frac{2}{3} & \frac{2}{3} & \frac{2}{3} & 1 & 1 & 1 & \frac{2}{3} \\ \frac{1}{3} & \frac{1}{3} & \frac{1}{3} & \frac{2}{3} & \frac{2}{3} & \frac{2}{3} & 1 \end{bmatrix}$$

The same 7 stimuli could be represented in a space with different dimensionality thereby changing their similarity. For example, the 7 stimuli could be represented in 1 dimension as 7 angles of a tilted line, 7 brightness levels of a single pixel, etc. The associated $\mathbf{D}_{k,n}^{1D}$ is given by:

$$\mathbf{D}_{k,n}^{1D} = \begin{bmatrix} 1 & \frac{6}{7} & \frac{5}{7} & \frac{4}{7} & \frac{3}{7} & \frac{2}{7} & \frac{1}{7} \\ \frac{6}{7} & 1 & \frac{6}{7} & \frac{5}{7} & \frac{4}{7} & \frac{3}{7} & \frac{2}{7} \\ \frac{5}{7} & \frac{6}{7} & 1 & \frac{6}{7} & \frac{5}{7} & \frac{4}{7} & \frac{3}{7} \\ \frac{4}{7} & \frac{5}{7} & \frac{6}{7} & 1 & \frac{6}{7} & \frac{5}{7} & \frac{4}{7} \\ \frac{3}{7} & \frac{4}{7} & \frac{5}{7} & \frac{6}{7} & 1 & \frac{6}{7} & \frac{5}{7} \\ \frac{2}{7} & \frac{3}{7} & \frac{4}{7} & \frac{5}{7} & \frac{6}{7} & 1 & \frac{6}{7} \\ \frac{1}{7} & \frac{2}{7} & \frac{3}{7} & \frac{4}{7} & \frac{5}{7} & \frac{6}{7} & 1 \end{bmatrix}$$

As can be seen by comparing $\mathbf{D}_{k,n}$ and $\mathbf{D}_{k,n}^{1D}$, changing the dimensionality of the stimuli changes their similarity. For example, Stimuli 1, 2 and 3 are identical when represented in 3 dimensions but dissimilar when represented in 1 dimension. The similarity between Stimulus 1 and Stimuli 6 and 7 decreases from 3D to 1D.

As the Category 1 likelihoods, $p = p(F_1|C_1) = p(F_2|C_1) = p(F_3|C_1)$, increase from .5 to 1, the MAP probabilities of each of the stimuli will increase. That is, Stimuli 1, 2, and 3 will have a higher posterior probability of occurring in Category 2 and Stimuli 4, 5, 6, and 7 will have a higher probability of occurring in Category 1. This will lead to an increase in the value of E and a decrease in U with an associated increase in the predicted optimality given the stimulus set. Likewise, increasing the total number of trials N_T will increase $N_{n,i}$ and hence E and lead to a decrease in U. In addition, representing the 7 stimuli in 1 dimension will decrease their similarity as described above leading to an increase in Relative Uncertainty with an associated decrease in the predicted optimality.

In Fig. S4 we show examples of these effects on U for a range of values of the feature likelihoods, p, the total number of training trials, N_T, and for similarity measured for 3D vs. 1D representations of the stimuli (as given by $\mathbf{D}_{k,n}$ and $\mathbf{D}_{k,n}^{1D}$, respectively). The predicted decrease in U can be seen for increasing values of p (Fig. S4 A) and N_t (Fig. S4 B). U is greater for the 1D stimulus representation but the effect, in this case, is negligible with high values of p and N_T.

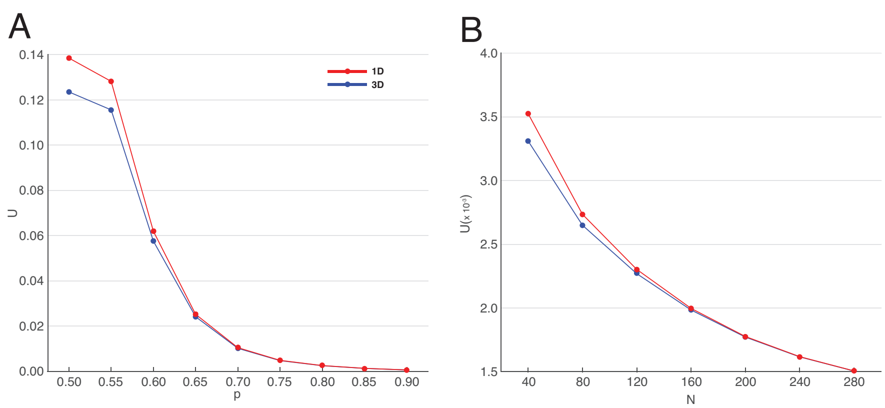


Figure S4: Relative Uncertainty, U, as a function of **A** Category 1 feature likelihood, p, and **B** total number of training trials, N_T. Blue lines represent the case in which stimuli are represented in 3D with associated similarity matrix, $\mathbf{D}_{k,n}$, and red lines represent the 1D representation of the stimuli with similarity matrix, $\mathbf{D}_{k,n}^{1D}$. Decreasing values of U are associated with a relative increase in the likelihood of an observer adopting an optimal categorization strategy for the stimuli (see text). Representing the stimuli in 1D vs 3D increases uncertainty (with a lower predicted likelihood of optimality) but the effect becomes negligible with high values of p and N_T.