Review Feedback and Response

- The purpose of author feedback is to point out technical errors or significant misunderstandings in the reviews; it is not to dispute the opinions of the reviewers, or to explain how criticisms could be addressed in a future revision of the paper.
- Do not necessarily expect replies to your feedback in the final reviews. The senior program committee will ensure that feedback identifying legitimate flaws or misunderstandings will be taken into account in final reviews and decisions.
- Please do not provide feedback explaining how you can address the referees' concerns or criticisms in future versions of the paper. The paper must be publishable as submitted.
- Feedback is strictly limited in length to 150 words per review, no exceptions.

Paper ID	53
Paper authors	Jivko Sinapov, Alexander Stoytchev
Paper title	The Boosting Effect of Exploratory Behaviors
Paper subtitle	
Paper Type	Physically Grounded AI Track (6 page max)
Keywords	Robotics ** Machine Learning applied to robotics, vision, and other activities grounded in the real world
Abstract	Active object exploration is one of the hallmarks of human and animal intelligence. Research in psychology has shown that the use of multiple exploratory behaviors is crucial for learning about objects. Inspired by such research, recent work in robotics has demonstrated that by performing multiple exploratory behaviors a robot can dramatically improve its object recognition rate. But what is the cause of this improvement? To answer this question, this paper examines the conditions under which combining information from multiple behaviors and multiple sensory modalities leads to higher object recognition. Two different problems are considered: interactive object recognition using auditory and proprioceptive feedback, and surface texture recognition using tactile and proprioceptive feedback. Analysis of the results shows that metrics designed to estimate classifier model diversity can explain the improvement in the robot's recognition accuracy. This finding establishes, for the first time, an important link between empirical studies of exploratory behaviors in robotics and theoretical results on boosting in machine learning.
Download	

Relevance	Significance	Technical Soundn	Novelty	Quality of Evalu	Clarity	OVERALL	CONFIDENCE
10	9	9	9	9	10	9	8

Review **[Nomination for Best Paper Award]**

Comments to author(s)

REVIEWERS COMMENTS TO AUTHORS:

This paper makes a fascinating parallel between the advantage of combining multiple weak clues from exploratory behaviors and the advantage of combining multiple weak classifiers in classification tasks.
The paper examines two problems: combining auditory and touch feedback for object recognition, and texture recognition using tactile and proprioceptive feedback. The paper shows that metrics for estimating classifier diversity are also useful to estimate the expected improvement in accuracy for multimodal recognition tasks. This paper finds that high disagreement between data results in higher recognition improvement, and the relation is linear when the proper metrics are applied.
The paper concludes that behaviors are weak classifiers, and combining multiple behaviors results in strong classification. I agree with the authors that this is an important contribution.

RELEVANCE: This is the type of paper I expect to see presented in this track.

SIGNIFICANCE: This is an important paper in the sense that it dispels the naive thinking that for recognition to improve there is a need for consensus between behaviors. The proposed theory can have an impact in other domains, such as multiple sensing modalities or observations from multiple robots.

TECHNICAL SOUNDNESS: The approach is simple and empirical, but well supported by experiments.

NOVELTY: The foundations of the theory were borrowed from psychology and other domains, but the extensions and experimental verification are novel to the best of my knowledge.

QUALITY OF EVALUATION: Excellent validation

CLARITY: Beautifully written paper.