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Seeing chance: perceptual reasoning as an epistemic resource for grounding compound event spaces.

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Summary: The mathematics subject matter of probability is notoriously challenging, and in particular the content of random compound events. When students analyze experiments, they often omit to discern variations as distinct events, e.g., HT and TH in the case of flipping a pair of coins, and thus infer erroneous predictions. Educators have addressed this conceptual difficulty by engaging students in actual experiments whose outcomes contradict the erroneous predictions. Yet whereas empirical activities per se are crucial for any probability design, because they introduce the pivotal contents of randomness, variance, sample size, and relations among them, empirical activities may not be the unique or best means for students to accept the logic of combinatorial analysis. Instead, learners may avail of their own pre-analytic perceptual judgments of the random generator itself so as to arrive at predictions that agree rather than conflict with mathematical analysis. I support this view first by detailing its philosophical, theoretical, and didactical foundations and then by presenting empirical findings from a design-based research project. Twenty-eight students aged 9–11 participated in tutorial, task-based clinical interviews that utilized an innovative random generator. Their predictions were mathematically correct even though initially they did not discern variations. Students were then led to recognize the formal event space as a semiotic means of objectifying these presymbolic notions. I elaborate on the thesis via micro-ethnographic analysis of key episodes from a paradigmatic case study.

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