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## The Body of Proof: How Inscriptions Shape Mathematical Discovery

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Where do mathematical insights come from? According to classic accounts, creativity is a multi-stage process that involves combining ideas in novel ways. Evidence for these accounts, however, is drawn from artificial lab-based settings or is zoomed out from the messy, moment-to-moment details of discovery. Here, I examine a video corpus of expert mathematicians generating proofs in an ecologically valid setting. I find that mathematicians begin by creating a variety of inscriptions. They then interact with these inscriptions through gaze, speech, gesture, and writing. When they experience an insight, however, their interactions become unpredictable, and they begin to connect inscriptions in novel ways (quantified by an information-theoretic measure, surprisal). Expert mathematical discovery, I conclude, exhibits the combinatorial processing that has been proposed to characterize creativity. Even at the pinnacle of abstraction, at the highest levels of expertise, new ideas are born when the body discovers unexpected affinities among ideas. In light of these findings, I consider what it means for mathematical illustrations to be rigorous—not merely accurate representations, but active participants in discovery.

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