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Although some researchers argue that diagrams can aid undergraduates' proof constructions, most undergraduates have difficulty translating a visual argument into a formal one. The processes by which undergraduates can construct a proof based on a visual argument are poorly understood. We investigate this issue by presenting ten mathematicians with a mathematical task that invites the construction of a diagram and examine how they used this diagram to produce a formal proof. This talk focuses on (a) the extent to which mathematicians based their proofs on the diagram, (b) the ways in which they used the diagram, and (c) the skills and strategies they used to translate an intuitive argument into a formal one. We observed that mathematicians used diagrams to notice mathematical properties, to verify logical deductions, and, surprisingly, to justify assertions. However, their use of diagrams relied on sophisticated proving strategies and a range of logical skills, such as the ability to strategically reformulate logical statements. (Received September 21, 2010)