Why (and how) did biological evolution produce mathematicians?

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Through play and exploration young children can discover things empirically that are later understood as non-empirical ("toddler theorems"), including geometrical, topological, arithmetical and epistemic facts. For example: Pulling a fixed-length string attached to a remote movable object will first cause the string to become straight, then the object to move; features on a house encountered going round the house one way are encountered in the reverse order going round the house the other way (from the same starting point); counting objects from left to right gives the same result as counting from right to left; pushing a drawer shut is impossible (and, incidentally, painful) with your hand grasping the top front edge; moving towards an open door makes more information available visually about the room it leads to; you can make a solid cube but not a solid square from 8 cubes, and a solid square but not a cube from exactly 9 cubes; and many more.

I conjecture that the ability to reconstrue some empirical, statistical, generalisations as structure-based exceptionless truths evolved because our human and non-human ancestors needed to solve novel problems in complex 3-D environments, and that the information-processing architectures and mechanisms making that possible are also the basis for mathematical reasoning in humans.

Similar capabilities will be required for intelligent, human-like robots e.g. performing domestic tasks. The task of designing such robots can help to shed light on some old debates in the philosophy of mathematics, e.g. as to whether mathematical truths are empirical (Mill), definitional (Hume?), reducible to logic (Russell), purely formal (Hilbert), or, as Immanuel Kant proposed, both synthetic (expanding knowledge) and necessary (incapable of having counter-examples). Some of the main ideas of the talk, with a collection of examples, can be found here, including http://www.cs.bham.ac.uk/research/projects/cogaff/talks/#toddler