Bolles R C. Species-specific defense reactions and avoidance learning. *Psychol. Rev.* **71**:32-48, 1970.

The paper starts with the assumption that animals have innate defensive behaviors, such as freezing, fleeing and fighting. It is proposed that if a particular avoidance response is rapidly learned, then that response must necessarily be one of the animal's species-specific defense reactions, or part of such a reaction. Some reinforcement-produced learning does occur with more slowly learned avoidance responses, but it is slow, uncertain, and not based on the conventional mechanism. [The *Science Citation Index® (SCI®)* **and the** *Social Sciences Citation Index™ (SSCI™)* **indicate that this paper was cited a total of 260 times in the period 1971-1977.]**

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"The trick in writing a paper that will be frequently cited lies partly in saying the right thing, of course, but it also depends upon saying it at the right time. Say the right thing but say it a few years too soon, and (if the paper is published at all) it is likely to attract little attention. Say the same right thing just a few years too late, and it is likely to be suitable only for a textbook. I was fortunate to have this particular paper appear at just the right time.

"Psychology has always had a strong empiricist bias: a conviction that everything is explained by learning through experience. Once the basic, universal laws of learning were discovered, it was assumed, then everything else —all behavior, personality, social organization —would fall into place. That we could not find, or agree upon, any set of universal laws did not seem to matter; the bias persisted. Clear evidence of inhomogeneities in learning, implying a failure of learning laws to be universal, did not matter. The empiricist assumption swept everything before it like the incoming tide. Further evidence from ethology of genetic determinants of behavior was simply washed away. Nothing availed against the tide.

"My own research had indicated that animals are more able to learn avoidance behaviors in some situations than in others. This troublesome fact was already recognized, but it was not considered anything more than a peculiarity of avoidance behavior (long a problem for learning theorists) or of the specific situations that had been studied. In 1966 I conducted a seminar on ethology. Our discussion of this point of view led us to the idea that the inhomogeneities in avoidance learning, which were so troublesome for learning theory, might tell us something important about the animal and how it avoids the natural dangers in its particular environmental niche.

"This idea was promptly supplemented with further data and then polished up in a few colloquium presentations. When the paper appeared it was at that happy moment when Garcia, Seligmen, and Brelands, all acting quite independently, had each begun to question the universality of general laws of learning. And now as we splashed about we could see, incredibly, the tide was going out."