The highlight for December is by Paul Rozin from the Department of Psychology at the University of Pennsylvania. Dr. Rozin's name is one of a small handful who is recognizable to most everyone who has ever heard of taste aversion learning or who has ever run a study in this area. Along with Jim Kalat, he wrote the seminal paper in the field "Specific hungers and poison avoidance as adaptive specializations of learning" (Psychological Review, 1972, 78, 459-486) in which the focus on specific hungers shifted from an innate recognition of needed nutrients to an acquired aversion of diets deficient in those very same nutrients. While this alone was important, the impact of the paper went considerably beyond offering a mechanism for these specific diet choices. The paper was one of the first (along with those by Garcia and Ervin in 1968 and Revusky and Garcia in 1970) that broached the issue of adaptive specializations in learning. Taste aversion learning (as described by Garcia, Revusky, Rozin and others) was added to a host of other interesting behavioral and learning preparations (e.g., bird song learning, imprinting, autoshaping, species specific defense reactions, schedule-induced polydipsia) that either did not seem easily explained by traditional learning principles or evidenced learning under conditions in which learning was not expected to occur. Together (and due much to the force and strength of the work of Dr. Rozin), the concept of adaptive specializations of learning was introduced. Although this term meant many things to many people, Rozin was clear on his meaning in the 1972 paper. Not suggesting that one throw the baby out with the bathwater, he argued that learning and its principles had to be viewed differently. As he and Kalat concluded when examining phenomena such as taste aversions and imprinting "…they can be considered as examples of a basic adaptational principle pervading much or all of learning." It was this biological-evolutionary framework that should drive our examination and understanding of behavior (and learning).

In his highlight, Dr. Rozin describes his early work with Willard Rodgers on the development of the conditioning account of specific hungers and how his understanding of this mechanism was reinforced by the early work on taste aversion learning, He further describes his own evolution in research (from animals to humans; from aversions to preferences; from evolutionary constraints to cultural flexibility). Throughout his career, Dr. Rozin has examined interesting phenomena in creative and innovative ways. His highlight provides a brief summary of this important work.

From trying to understand food choice to conditioned taste aversions and back: A short odyssey

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As I look back on my scholarly career, I find two persistent themes (Rozin, 2002). One is that I like to work on what look like promising and tractable problems that involve big effects and are ignored. A second is that I like a problem that is really puzzling, one for which I cannot even imagine a really good explanation. I selected my dissertation topic, as it turns out, according to these principles. In the 1930s, Curt Richter had done the classic work on specific hungers in laboratory rats (Richter, 1943). He showed that when rats were deficient in a particular nutrient, they would selectively consume foods or solutions that contained the needed nutrient. His most detailed analysis was for sodium appetite, and in this case the evidence suggested strongly that there was an innate enhancement of the taste of sodium triggered by sodium deficiency (Richter, 1959). Richter proposed that this type of innate mechanism was also behind the specific hungers for other specific minerals, vitamins, and macronutrients. It seemed odd to me that each or many of the some 40 required nutrients would have such a mechanism, when deficiencies in many nutrients are quite rare. In addition, there was other evidence that the rat response to most nutrients they were deficient in was less rapid and reliable than was the case for sodium. But the only alternative to the innate formulation was learning, and that possibility was inconsistent with what the known principles of learning. How could rats associate the taste of a particular nutrient (or other co-occurring distinctive taste) with its beneficial consequences? The consequences occur typically hours after ingestion, and there would be many other cues (such as the appearance of the food and the many intervening events) that would be equally contingent with beneficial effects.

My early work on specific hungers, in the laboratory of Jean Mayer, and in conjunction with a number of undergraduate and graduate students (Carolyn Wells and Willard Rodgers, among others), was based on the appetite for vitamin B1 (thiamine). I chose this example because there was excellent evidence that there was a specific hunger for vitamin B1, deficiency could be produced with a deficient diet in a few weeks, and recovery upon ingestion of the vitamin was relatively rapid (perhaps beginning as quickly as 30 minutes after ingestion). Our early work confirmed that this specific hunger was learned, because it often took a few days to appear, when one of a number of choices contained the needed vitamin. One critical experiment showed that after rats had spent a few weeks on a deficient diet, they would show an immediate preference for any new diet (Rodgers and Rozin, 1966). In addition, their behavior towards the deficient diet was like their behavior to innately aversive tastes; spillage, and specific negative expressive gestures. These findings turned the problem around. The problem was originally framed as how did the rats discover an enriched diet? These results indicated that much learning had occurred before any choice was offered; the rats had developed an aversion to the deficient diet. We had some evidence that the aversion was to the taste of the diet, and not its appearance.

Somewhere around this time, my colleague Henry Gleitman pointed me to the first of the two classic John Garcia et al. studies (1966a, 1966b) on conditioned taste aversion, and the second which followed quickly. The principles of long delay learning and "belongingness" hit me in the face immediately; they were just what I needed to explain deficient diet aversion. I think I became the first fan and booster of John Garcia's important findings. (Of course, he had trouble publishing them, a feature that has also accompanied most of my subsequent work on human food choice.) I embraced the "Garcia" principles, and, working mostly with my graduate student, James Kalat, began to explore its properties. So, I became a fan and a student of learned taste aversions.

My PhD at Harvard was personally crafted by me, as a joint biology and psychology PhD. My acquaintance with evolutionary biology clicked in, and led to the formulation of taste aversion learning as an adaptive specialization, as described in a Psychological Review paper with Kalat (Rozin & Kalat, 1971). The idea of adaptive specializations in learning, under one name or another, was in the air. Papers by Garcia and his colleagues (Garcia et al., 1974), Martin Seligman (1970) and Sara Shettleworth (1972) independently, at the same time, came up with similar ideas.

It is all history that CTAs became a rage, a very popular situation for the study of animal learning, and a major force in bringing evolutionary considerations into the study of learning and psychology, more generally. Marci Pelchat did a particularly important set of studies on this, for her dissertation, under the direction of Harvey Grill and myself. She showed a special tendency for rats to develop negative affective reactions ("dislikes") to tastes associated with illness; in contrast, although rats could learn to avoid foods paired with peripheral distress (shock to the feet) or lower gut cramps without nausea (produced by high levels of lactose), in these cases, there were no facial or bodily signs of aversions. These were more slowly learned instrumental aversions (Pelchat et al., 1983). She then demonstrated the same phenomenon in humans, via questionnaire. People who had gotten sick to their stomach after eating a food developed a distaste for that food, while people who had other negative events after eating a food (like respiratory distress or skin eruptions) avoided the food but did not dislike it (Pelchat and Rozin, 1982).

This work led to a taxonomy of food preferences and aversions, developed with April Fallon, which made the major distinction between affective and instrumental learning (Rozin and Fallon, 1980).

The popularity of CTAs chased me away from the problem. Moved by wanting to do work on something more closely related to a real world problem, I set off on a collaboration with Lila Gleitman on why reading acquisition was difficult, especially since learning to speak a language, which is much harder in principle, occurs with less problems. My formulation of this problem traced directly to the CTA work; humans evolved to speak, and had the appropriate predispositions. But written language was a new event in our species, and learning here was not "prepared," more like the learning of arbitrary relations.

This work led to the general formulation of accessibility, the idea that predispositions or adaptive specializations that evolved in a particular context could be liberated from that context and applied to new inputs (Rozin, 1976). Thus, for the case of reading alphabets, the evolved phonological segmentation machinery involved in perception and production of phonemes was mapped to orthography by cultural inventions, such that learning to read the alphabet involved accessing this originally speech-limited system.

I drifted off to work on human memory and amnesia, and then returned to food choice in humans, inspired by the Flavor Principle Cookbook, written by my wife, Elisabeth Rozin (E. Rozin, 1973). She noted that most of the world's traditional cuisines use a characteristic set of flavors, which she called flavor principles, on almost all of their savory dishes. I wondered why. That took me into the study of why innately aversive hot peppers became pleasant experiences for well over a billion people in the world, where hot pepper is a sought after feature of their flavor principle. A second somewhat anomalous feature of human food choice caught my eye. The strongest aversions to food, what we call disgusts, occur almost exclusively to animal products, which are also the most preferred and nutrient-rich foods. That was odd. My work on disgust brought me back to conditioned aversions, because pairing a neutral stimulus with a disgusting entity, like a cockroach, produces one-trial aversion in some people. This turned out to be an easy way to study aversions in humans: ethical and robust. But it isn't quite the same as other kind of learning, because a cockroach produces a juice aversion only if the cockroach contacts the juice (the magical principle of contagion) (Rozin, et al., 1986). A cockroach next to the juice, something much more like the usual conditioning design, is not very effective. And the contact produces all sorts of cognitions, of mixing "essences," not just the usual conditioning contingencies. So there is much to study here, some of which I have explored in studies of magical thinking; contagion, it turns out, is a human universal, but is not present in very young children (work with Carol Nemeroff; Rozin & Nemeroff, 2002).

My work now keeps bumping into adaptive specializations in learning. Oddly we do not know how humans develop food preferences, or even most of their aversions. Surprisingly, parents, who share genes with their children and control most of the child's environment for the early years of life, do not transmit their food and other preferences very well to their children. Parent-child correlations are in the range of 0 to .30 for food or music preferences (Rozin, 1991). Where does the learning come from?

Exploration of the origin of preferences took me into the study of evaluative conditioning in humans, of which human CTAs are a prime example. Evaluative conditioning was originally described by Martin and Levy, and in recent decades, has been studied most thoroughly by a group at the University of Leuven, led by Frank Baeyens. I think it is an extremely important process in preference formation, and it generally follows Pavlovian laws. With Debra Zellner (Zellner et al, 1983; Rozin & Zellner, 1985), I did some basic experimentation on this phenomenon. But, unlike the prime example, CTAs, evaluative conditioning is usually not robust, and often fails to occur (Rozin, Wrzesniewski & Byrnes, 1998). There is something important but elusive here, and we don't know what it is. My personal preference for studying things that are robust and easy to obtain (like animal or human CTAs, or disgust at rotted meat or cockroaches) led me to abandon my work on evaluative conditioning, even though I think it is fundamental.

My current research, on both human attitudes to food, and ethnopolitical conflict, has taken on a much more cultural orientation. My research and observations suggest to me that culture is the principal shaper of human preferences and aversions. So now I am interested in the evolution of culture, similarities between biological and cultural evolution, and how culture is manifested, in both minds and environments. But the original ecological-evolutionary approach that I studied as a graduate student, and that was reinforced in my early work on specific hungers and aversion learning, remains a major part of the framework within which I look at the world.

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