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Remembering Robert Zajonc: The Complete Psychologist

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Abstract

This article joins with others in the same issue to celebrate the career of Robert B. Zajonc who was a broad, as well as a deeply talented, psychologist. Beyond his well-known focus in social psychology, the work of Zajonc also involved, at one time or another, forays into nearly every other subfield of psychology. This article focuses specifically on his studies that extended into biopsychology, which deserve special highlighting in order to be recognized alongside his many major achievements in emotion and related social topics. The biopsychological focus is offered here in the hope that all his diverse contributions be savored together when celebrating the complete psychology of Robert Zajonc.

Keywords
affect, brain, emotion, hypothalamus

The marvelous psychologist who was Robert B. Zajonc had a gift for crossing intellectual borders. Bob was a complete psychologist, with omnivorous interests, who could go to any area of the discipline in his chase after psychological truths.

Bob Zajonc will always be remembered chiefly as an outstanding social psychologist. That is surely right and just. Still, Bob was never content to be confined to any one intellectual compartment. Before inter-disciplinary study was a common term, Bob was a prototype for an inter-disciplinary psychologist, and in the course of his career he dealt at some time with nearly every subfield in psychology. This breadth of mind, together with his intellectual independence, zest and originality, made for a unique brand of Zajonc scholarship.

Rebalancing the Field the Zajonc Way

Bob once remarked that he had often decided to take up a particular research topic out of a sense of annoyance with what he had previously heard or read about the topic. He was motivated to correct what he saw as mistaken views. His willingness to tackle the consensus often led him to inject an intellectual breath of fresh air that challenged and enriched the field's understanding of a topic.

There was in my opinion a Zajonc signature that marked quite often just how he would go about doing that. First, he would advance a thesis that leaned against the dominant view, pushing in a new and different direction. His thesis would provoke resistance, which I believe he often relished. Then, combining intellectual audacity and experimental ingenuity, he would amass empirical evidence step by step for his thesis. Surprising demonstrations were forthcoming, and his clever experiments would again and again provide evidence for his side of the argument. Gradually the weight of the data on his side would grow until it became so impressive that no one could ignore or dismiss his view any longer. The consensus was no more.

Bob was a compelling advocate. In these cases he could often persuade readers to his viewpoint. He could persuade readers to his viewpoint. And even those who weren't persuaded were engaged and stimulated, and forced to accommodate his argument. In the end, Bob Zajonc would force colleagues either to accept his thesis, or at least to acknowledge his view as a much more plausible hypothesis than many would otherwise ever have dreamed possible.

My personal interactions with Bob came from the decade when we overlapped as faculty in the Department of Psychology at the University of Michigan. As a member of the biopsychology area, I had always felt a certain envy of our fine social psychology area

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at Michigan chiefly because of their right to claim Bob Zajonc as one of their own. Of course, they had every right to claim him, as Bob was first and foremost a member of that area and affiliated institute. Still, Bob might equally well be classified as an emotion psychologist (Zajonc, 1980), or a cognitive psychologist (Zajonc & Mullally, 1997), or nearly any other type of psychologist, and any of those areas of psychology would have been glad to claim him. He might even—and this is the chief point I would like to advance in this article—be thought of as a biopsychologist. Though to many his stellar contributions to social psychology so much overshadow his biological facets as to make those facets almost invisible to many I always thought of him as a biopsychologist too, and still do now.

I want to stress this perhaps overlooked side of Robert Zajonc because it seems crucial to recognize his unique ability to wear so many psychological hats so as to appreciate the true originality and power of Bob's work. Here I will indulge the inclination to paint this biopsychological aspect of the Zajonc portrait, confident in knowing that Bob's accomplishments in the domains of social psychology, emotion, cognition, and other psychological areas will be well commemorated by other authors in this issue and elsewhere.

Robert Zajonc as Biopsychologist

One half of the thesis that Bob was a biopsychologist is the claim that he was a comparative psychologist. Bob often drew on comparative psychology, and conducted several comparative studies on animals with other colleagues again and again over several decades. Many of those studies are considered in detail by Rajecki in this issue (Rajecki, 2010). The human–animal commonalities included social facilitation and mere exposure and preference effects (Berridge & Zajonc, 1991; Carter, Salive, & Zajonc, 1966; Zajonc, 1969; Zajonc, Heingart, & Herman, 1969; Zajonc, Markus, & Wilson, 1974; Zajonc, Reimer, & Hausser, 1973; Zajonc, Wilson, & Rajecki, 1975).

Bob's interest in comparative psychological phenomena extended from the 1960s through the 1990s. During the late 1960s he edited a volume on *Animal Social Psychology: A Reader of Experimental Studies* (Zajonc, 1969). To explain why he created that book, he wrote in prefatory remarks:

> A few years ago I was asked by one of my colleagues to write a short text in experimental social psychology. Since I would have found it rather unexciting to deal with material that was widely and very adequately represented in existing textbooks, I decided to give attention to literature which, in my opinion, was relevant for social psychologists, but which was generally missing in standard texts. One such area was animal experimentation on social behavior. (Zajonc, 1969, p. v)

Zajonc went on to explain:

> As human beings, we know too much about man—too much to be able to pull out from this tangle the fundamental and elementary threads that form the basis of a systematic theory. Because our personal information about man tends to fuse itself with scientific information, the essentials escape us. We have less personal knowledge about animals, but not less scientific knowledge. (Zajonc, 1969, p. 2)

Bob suggested a solution:

> There is another strategy which the social psychologist (and psychologists in other areas) will find more promising: for each empirical generalization and for each theoretical formulation, unless we know *explicitly* otherwise, let us assume that it applies generally to all species . . . *General* laws of social behavior are more likely to emerge when research on the social behavior of man is carried out side-by-side with research on the social behavior of other species. (Zajonc, 1969, p. 4, italics in original)

Bob also practiced in experiments with colleagues what he preached in his theory. In original studies, they published several research papers using animals between 1965 and 1995. These studies included rats, pigeons, chicks, and even cockroaches, as well as humans (Berridge & Zajonc, 1991; Carter et al., 1966; Zajonc, 1969; Zajonc et al., 1969, 1973, 1974, 1975). The articles concerned topics ranging from social facilitation to the induction of preferences by familiarity and mere exposure, sensory interaction, and thermal controls of affect.

My own introduction to the work of Zajonc was as a graduate student through reading of one of these comparative studies, the one that studied social facilitation in cockroaches (Zajonc et al., 1969). In a first-year proseminar series in social psychology taught by Albert Pepitone at the University of Pennsylvania, this paper was the topic of one week's discussion. I loved the paper's audacity and verve. A few years later, after arriving in Ann Arbor, I was delighted to meet Bob in person. That charming paper immediately sprang again to mind when we met.

Who else but Robert Zajonc would have thought to test cockroaches for social facilitation? In Bob's remarkable study, he showed that cockroaches, tested in the presence of another cockroach, more rapidly ran down a goal runway than if tested by themselves in the absence of others. Without such a powerful demonstration, the claim that social facilitation was a fundamental trait shared with animals extending so far from humans would likely have been met with disbelief by many readers. Armed with such evidence, Zajonc could compel many to assent to his conclusion that the phenomenon "applies generally to all species."

Robert Zajonc: Physiological Psychologist and Neuroscientist

The second half of my thesis that Bob was a biopsychologist, too, is the claim that he was also a physiological psychologist and a neuroscientist. This was evident especially in the 1980s–1990s when he became interested in exploring an affective neuroscience hypothesis that tied hedonic mood to the temperature of the brain, modulated via venous blood drainage, mediated by changes in hypothalamic function.

His provocative theory of affect based on vasculature control of brain temperature was presented to the world in 1985 in an article published in the widely-read journal, *Science* (Zajonc,

1985). It was elaborated further a few years later in co-authored review articles in the *Annual Review of Psychology* (Adelmann & Zajonc, 1989) and in *Psychological Review* (Zajonc, Murphy, & Inglehart, 1989). These articles helped gain wide attention for the theory, which suggested, among other things, that happy facial expressions promoted a cooler brain, helping via feedback to promote positive affect. Of course, this idea that sensory feedback from emotional reactions influences emotional experiences drew from and facilitated a larger family of related feedback theories of emotion, including William James's classic visceral feeling theory of emotion, as well as modern theories of affect–cognition interface, "somatic markers," and "embodied emotion" (Damasio, 1996; James, 1884; Niedenthal, 2007; Niedenthal, Augustinova, & Rychlowska, 2010; Zajonc & Markus, 1984).

The hypothesis of Zajonc and colleagues was unique in the role it assigned to blood modulation of brain temperature, and the resulting generation of valenced positive or negative mood. Here it drew on a century-old proposal first published by Israel Waynbaum, who suggested that facial reactions could change the temperature of blood leading to the brain by compressing and relaxing particular cerebral arteries that fed oxygen-rich blood (Waynbaum, 1907). Drawing on modern evidence that facial expressions and muscles were more likely to influence cerebral venous outflow from the brain, rather than arterial inflow, Bob reversed the assignment of affect causation from arteries to veins. His hypothesis argued instead that facial expressions impacted venous blood draining from the brain into sack-like reservoirs called sinuses that surround the brain before flowing down into veins of the body. Blood from the brain drained especially to the facial veins via the cavernous sinus, a pool beneath the brain hypothalamus. The cavernous sinus influences the temperature of the hypothalamus via heat exchange. Bob posited that happy facial expressions drained the brain in a way to cool the hypothalamus and so helped amplify pleasurable feelings. Inversely, he held that negative facial expressions would warm the hypothalamus, producing aversive feelings.

In support of these hypotheses, Bob and colleagues produced a number of clever experimental demonstrations that higher positive affective ratings could be induced manipulating people's facial expressions appropriately (Adelmann & Zajonc, 1989; McIntosh, Zajonc, Vig, & Emerick, 1997; Zajonc, 1985, 1994; Zajonc et al., 1989). For example, getting people to pronounce particular vowel sounds predicted to contort their facial musculature in such a way as to create cooler blood and brain patterns remarkably led to more positive subjective ratings assigned to shapes, sounds, and other stimuli.

Personally, I benefited from the Zajonc hypothesis of thermal affect in a special way because it was the source of an experimental collaboration between us (Berridge & Zajonc, 1991). Bob suggested over lunch around 1990, shortly after I had received tenure at Michigan, that we cooperate together in an experiment to find out if positive affective reactions could be generated by directly cooling the brain. My laboratory would strive to test his ideas by experimentally cooling the hypothalamus of rats, as he thought positive facial expressions might do in people, and we would look for behavioral indices of positive states such as appetitive motivation or pleasant affect. I jumped at the prospect of a collaboration with Bob because the enterprise seemed sure to be stimulating and fun. And of course it was.

In the end, almost to my surprise, we even found evidence to confirm Bob's prediction that direct brain cooling could produce a positive psychological process (Berridge & Zajonc, 1991). We implanted painless cooling probes directly into the brain of rats, positioned to cool just the hypothalamus. Cooling a rat's hypothalamus is a bit tricky because the brain structure is so small. Our probe was a tiny v-shaped loop of hypodermic steel tubing that was thermally insulated except at the exposed bottom tip. Iced water flowed through the tube, cooling the hypothalamic brain tissue that surrounded the loop, and consequently dropping the temperature of the hypothalamus by several degrees. Conversely, heated water flowing through the loop could warm the hypothalamus.

When a rat's hypothalamus was cooled or warmed, we ran two behavioral tests on incentive motivation and affect: a "wanting" test and a "liking" test, both using food rewards. In the "wanting" test the rat, which had fully recovered from its hypothalamic surgery weeks before, was allowed to eat as much as it wished, and the question was whether brain cooling would increase its inclination to eat. It did! Every once in a while the chilled water flowed through the probe, cooling the hypothalamus for a few minutes. During these periods of cooling, the rat's behavior changed, and it typically began to eat. Once the cooling stopped, the eating often stopped too. On average, a cooling-responsive rat ate nearly twice as much food when its hypothalamus was cooled than otherwise. That pattern was reminiscent of the effects of electrical stimulation of the same region of lateral hypothalamus, which also produces stimulation-bound eating and other motivated behaviors, as well as serving as a worked-for reward (Olds & Milner, 1954; Valenstein, Cox, & Kakolewski, 1970).

The positive motivation consequence of cooling we observed seemed very much in keeping with the Zajonc prediction. A next step was to explore the possibility of sensory pleasure more directly, and to find out if the positive state magnified the hedonic impact of sensory pleasures in the "liking" test. Did brain cooling make the rats "want" to eat food more by making them "like" its taste more?

We approached that question by drawing on a measure of "liking" reaction that my laboratory and others have used to study brain mechanisms of sensory pleasure. This is of affective facial expressions elicited by the hedonic impact of tastes, for example as seen in newborn human infants (Steiner, 1973). Sweet tastes elicit positive facial "liking" expressions (e.g., lip licking) whereas bitter tastes elicit negative facial "disliking" expression (e.g., gapes). Some of these affective expressions developed from the same evolutionary source and are similar in humans, chimpanzees, monkeys, and even rats (Grill & Norgren, 1978; Steiner, Glaser, Hawilo, & Berridge, 2001). Although rats lack the musculature for brow, nose, or cheek expressions, they do make a set of homologous lower-face expressions of the tongue and jaw. In response to a sweet taste, rats lick their lips

in "liking," whereas in response to a bitter taste rats make negative "disliking" expressions such as gapes. Many brain manipulations that alter sensory pleasure, such as enhancing pleasure via neurochemical stimulation of limbic hedonic hotspots in nucleus accumbens or ventral pallidum with opioid or cannabinoid signals, cause a selective increase in the positive "liking" reactions to tastes (Kringelbach & Berridge, 2009; Smith, Mahler, Pecina, & Berridge, 2010). We applied this test to rats that received hypothalamic cooling. Would cooling the hypothalamus increase sweetness "liking"? Here the evidence glass turned out to be only half full, as our results showed that brain cooling did not amplify hedonic "liking" for food, despite having made the rats "want" to eat more (Berridge & Zajonc, 1991).

But this was not necessarily a shock, as the same sort of "wanting-without-liking" is all that is produced by several brain manipulations that traditionally were considered to be pleasure prototypes, but turned out to be something not quite, such as stimulation by so-called "pleasure electrodes" or activation of mesolimbic dopamine systems (Berridge & Valenstein, 1991; Kringelbach & Berridge, 2009; Olds & Milner, 1954; Smith et al., 2010). All of those brain events plus hypothalamic cooling may be viewed as causing one-half of reward, namely incentive salience or "wanting," even if not the other half of hedonic pleasure. Incentive salience may make the world seem brighter and more attractive to the individual, and so at least facilitate positive states in that way. At moderate activation levels, incentive salience may add positive zest to life and perhaps even promote happiness (Kringelbach & Berridge, 2009), though at stronger levels incentive salience may be a mechanism of addiction (Robinson & Berridge, 2003). Altogether, activation of incentive salience seemed close enough to fit the central purpose of Bob Zajonc's vascular theory of positive emotion, especially given Bob's other affective thesis that people may have limited conscious or cognitive access to their own emotional processes (Murphy, Monahan, & Zajonc, 1995; Winkielman, 2010; Winkielman, Zajonc, & Schwarz, 1997; Zajonc, 1980, 1998), which conceivably might even sometimes lead them to confuse their own "wanting" for "liking."

For me, the collaborative project with Bob was a truly marvelous experience. In large part that was because of the many conversations it afforded during the project and for several years afterwards, usually over lunch. These were always stimulating and pleasant, ranging over many issues in psychology and other topics.

Bob's experimental interest in thermal modulation of affect continued throughout the 1990s and he continued to publish on the topic of his vascular temperature theory of emotion (McIntosh et al., 1997; Zajonc, 1994). One of his last experiments on the topic was described in a collaborative study with McIntosh and colleagues, which reported that negative facial expressions in humans tended to restrict nasal airflow and raise forehead temperature (McIntosh et al., 1997). They found that the physiological reactions resulted in increases in subjective ratings of negative affect, in conformance with the vascular temperature hypothesis.

In a larger context, Bob's work on the thermal hypothesis can be seen as part of his career-long effort to better understand affect. That important work helped distinguish affect as an independent psychological process, together with his work on mere exposure (induction of positive affect via familiarity), the primacy of affect (not needing mediation by elaborate cognition), and unconscious emotional reactions (not requiring conscious perception of an eliciting event). To an appreciable degree, Bob's efforts helped open up affect for psychological study in an age when hedonic processes were still relatively ignored or reinterpreted in other ways. Those efforts contributed to the resurgence in studies of affect across many areas of psychology and allied disciplines, which I believe has been a very good thing (Barrett, Mesquita, Ochsner, & Gross, 2007; Cacioppo, Berntson, Larsen, Poehlamann, & Ito, 2000; Davidson & Sutton, 1995; Ellsworth & Scherer, 2003; Frijda, 2007; LeDoux, 1996; Moreland & Topolinski, 2010; Niedenthal, Winkielman, Mondillon, & Vermeulen, 2009; Russell & Barrett, 1999).

Robert Zajonc: The Complete Psychologist

The complete psychology of Robert Zajonc can only be fully appreciated by recognizing his interests across several subfields, from social psychology to biopsychology. Of course, in magnitude Bob's projects in physiological psychology or comparative psychology were small in comparison to his many other contributions to social psychology and to human emotion and cognition. Still, these projects and themes were important to Bob and they stand as important parts of his contributions to psychology.

Throughout his career, Bob was always willing to tackle the most fundamental and important issues in psychology (e.g., the nature of affect and cognition). He was never daunted by obstacles, and had a marvelous gift for finding new and valuable perspectives on enduring questions. Bob's way of thinking about psychological puzzles was not confined by the boundary lines that separate subfields of psychology. At least, he never saw those boundaries as fences that could keep him out of any topic. Instead he saw borders as mere open doors for him to pass though in search of material to support his mission of the moment.

Robert Zajonc opened up ideas that the rest of psychology had overlooked or never considered. He performed this service to psychology again and again, and as a result repeatedly moved the field forward. His gifts made him a leader in psychology and a delightful companion for talking about nearly any topic. And always with a charm that is greatly missed.

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