In Memoriam: William D. Timberlake (1942–2019)[1]

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Bill Timberlake was spry at seventy. Although he held the presence of someone who had lived for centuries, he stood straight and strong. Yet, just a few years later, weakened by a progressive, terminal disease, Timberlake took a bad fall, from which he would never recover.

William D. Timberlake (19 November 1942-17 October 2019) earned his PhD in experimental psychology at University of Michigan in 1969 under the supervision of David Birch. He joined the Indiana University psychology faculty the same year, where he remained for the rest of his career (see Arnet, 2019, for a biography).

Timberlake will be remembered for many achievements. He conducted important work in a wide variety of areas related to the behaviour of animals, including behavioural economics, contrast effects, spatial cognition, adjunctive behaviour, time horizons, and circadian entrainment of feeding and drug use. By 1983, he had published two influential theories, and a wealth of data supporting them.

The earlier of these theories, his disequilibrium approach to reinforcement, has been known by various names, at various stages of development: behaviour regulation theory, response deprivation theory, molar equilibrium theory, and disequilibrium theory (Timberlake & Allison, 1974; Timberlake & Wozny, 1979; Timberlake, 1980; Hanson & Timberlake, 1983; for an updated introduction, see Jacobs, et al., 2019). The disequilibrium approach involves a shift in conceptualisation of reinforcement: reinforcement is attributed not to environmental stimuli, but to constrained behaviours. Given the centrality of reinforcement in mainstream views--a notion not updated since Thorndike (1911) decreed his Law of Effect--this meant a shift in bedrock. Although Thorndike's Law of Effect remained a 20th century intuition, some expect 21st century psychology to look instead to disequilibrium (e.g. Jacobs et al., 2019).

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The second of Timberlake's major theoretical contributions was his behaviour systems approach (Timberlake, 1983ab, 1990, 1993, 1994, 2001). This was another big resetting of foundations, one that tugs at another seductive 20th century intuition, that functional capacities, such as learning, can be separated from the particulars of performance. Timberlake saw that to distil some abstract capacity from the rest of what the animal does--or to even know how to begin such a project or judge its feasibility--requires a fuller appreciation of the latter than is currently possessed. With this sobering sentiment, he put his approach in contrast with analytical trends in psychology. Not just explicitly analytical or operational approaches, but every attempt to abstract some cognitive or functional capacity out of an animal's behaviour, as is commonly done across the sciences of behaviour, should feel the prick of Timberlake's pen. His solution was to begin by modelling performance in a given species and environment, and then to use that model to frame an understanding of the focal construct in that specific context. This is what Timberlake (2007) meant by a *theromorphic* approach: one that is based on an explicit model of the animal. Rather than claim precedence for these ideas, he underplayed their novelty and stressed their connection with existing, related views by referring to his theory as *a behaviour systems approach*, a phrase with a past. Even acknowledging its connections with earlier views, however, it was Timberlake's theory that provided the basis for dissolution of a list of the most vexing theoretical issues in psychology.

By the time of his death, Timberlake's theories and the empirical work that underlay them had become standard fare in animal learning curricula, and had reached generations of psychology students at universities around the world. This was due in part to the good judgement of writers of textbooks (e.g. Domjan, 1982-2015), in which Timberlake's work features prominently. Timberlake's scientific contributions were further recognised with numerous awards, including the Pavlovian Society's Research Award (2007). He served on the editorial boards of all the field's major journals. Timberlake was a fellow of the American Association for the Advancement of Science, held multiple offices of three APA divisions, and served as president of APA's Division 6. Over the last months of his life, a Festschrift of 20 papers dedicated to Timberlake's influence was published (https://www.sciencedirect.com/journal/behavioural-processes/special-issue/10GTX28DGHR), in which scholars from around the world and multiple disciplines, field leaders among them, wrote about how Timberlake's work has moved psychology and allied sciences forward.

While his theoretical contributions are easiest to put in print and to credit with specific citations, Timberlake did much more for the sciences of behaviour. Perhaps his single biggest accomplishment was to provide the infrastructure for cross-disciplinary cooperation and communication among the sciences of behaviour. Many psychologists have recognised the value of integration with ethology, and many welcoming hands have been extended. Timberlake saw, however, that cross-disciplinary integration takes more than good intentions. When Timberlake extended his welcoming hand to ethology, his hand held infrastructure. Timberlake was the key mover behind the establishment of the interdepartmental animal behaviour programme and Center for the Integrative Study of Animal Behavior (CISAB) at Indiana University. With these, Timberlake and co-founder, biologist Ellen Ketterson, institutionalised interdisciplinary training and cooperation among the sciences of behaviour.

Although the creation of CISAB was a team effort, it was Timberlake who assembled the team, and in Ketterson's (2010) words, Timberlake was "the person whose vision it was that we could develop an animal behavior community on the Indiana University campus that would truly cross disciplinary boundaries." Timberlake led every aspect of its establishment. "We study using a curriculum that was

envisioned by Bill. We function under an administrative structure established by Bill. We participate in an ethics seminar that Bill knew we needed to create. And we attend a yearly conference that Bill urged us to hold.… At every step Bill thought about what we needed and helped to persuade the rest of us to his point of view--leading to some choppy moments for sure, and some absolutely great outcomes" (Ketterson, 2010). In addition to integrative science, Timberlake was deeply committed to providing cross-disciplinary training to students in animal behaviour. He was careful to assure that this education came with the university's accreditation: he established first a graduate minor and area certificate (1993), then an undergraduate minor (1994) and undergraduate area certificate (1996). In addition, Timberlake (with William Rowland, and later with Emilia Martins) initiated and led a funded educational programme that has provided practical animal behaviour research experience to hundreds of undergraduate students since 1995. Because the foundation for CISAB was so well laid, it has survived and grown. Today, the animal behaviour programme offers a full degree major in animal behaviour, a precedent that universities around the world have begun to emulate.

Timberlake was also a leader in the development of mechanisms of oversight for the ethical use of animals in science. Timberlake saw that effective ethical oversight of animal research and a stable, engaged overseeing entity were important for the protection of animals used in research, and also that these required care in implementing. After establishing (with co-chair, James Holland) an animal research ethics committee on the Bloomington campus (the ancestor of today's BIACUC, Bloomington Institutional Animal Use and Care Committee), he discovered its efforts being compromised by a superordinate, multi-campus entity centred in Indianapolis. One of Timberlake's battles was to keep ethical oversight local. He saw that Bloomington's needs were not the same as other campuses, such as the needs of the large medical school in Indianapolis, and that efforts to maintain central control were producing a number of problems that impeded science. He also saw that a single rigid set of standards would interfere with efforts to provide high-quality conditions for animals in basic science research. Timberlake succeeded, and to this day, there is a single, local, stable entity (BIACUC) that oversees animal use on the Bloomington campus. He achieved this against a tide of sentiment by which scientists were seen as enemies of animals, a sentiment he saw as counterproductive to BIACUC's purposes. Timberlake maintained that most psychologists and biologists working with animals do care about the quality of treatment animals receive, and furthermore that these were the people best positioned to know what the animals need, and to assure that suitable conditions are attained. During his years on the committee (1985-1989), he worked to support responsible scientists' efforts to assure ethical treatment for animals in research. After passing the baton, he turned his attention to preparing the next generation of scientists to be leaders of ethical animal care, establishing research ethics courses and making them a part of core graduate and undergraduate animal behaviour curricula at Indiana University. He served on the Campus Committee on Teaching Ethics in Science from 1989, then on the Board of Fellows of the Poynter Center for the Study of Ethics from 1993.

Timberlake knew first-hand the kinds of pressures and pains that divide sciences and back scientists into disciplinary trenches. Yet, even while facing these pressures and pains himself from every direction, his commitment to cross-disciplinary cooperation and communication never faltered. He remained on no one's side, and everyone's side. Those who regard Timberlake as a critic of their own perspective should take heart, as he may have defended it in other contexts, and critiqued opponent views with equal vigour. Timberlake taught that various ways of approaching our subject matter have their place,

and that miscommunication arises from failures to appreciate the goals and assumptions by which each approach works. Timberlake not only welcomed diversity in science; he saw that it needed nurturing, and worked to assure the university was prepared to provide it via interdisciplinary education.

Timberlake had a talent for seeing through mirages of apparent explanation, and much of his work had the effect of dismantling exaggerations of understanding. Amid widespread interest in isolating abstract capacities, Timberlake repeatedly reoriented attention to the animals themselves, and how their species-typical characters interact with given experimental circumstances. While some of his contemporaries baulked at reference to cognition to describe the behaviour of animals, Timberlake never did. Rather, the sharp end of his pen was aimed at the various ways of abstracting the context and particularities of the animals studied out of analyses, a critique that applied with equal force to cognitive ethology, operant psychology, and very much in between. Although a sobering message, Timberlake's plain attention to the animals and deep knowledge of their behaviour lay behind all his successes.

Timberlake felt humbled by the sophistication of animals and how imperfectly we understand them. Even after a long career of watching animals and uncanny success in making sense of them, the mysteries still outweighed the answers. Timberlake saw that those of us who work to understand the behaviour and cognition of animals face a daunting circumstance: our topic is enormously complex, and foundations are smaller and spongier than they once seemed. This sobriety did not slow his positive contributions to theory. Timberlake was a brave and creative thinker, and he had an eye for the kinds of data needed to address the big questions.

Timberlake was involved in the arts throughout his life, including theatre, poetry, and especially music. Bill was a talented guitarist and singer. He had been in rock bands, sang bass with the Bloomington Chamber Singers, and together with his family, sang folk music with the less formal Potluck Singers. And until recent months, undeterred by mounting illness, he was taking refresher guitar lessons. He was also talented in several sports (and uncommonly tall), perhaps even to the extent of having affected his recruitment at University of Michigan. Bill was a devoted father to two children and husband to his wife of four decades, Holly Stocking.

At Timberlake's memorial service (23 Nov. 2019), many people rose to speak. In a rare occurrence, recognition for his scientific contributions was exceeded by recognition for the rest of the many facets of his life. People spoke of his kindness and modesty and his ready sense of humour. People spoke of his open-mindedness, his candour, and his willingness to do things differently. Methodist minister and body psychotherapist, John Ryerson, who presided over Bill and Holly's unusual wedding (1980), described it (posthumously, by video) as "strange" and "beautiful" (they were married by walking through a wood to the edge of the water at Griffy reservoir and skipping rocks). Poynter Center's David Smith described Timberlake's dedication and "total lack of fear" in facing ethical concerns that needed addressing. Fellow monastery members spoke of Timberlake's years of studying Buddhism, and his engagement in the Bloomington Buddhist community. Three former CISAB directors (Ellen Ketterson, Greg Demas, Cara Wellman) each reaffirmed the importance of Timberlake's vision and leadership in establishing lasting grounds for practice and training in a truly integrative animal behaviour programme at Indiana University. How Bill also indirectly contributed to the shape of Indiana University's cognitive science programme, by having recruited the people who would come to direct it, was noted by its current director, Peter Todd. Others spoke of an openness to listen, to his students, to his colleagues, to

practitioners of other disciplines and approaches, to people of all kinds, and to connect with every dog he encountered, perhaps due to the same careful attention to others.

Timberlake's last known words were: "It is what it is." A forthright acceptance of given circumstances may be regarded as a theme of his life and career. There is courage in facing the natural world as it is, in science and in life, and to neither be put off course by its complexity or occasional harshness, nor be seduced by easy answers. Timberlake was a brave thinker, a fierce advocate, and a natural leader. Throughout all he accomplished, he remained kind, modest, honest to a fault, careful in scholarship, and free in life.

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