Princeton University

Honors Faculty Members
Receiving Emeritus Status

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The biographical sketches were written by
colleagues in the departments of those honored.

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Anne Marie Treisman

Anne Treisman was born in 1935 in Yorkshire, England. She was interested in science early on, but at her father's wish that she become a "cultured" person, she switched to French, Latin, and history for her last three years of high school. Upon receiving a B.A. in modern and medieval languages at the University of Cambridge, she was offered a research fellowship to work toward a doctoral degree in French literature. This time she decided to follow her interest in science and used the fellowship funds (with permission) to obtain a one-year undergraduate degree in psychology instead. She obtained her Ph.D. from the University of Oxford in 1962, where her thesis, "Selective Attention and Speech Perception," presaged her major contributions to our understanding of attention and perception.

Anne joined the Princeton faculty in 1993, following university appointments at Oxford, the University of British Columbia, and the University of California–Berkeley. Her academic honors include election as a fellow of the Royal Society, London (1989), American Philosophical Society (2005), National Academy of Sciences (1994), American Academy of Arts and Sciences (1995), honorary degrees from the University of British Columbia and University College London (2004, 2006), the Warren Medal of the Society of Experimental Psychologists (1990), and the Grawemeyer Award in Psychology (2009), which recognizes outstanding ideas in psychology. Her work has appeared in 29 book chapters and more than 80 journal articles and is heavily cited in the psychological literature, as well as prominently included in both introductory and advanced textbooks. She was named the James S. McDonnell Distinguished University Professor of Psychology in 1995.

Her early work focused on how attention can filter perceptual input, allowing only potentially relevant information to reach consciousness.

The dominant theory at the time postulated a general, non-selective filtering mechanism. Anne used a selective listening paradigm to see what kinds of information get through the general filter. People wore earphones and were instructed to attend to only one ear. Messages in the attended ear were understood and remembered, those in the unattended ear were filtered out—they were neither noticed nor remembered. However, potentially important information, such as mention of one's name in the unattended ear, is instantly noticed, demonstrating that the attentional filter is selective.

In the 1970s, Anne's research interests turned from audition to vision, and to the feature integration, or binding, problem. Anne began with two observations: (1) perceptual features, such as shape, color, and motion are processed by different subsystems of the brain; (2) nonetheless, we experience multi-featured objects as integrated wholes. For example, when we look at a red ball rolling on the floor, we do not see redness, roundness, and motion as separate percepts. Instead, we see a moving red ball. How is this accomplished? Anne proposed that there is a "spotlight" of attention that serially moves around in the representations of space in the brain, perhaps as often as 25 time a second. The features of an object are bound together when the spotlight of attention lands on the location of that object. In a sense, this suggests that we need to know *where* an object is before we can know *what* it is—i.e., before its features are bound together.

This idea is quite counterintuitive. People are not aware of either the serial scan, or of the binding process. Anne's genius in examining this idea was in developing striking predictions of her feature integration theory and testing those predictions empirically. One such prediction is that one process is involved in detecting that a particular feature is present somewhere in a visual scene (e.g., there is something red in the scene), and a different process in detecting a conjunction of features (e.g., there is a red X on the left side of a scene). Key evidence for this prediction came from the results of visual search tasks. People are asked to look for a target item among some number of other items. The time to find a target defined by a single basic feature (e.g., a red target among green distractors) was independent of the number of distractor items. This

implicates a parallel search process. If a target was not distinguished by a single basic feature (e.g., a letter among various other letters), then the time required to find the target increased as a linear function of the number of distracting items, suggesting a serial process of binding one item at a time.

The theory predicted a phenomenon heretofore not observed—the phenomenon of illusory conjunctions. When people cannot focus their attention, they may misperceive objects by combining features from other objects, e.g., see a red T when the actual objects are a red O and a blue T. It's often said that there is nothing as practical as a good theory, and in Anne's case her Feature Integration Theory (FIT) was good indeed. The theory helped to explain a puzzling symptom in patients with parietal lobe damage—known as Balints' patients. These people have lost their ability to localize objects visually. According to FIT, if an object cannot be localized, then the selective attention cannot be deployed to that object, making binding of features difficult, if not impossible. Anne found that these patients had a major binding problem. Even when presented with just two objects, say a red X and a blue T, the patients would often see a blue X or a red T, even if they were given unrestricted observation time to make their judgments. This result was a striking confirmation of the counter-intuitive notion that we need to know *where* an object is to know *what* it is—what features must be bound together. And, because these patients could not attend selectively to different object locations, they display simultanagnosia (their inability to see more than one object at a time).

The theory also raises important questions. For example, if people must bind objects one at a time, how can we have immediate impressions of the detailed scenes that we encounter on a daily basis? Anne contrasted the operation of binding in order to individuate objects with a different mode of attentional deployment that processes sets of similar objects (e.g., a flock of geese) and even whole scenes. These latter attentional processes provide information about the global properties of scenes, general spatial layouts and gists of scenes, without the need to bind features of individual objects. Together, focused and global attention allow people to combine accurate identification of a few objects with quick apprehension of the gist of a scene.

The impact of Anne's work on theory and practice has been enormous. Her original 1980 paper on FIT is the most cited paper in the last 12 years in the main cognitive psychology journals. Her papers on attention have been cited more than 8,200 times. Her theory was instrumental in bringing together the behavioral phenomena of focused and global attention with what neuroscientists have discovered about the functions of the various pathways involved in representing locations and actions. And her work has been used by applied psychologists who work to improve the discriminability of such things as railway and traffic signals, or the search for weapons by baggage inspectors in airports. With luck, the people who design training regimens for airport security personnel may well be able to use her work to speed up the process without loss of accuracy.

Rounding out this brief summary of Anne's stellar career, her contributions extend to her training of graduate and undergraduate students, her unstinting participation in both journal and book reviewing, in grant review processes, and in University service. Binding all of her features together, we have enjoyed the friendship and collegiality of a complete academic.