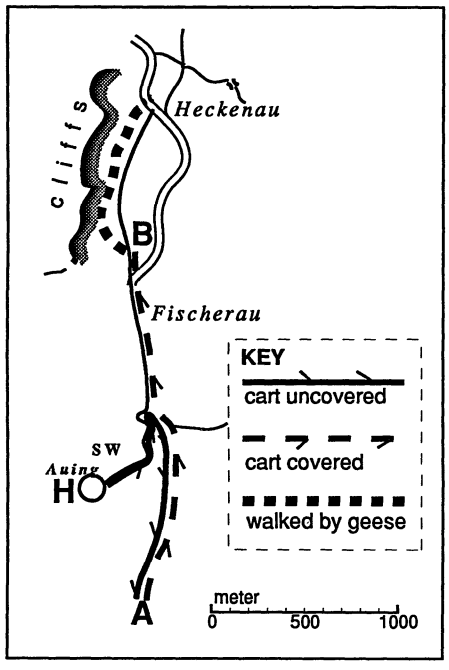

Example of a two-leg experiment on dead reckoning. "Two domestic geese were transported in the open cage from *H* to *A*. At *A*, the cage was covered completely and the geese were further transported to *B*, where they were released. The two geese walked together and stopped at the indicated spot. The course they took was appropriate for the uncovered leg of the cart-trip. Had they been released at *A*, this course would have carried them near home." [From *The Organization of Learning*; based on U. V. Saint Paul, in *Avian Navigation*, F. Papi and H. G. Wallrap, Eds. (Springer-Verlag, 1982)]

to interest experts and sufficient examples and graphics to encourage the more general reader through the sometimes long sections on modeling and isomorphisms. This is one of the increasing number of books that would be well served by publication with a diskette or CD-ROM of simulations and models.

In the book's opening chapter Gallistel strikes a distinctly ecological note in a series of vignettes illustrating how learning modifies the everyday behavior of animals—ants ably returning home with booty over featureless desert sands, bees coming on time to share breakfast on the terrace with a naturalist. Accounting for these examples ultimately reveals his attempt to construct a complete picture of how animals represent stimulus events.

Gallistel's inclusive picture of learning begins with how representation fits into the mechanisms by which animals locate themselves efficiently and accurately in space and time, including the phenomena of navigation, dead-reckoning, cognitive maps, and circadian and interval-based times of occurrence. Gallistel then considers the encoding of events by counting and estimates of rate and the representation of the correlation of multiple events in time in Pavlovian conditioning. He completes his picture with consideration of how information may be encoded and retrieved from the nervous system. Throughout the book Gallistel focuses on the representation of information in vectors and proposes a number of models of the phenomena he recounts.

The literature reviewed, though not exhaustive, is surprisingly diverse, ranging among the topics of natural history, physiological ecology, ethology, human information processing, animal learning, and neuroscience. There is considerable focus on basic data, and Gallistel does not avoid making value judgments and arguments criticizing and extending other people's work. Because an entire book could have been written on any one of the major topic areas, residents of each area are bound to find shortcomings. I certainly found the sections on Pavlovian conditioning highly selective, and a few accounts of data did not quite jibe with my interpretations. The sudden introduction of a location sense in chapter 6 and the distinction between proximal and distal cues were confusing. There are several points at which I wasn't compelled by the contrast Gallistel saw between hypotheses. For example, I struggled with the purported differences between the expectancy and the entrainment models of how events are located in time; the section reminded me of the interesting but apparently indefinable differences between expectancy and stimulus-response learning theorists in the 1940s.

I found the initial chapter on representation difficult and the chapters on number and rate too idiosyncratic. The rate chapter in particular appears to confuse paradigms in which the probability of payoff for different alternatives changes over time (for example, concurrent variable-interval schedules of food presentation) with those in which the probability remains constant (for example, concurrent fixed-ratio schedules or probability-learning procedures). It doesn't seem plausible that a matching of responding to reinforcement rate should occur in both circumstances through the same mechanism. Also, sensitivity to rate transitions would seem to be an important determinant of switching between alternatives.

But on the whole I was struck by the useful and entertaining way in which much of the experimental material is reviewed, making this a reasonable introduction to several research areas. Gallistel does not shy away from taking sides, and I liked many of his observations (for example, his demonstration that consistent numerical constants in the Rescorla-Wagner equations cannot predict the range of phenomena apparently accounted for at a qualitative level, or his expression of doubts about attempts to build a cellular alphabet of learning types). The modeling enterprise is usually interesting, though often of a work-in-progress nature. There is perhaps too much argument concerning vector representations and isomorphisms given our current data, but these are Gallistel's central points and 20 years' hindsight may reveal brilliance.

In the end what I missed most is an account of how these representations, computations, and isomorphisms come together to produce (to compute, if you will), say, a foraging rat. Though learning is viewed complexly in this book, it is still defined in static terms as the accumulation of information about the world, rather than as a dynamic component of the motivational processes and mechanisms coadapting the animal and the environment. This contrast can be highlighted by comparing the language and procedures of the chapters on Pavlovian conditioning with those of the earlier analyses of how animals function in their individual worlds.

Put another way, Gallistel's two books need to be fitted together more explicitly. The organization of action and the organization of learning coevolved. In this respect, Gallistel's two books are best appreciated as a thought-provoking and information-filled prolegomenon, a marked advance toward embedding the study of learning in the context of an evolved functioning organism (see W. Timberlake and G. A. Lucas, "Behavior systems and learning: from misbehavior to general laws," in *Contemporary Learning Theories*, S. B. Klein and R. R. Mowrer, Eds. [Erlbaum, Hillsdale, NJ, 1989], pp. 237–275). Scientists broadly interested in the fit of learning and behavior could not pick a better starting place to continue the task of integration.

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Language Without Cognition

Laura. A Case for the Modularity of Language. JENI E. YAMADA. MIT Press, Cambridge, MA, 1991. xviii, 169 pp., illus. $27.50. Issues in the Biology of Language and Cognition. A Bradford Book.

Is human language a separate faculty, or is it just one of the mightier weapons in our general cognitive armamentarium? Are complex vocabulary and syntax our crowning intellectual achievement, evidence of ab-

stract abilities and advanced cognitive development? Consider the central figure in Jeni Yamada's book *Laura*, a young woman born in California, one of four daughters of a teacher mother and a college professor father. When asked at the age of 16 years to name some fruits, she responded with "pears," "apples," and "pomegranates." In referring to a recent distressing event at around the same time, she said: "He was saying that I lost my battery powered watch that I loved; I just loved that watch."

The responses are unremarkable—except that Laura is a retarded person with a full-scale IQ of just 41. Yamada's book is a case study, conducted over a period of several years, beginning when Laura, who is now in her 20s and living in a group home, was around 15. Laura was given extensive batteries of tests of linguistic, cognitive, and neuropsychological functioning, and her spontaneous speech was transcribed and meticulously analyzed. Her parents were also able to supply extensive notes on her birth and early development. Laura's retardation is of unknown etiology, and developmental delays were noted during her first year. Her language, however, has always been far in advance of her other abilities. This book presents data and arguments that support the conclusion that language is an independent, or modular, ability. At the time of testing, even though Laura could talk about pomegranates and produce complex sentences with multiple embeddings such as the one quoted above, she performed essentially at the preschool level in most standardized tests of intellectual functioning. She could not read or write or tell time. She did not know who the president of the United States was or what country she lived in. Her drawings of humans resembled potatoes with stick arms and legs, and, unlike many two-year-olds, she did not know her own age.

Theorists of language have been at odds with one another for the last quarter-century over questions having to do with the nature of language and the possible prerequisites for its development. At one extreme, followers of the Skinnerian behaviorist tradition see language not as a separate skill but as a learned behavior like any other, subject to the laws of learning: Adults teach children to speak through selective reinforcement of their early babbling. Learning theorists, of course, do not posit mental processes underlying behavior, although they do not deny that organisms differ; human gurgles may be shaped into speech, for instance, whereas cat *meow*'s, even under optimal schedules of reinforcement, remain *meow*'s.

At the other theoretical extreme, innatists view language as inherently determined and

A drawing by Laura of a turkey, made by tracing her hand. [From *Laura*]

arising from a set of universal and specifically linguistic principles that are triggered and then unfold in every individual exposed to language. Innatists see language as a unique part of our biological endowment, as robust and as unaffected by environment as the universal phenomenon of walking.

Somewhere in between these theoretical positions lie two or more schools of developmental theorists. Cognitivists, mainly followers of Jean Piaget, theorize that language development in an individual is but one facet of cognitive development in general. Language arises from an interactive process that relies upon prior cognitive attainments. For instance, in early naming the child first learns what a dog is and then learns to map the word *dog* onto that concept. Later, the use of some passives and embedded structures in language is assumed to require that the individual first understand underlying cognitive concepts characteristic of children who are at least in Piaget's concrete operational stage.

Social interactionists and functionalists, who have yet another theoretical focus, see language as emerging from communicative and functional bases; a child learns language in order to accomplish certain communicative and pragmatic ends in the world. According to this view, infants communicate with adults long before they speak, through gaze, gesture, pointing, and other nonverbal means. Language emerges from this communicative matrix in the service of functional, interpersonal, and pragmatic ends.

The cognitive view has been particularly influential in recent years, especially among psychologists. Although it has often been observed that language development typically correlates with other milestones in physical, cognitive, and social development in children, it is cognition that is thought to underlie language, whereas developments in other spheres are regarded as merely the usual accompaniments. For instance, first words and first steps routinely occur at about the same age, but few would argue that they are causally related. There is common acceptance, however, of the Piagetian claim that linguistic development depends upon the elaboration of more general cognitive structures. It is true that there are usual cognitive attainments that precede or accompany stages of language development, but it is cases such as Laura's, where there is obvious dissociation, that must interest us.

Yamada's book presents the data in a particularly useful way because she is at all times aware of the theories and their conflicting claims. She also refrains from making extreme claims herself and is sensitive to the difficulties posed by the complex and componential nature of language. She is able to match theoretical predictions against Laura's actual linguistic performance.

In general, the claim that particular cognitive attainments must precede language at every level is not upheld. Laura was unable to perform beyond the preschool preoperational level in most Piagetian tasks—for instance she could not decenter or consider two features of a problem at the same time, such as both the color and the shape of objects to be sorted. On short-term memory tests she could repeat at best three words or digits, approximately the level of a three-year-old. Yet she had no difficulty producing passives, embedded clauses, and other syntactic structures that are thought to rely upon such cognitive abilities.

Functional, social, and pragmatic forces also did not appear to be driving Laura's language. Her pragmatic skills were quite poor, and her conversations were often inappropriate, if not bizarre. For instance, in a conversation about her savings account, she was asked, "How do you earn your money?," to which she replied "Well, we were taking a walk, my mom, and there was this giant, like, my mother threw a stick." Although she talked a great deal, she had difficulty communicating effectively. Laura's vocabulary and grammar were far in advance of her ability to make conversation or even to understand similarly complex language addressed to her.

We must conclude that Laura exhibited a basically autonomous facility for language, particularly for grammar. As Yamada notes, "The data presented here strongly indicate that any viable account of language acquisition must incorporate the notion that language is at least in part governed by principles that are unique to it" (p. 119).

Ultimately, both cognitive theory and linguistic theory will have to account for the

remarkable dissociations that can exist between an individual's understanding of the world and his or her ability to produce complex language. *Laura* provides the kind of detailed evidence in both linguistic and cognitive domains that will help to build those better theories.

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Social Impressions

Interpersonal Perception. EDWARD E. JONES. Freeman, New York, 1990. xvi, 313 pp., illus. $29.95; paper, $18.95. A Series of Books in Psychology.

"There is more to seeing," the aphorism goes, "than meets the eyeball." Edward E. Jones's *Interpersonal Perception* seeks to show us how much more there is, particularly when what we are seeing is other people. It is a fascinating volume, one that seems simultaneously aimed at three audiences. For each, it should prove a different book; for each, it should prove a valuable book.

A first audience for Jones is the intelligent layperson. For this reader, *Interpersonal Perception* is designed as an introduction to a field of research that has become one of the half-dozen major topics defining the field of social psychology in recent years. The central question that Jones's book addresses is how we come to know, or think we know, what another person is *really* like. When we perceive another person, we typically come away not just with an idea of that person's size, shape, color, and the like; we also, almost inevitably, have beliefs about what that person is like inside—beliefs about that person's underlying intentions, dispositions, preferences, and attributes.

For this first audience, the very fact that we automatically reach such conclusions and the processes by which we do so are the subjects of Jones's selective survey of this field. Although Jones does describe the actual research from which his conclusions derive in some detail, this work is presented in the form of a narrative designed to be accessible to readers without strong backgrounds in psychology. Jones tells the story of his field with charm and grace.

A second audience for this volume is Jones's professional colleagues. For this group, the book serves as an intellectual autobiography, presenting the history of Jones's own central involvement in this field of research (indeed, in making this a significant "field of research") for more than 40 years. Although, as Jones himself notes, he was not actually "there at the beginning," he was there close to it. Both Jones's own career and the current book begin with the 1957 Harvard symposium that first led to the recognition of a coherent and substantial field of social psychology concerned with "person perception."

For this second audience, the heart of Jones's account is the progression of his own seminal work and its links to other important landmarks in the field. The result is a portrait of the artist that makes clear the coherence underlying Jones's many distinctive research endeavors in a way individual research accounts typically do not. Three characteristics of this portrait, three recurrent themes, stand out.

First, Jones chose from the start to define the central question of person perception as one of understanding intentional action and the inferences people draw about underlying dispositions, attitudes, and capabilities from those actions—a question that serves to focus attention on the uniquely social aspects of interpersonal perception. Hence, the correspondence between overt actions and covert characteristics necessarily becomes a central theoretical issue. Second, Jones also focused quite early on the manner in which social perception processes are deeply dependent on individuals' goals in particular settings. Thus, Jones was one of the first to highlight the sometimes powerful conflict between people's desire to perceive their social world accurately and their desire to perceive their social world as they would like it to be or in ways that make them feel good about themselves—the tension between effective reality-testing and successful wish-fulfillment. Third, Jones also chose from the outset to stress the interpersonal character of social perception. Interpersonal perception is necessarily a process that takes place primarily in contexts in which individuals are simultaneously perceivers of others and objects of others' perceptions. In such an account, potentially competing motives and the manner in which we cope with such conflicts ourselves and analyze them in others assume importance.

From these three central choices comes the rich array of problems that Jones has addressed over the years and discusses in this volume. These include the study of ingratiation and its surprisingly powerful effects even on forewarned targets, research on the proverbial "rocky [inferential] road" from actions to dispositions, analyses of the different goals and perspectives of "actors" versus "observers," and work on the psychological impact of stigma. Jones is a master of the technique of moving back and forth between the study of phenomena of interest that imply new processes and the study of processes of interest that imply new phenomena.

Finally, a third potential audience for this volume is the beginning student in psychology. For this last group, Jones's book can be seen as a loving exposition by example of the art of classical experimental social psychology. The book is filled with excellent illustrations of experiments that "tell a story" about people's reactions to experimental situations carefully crafted to involve participants in meaningful social interactions, albeit within a laboratory context. In an era in which social psychologists all too frequently ply their trade "hypothetically," assessing participants' reactions to verbal descriptions of persons and situations, Jones's insistence on the study of real people in real social interactions and his focus on the uniquely social and interactive nature of interpersonal perception provide a refreshing reminder of the power of the classic experimental approach to social psychology.

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