A Theory of Cognitive Balance

Psychological Reactance. A Theory of Freedom and Control. SHARON S. BREHM and JACK W. BREHM. Academic Press, New York, 1981. xiv, 432 pp. $36.50.

Social psychology has been criticized for following fads. Lines of research and the theories behind them are not falsified or extended so much as abandoned when a new topic captures the collective fancy of those in the field. Though not always valid, this criticism contains enough truth to explain why progress in social psychology is questioned, why the data base of the field is constantly in flux, and why theories in social psychology are overly circumscribed and short-lived.

It is against the context provided by this characterization of social psychology that the book by Sharon S. Brehm and Jack W. Brehm is best appreciated. "Psychological reactance" was first described by Jack Brehm in the middle 1960's as an unpleasant drive state occasioned by the threat to or elimination of some perceived freedom. People experiencing psychological reactance take steps to maintain or restore the threatened freedom. For instance, a consumer who has narrowed her automobile choices to a Datsun or a Honda will have her freedom to choose between these cars threatened if, for instance, the local Datsun dealer temporarily closes the showroom. She may restore her freedom by traveling to a city where a Datsun is available.

Psychological reactance is an instance of the balance theories prevalent in social psychology in the 1950's and 1960's. These theories collectively assume that social behavior is best explained by taking into account the social actor's thoughts and feelings and, further, that a state of balance or harmony among these thoughts and feelings is desirable. In cases of disequilibrium, efforts follow to restore balance. Psychological reactance thus is a motivating force behind the restoration of cognitive balance in the particular case where cognitive disequilibrium has resulted from threat to a perceived freedom.

Although most of the cognitive balance theories from the 1950's and 1960's have been abandoned, psychological reactance theory has not. Jack Brehm and his co-workers have continued to investigate the nuances of the theory in the laboratory, to apply the theory to a variety of phenomena, and to modify it as appropriate. One such modification is a central concern of the present volume: the melding of reactance theory with contemporary accounts of perceived control, such as the learned helplessness model.

Psychological Reactance is divided into five sections. In the first, the basic theory and its accompanying research are described, at times in too much detail. To some readers, this detail may prove a bit overwhelming, since Brehm and Brehm provide few guidelines with which to separate the forests from the trees, or even from the leaves. This reviewer wished that space had been devoted instead to questions about the role of language and culture in determining not just the details of the reactance process but also the phenomenon itself. Also, another basic question—which mode of freedom restoration is attempted in a given situation—receives only scant attention. Finally, although the basic research described in the section relies largely on laboratory experiments with subjects who are college students, an approach to research that is subject to legitimate criticism on a variety of grounds, Brehm and Brehm acknowledge few potential limitations to the approach.

Much more satisfying to read are the subsequent sections of the volume, in which psychological reactance is related to topics in many branches of psychology. More specifically, psychological reactance is implicated in such behaviors as attitude change, social relationships, decision-making, impression management, product preference, child development, the solution of social problems like littering and pollution, and response to psychotherapy.

Although most social psychological theories are highly limited with respect to the behaviors to which they might apply, psychological reactance theory is strikingly general, with even greater expansion likely in the future. The fertility of the theory in no small way is due to the ability of Brehm and Brehm, and their colleagues, to see the significance of reactance concepts above and beyond specific paradigms and operations. Virtually all social psychologists recommend an interplay between basic and applied research, but few actually conduct such integrated investigations. The success of Brehm and Brehm at pursuing reactance theory on several empirical fronts might inspire other researchers to similar efforts.

The next-to-last chapter of the book discusses freedom, reactance, and control. The discussion is of necessity preliminary, but it may prove to be the most valuable contribution of the volume. Though theories of perceived control have proliferated of late, they tend to be discussed in isolation from each other as well as from the "mainstream" of the discipline. Brehm and Brehm take steps toward presenting a coherent view of perceived control and relating the view to reactance theory (and to the rest of social psychology). One suspects that more than a few lines of future social psychological research will trace their genesis to this particular chapter.

In sum, *Psychological Reactance* is a book worthy of attention on two levels. First, it is a substantive contribution that goes beyond a simple review of the literature. The topics to which Brehm and Brehm apply reactance theory are important and diverse, and the volume provides a perspective on these applications that points the way for further applications. Second, the book is an example of what social psychological theory and research can be. Those outside the field, and particularly those within the field, might do well to study this example of the benefits that result from sustained and intelligent attention to a given topic.

CHRISTOPHER PETERSON
Department of Psychology, Virginia Polytechnic Institute and State University, Blacksburg 24061

The Use of Nitrogen by Plants

Genetic Engineering of Symbiotic Nitrogen Fixation and Conservation of Fixed Nitrogen. Proceedings of a symposium, Lake Tahoe, Calif., June 1980. J. M. LYONS, R. C. VALENTINE, D. A. PHILLIPS, D. W. RAINS, and R. C. HUFFAKER, Eds. Plenum, New York, 1981. xiv, 698 pp., illus., $69.50. Basic Life Sciences, vol. 17.

This is the proceedings of a symposium on enhancing biological production of ammonia from atmospheric nitrogen and soil nitrate. Perhaps "genetic engineering" was added in the hope that the words that once sold shares will now attract readers. There is in fact little of genetic engineering here. The 50 papers

cover a wide variety of topics related to the use of nitrogen by plants.

Traditional genetics and plant breeding have seldom been applied to increasing symbiotic N_2 fixation. Two papers by G. H. Heichel and D. K. Barnes and their co-workers decribe and evaluate a breeding program to enhance fixation by alfalfa. These scientists demonstrated that genetic differences for fixation do exist in alfalfa lines. Plant traits, including nodule mass, shoot dry weight, and fibrous roots, were positively correlated with nitrogen-fixing ability. Though it is obvious that many plant genes are involved in the symbiosis, significant increases in fixation were achieved after only a few generations of selection. It was important to test selections in the field, with appropriate rhizobial inoculant. This research demonstrates the potential for increasing N_2 fixation in agriculture. The authors recommend a similar collaboration of breeders, microbiologists, and plant physiologists for each major legume crop.

Symbiotic fixation is not "free fertilizer," and several papers deal with the energetics of N_2 fixation. There is some evidence that symbiotic fixation by legumes requires more energy than utilization of soil nitrate. It has been difficult till now, however, to estimate the metabolic cost of nodule formation and maintenance, or the cost of *p*H control during assimilation of nitrate. D. K. McDermitt and R. S. Loomis propose a novel method of determining, on the basis of the elemental composition of a legume and its growth yield, the cost of growth on different nitrogen sources.

The nitrogen-fixing enzyme nitrogenase reduces protons to H_2. This contributes to the energy cost of fixation if H_2 escapes the nodule. Some strains of *Rhizobium* have an uptake hydrogenase (Hup), which may permit a partial recovery of the energy lost in H_2 formation. A survey of soybean nodules from every soybean-producing area in the United States indicated that 75 percent were infected by rhizobial strains lacking the enzyme (Hup^-). It is remarkable that the *R. japonicum* strains in most commercial inoculants for soybean are similarly Hup^-. The gene for Hup is carried on a rhizobial plasmid, so it should eventually be possible to incorporate hydrogen uptake activity into efficient strains adapted for each region.

Denitrification is the process whereby some soil bacteria convert nitrate to N_2 or volatile nitrogen oxides. Up to one half of added nitrate fertilizer may be lost to the atmosphere in this way. Many of the bacterial species involved do not grow well in vitro, and the assays for some enzymes are difficult. Only a handful of scientists have persisted in studying this subject. Despite the major role of denitrification in decreasing soil fertility, the study of it is generally underfunded and unrecognized. For the nonspecialist, the 100 pages here provide a very good introduction to the topic.

Much of the research presented in the book has appeared in journals. Most of the papers are too short to adequately review their topics. Of little value as a reference book, this work may inform the casual browser.

T. LaRue
Boyce Thompson Institute for Plant Research, Ithaca, New York 14853

Paleobotany

Geobotany II. Proceedings of a conference, Bowling Green, Ohio, March 1980. Robert C. Romans, Ed. Plenum, New York, 1981. viii, 264 pp., illus. $39.50.

Geobotany II includes papers presented at the 1980 geobotany conference. (An earlier conference yielded *Geobotany*.) It includes all the papers presented, except for those by M. B. Davis, J. A. Doyle, and A. H. Knoll, for which only abstracts are included. (Doyle and Davis have presented similar ideas elsewhere, but Knoll's abstract on the paleoecology of Pre-Cambrian "microbes" is a bit frustrating—one would like much more. What business has an abstract—by nature an evanescent thing—in a book?)

The papers are mostly in the general area of paleobotany-paleopalynology. There is one ecological study (R. W. Dexter) of plant succession of a disturbed area at Cape Ann, Massachusetts, which really does seem out of place next to papers on the cupule organization of the earliest seed plants (L. C. Matten and W. S. Lacey) and the anatomy of two Paleogene woods (W. H. Blackwell *et al.*), though not so far out of line with a study of environmental changes in time, shown by "peat petrology" in South Florida (P. R. Kremer and W. Spackman), and one on the postglacial history of prairie fens and bog fens in Ohio (R. L. Stuckey and G. L. Denny). A number of the papers are pollen-analysis–based studies of Pleistocene and Holocene sections in various parts of North America (papers by R. E. Bailey and P. J. Ahearn; J. Terasmae; J. F. P. Cotter and G. H. Crowl; W. J. Merry; P. A. Delcourt and H. R. Delcourt). These are conventional pollen-analysis studies, but an editorial novelty is introduced in the papers by Cotter and Crowl and Bailey and Ahearn: foldout diagrams, as well as the *same* diagrams in page size, with a note that a full-size diagram follows. Surely no journal editor would have allowed that.

The two papers that were most interesting to me were those of G. R. Upchurch, Jr., and J. A. Doyle on the paleoecology of two Cretaceous conifers, *Frenelopsis* and *Pseudofrenelopsis*, that produced *Corollina* (*Classopollis*) pollen, showing that the two conifer genera had quite different ecological requirements; and a fascinating series of seven vegetation maps, 40,000 years ago to present, by Delcourt and Delcourt, based on paleobotanical-paleopalynological data. Unfortunately the maps, though very useful, are flawed and frustrating, because the shading on them is at a different scale from those in the keys and in a couple of cases even of a different pattern. I have colored mine with crayons as an aid but am still not sure I have it right. Again, a journal editor and referees would have caught this sort of thing. There are other difficulties, for example, unexplained boundary lines on maps in Stuckey and Denny. A final reason why these papers should have been submitted to ordinary journals is that there is buried on p. 213 the description by Blackwell *et al.* of a new genus (*Floroxylon*) not even mentioned in the abstract. Publication of new names in unconventional places is not uncommon but is a nomenclatural nightmare to be avoided.

Alfred Traverse
Department of Geosciences, Pennsylvania State University, University Park 16802

Peat Bogs

Peat Stratigraphy and Climatic Change. A Palaeoecological Test of the Theory of Cyclic Peat Bog Regeneration. K. E. Barber. Balkema, Rotterdam, 1981 (U.S. distributor, Merrimack Book Service, Salem, N.H.). xii, 220 pp., illus., + plates. $29.

A long-prevailing explanation for the upward growth of raised bogs involves cyclic hummock-hollow regeneration: hollows between hummocks are characterized by rapid growth of *Sphagnum* species, whereas the dry hummocks are relatively dormant; hollows thus become hummocks, and the microtopography is reversed cyclically many times as the peat accumulates. This book, an outgrowth of a University of Lancaster dis-