DISCRIMINATIVE CONTROL OVER PLIANCE OF HUMAN OPERANT BEHAVIOR

BY

TERRI L. OTTO

A Thesis
Submitted to the Faculty of Graduate Studies
in Partial Fulfillment of the Requirements
for the Degree of

MASTER OF ARTS

Department of Psychology
University of Manitoba
Winnipeg, Manitoba

ISBN 0-612-16224-9

Name _____

Dissertation Abstracts International is arranged by broad, general subject categories. Please select the one subject which most nearly describes the content of your dissertation. Enter the corresponding four-digit code in the spaces provided.

Behavioral Psychology
SUBJECT TERM

0384 U·M·I
SUBJECT CODE

Subject Categories

THE HUMANITIES AND SOCIAL SCIENCES

COMMUNICATIONS AND THE ARTS
Architecture 0729
Art History 0377
Cinema 0900
Dance 0378
Fine Arts 0357
Information Science 0723
Journalism 0391
Library Science 0399
Mass Communications 0708
Music 0413
Speech Communication 0459
Theater 0465

EDUCATION
General 0515
Administration 0514
Adult and Continuing 0516
Agricultural 0517
Art 0273
Bilingual and Multicultural 0282
Business 0688
Community College 0275
Curriculum and Instruction 0727
Early Childhood 0518
Elementary 0524
Finance 0277
Guidance and Counseling 0519
Health 0680
Higher 0745
History of 0520
Home Economics 0278
Industrial 0521
Language and Literature 0279
Mathematics 0280
Music 0522
Philosophy of 0998
Physical 0523
Psychology 0525
Reading 0535
Religious 0527
Sciences 0714
Secondary 0533
Social Sciences 0534
Sociology of 0340
Special 0529
Teacher Training 0530
Technology 0710
Tests and Measurements 0288
Vocational 0747

LANGUAGE, LITERATURE AND LINGUISTICS
Language
- General 0679
- Ancient 0289
- Linguistics 0290
- Modern 0291

Literature
- General 0401
- Classical 0294
- Comparative 0295
- Medieval 0297
- Modern 0298
- African 0316
- American 0591
- Asian 0305
- Canadian (English) 0352
- Canadian (French) 0355
- English 0593
- Germanic 0311
- Latin American 0312
- Middle Eastern 0315
- Romance 0313
- Slavic and East European 0314

PHILOSOPHY, RELIGION AND THEOLOGY
Philosophy 0422
Religion
- General 0318
- Biblical Studies 0321
- Clergy 0319
- History of 0320
- Philosophy of 0322

Theology 0469

SOCIAL SCIENCES
American Studies 0323
Anthropology
- Archaeology 0324
- Cultural 0326
- Physical 0327

Business Administration
- General 0310
- Accounting 0272
- Banking 0770
- Management 0454
- Marketing 0338

Canadian Studies 0385
Economics
- General 0501
- Agricultural 0503
- Commerce-Business 0505
- Finance 0508
- History 0509
- Labor 0510
- Theory 0511

Folklore 0358
Geography 0366
Gerontology 0351
History
- General 0578
- Ancient 0579
- Medieval 0581
- Modern 0582
- Black 0328
- African 0331
- Asia, Australia and Oceania 0332
- Canadian 0334
- European 0335
- Latin American 0336
- Middle Eastern 0333
- United States 0337

History of Science 0585
Law 0398
Political Science
- General 0615
- International Law and Relations 0616
- Public Administration 0617

Recreation 0814
Social Work 0452
Sociology
- General 0626
- Criminology and Penology 0627
- Demography 0938
- Ethnic and Racial Studies 0631
- Individual and Family Studies 0628
- Industrial and Labor Relations 0629
- Public and Social Welfare 0630
- Social Structure and Development 0700
- Theory and Methods 0344

Transportation 0709
Urban and Regional Planning 0999
Women's Studies 0453

THE SCIENCES AND ENGINEERING

BIOLOGICAL SCIENCES
Agriculture
- General 0473
- Agronomy 0285
- Animal Culture and Nutrition 0475
- Animal Pathology 0476
- Food Science and Technology 0359
- Forestry and Wildlife 0478
- Plant Culture 0479
- Plant Pathology 0480
- Plant Physiology 0817
- Range Management 0777
- Wood Technology 0746

Biology
- General 0306
- Anatomy 0287
- Biostatistics 0308
- Botany 0309
- Cell 0379
- Ecology 0329
- Entomology 0353
- Genetics 0369
- Limnology 0793
- Microbiology 0410
- Molecular 0307
- Neuroscience 0317
- Oceanography 0416
- Physiology 0433
- Radiation 0821
- Veterinary Science 0778
- Zoology 0472

Biophysics
- General 0786
- Medical 0760

EARTH SCIENCES
Biogeochemistry 0425
Geochemistry 0996
Geodesy 0370
Geology 0372
Geophysics 0373
Hydrology 0388
Mineralogy 0411
Paleobotany 0345
Paleoecology 0426
Paleontology 0418
Paleozoology 0985
Palynology 0427
Physical Geography 0368
Physical Oceanography 0415

HEALTH AND ENVIRONMENTAL SCIENCES
Environmental Sciences 0768
Health Sciences
- General 0566
- Audiology 0300
- Chemotherapy 0992
- Dentistry 0567
- Education 0350
- Hospital Management 0769
- Human Development 0758
- Immunology 0982
- Medicine and Surgery 0564
- Mental Health 0347
- Nursing 0569
- Nutrition 0570
- Obstetrics and Gynecology 0380
- Occupational Health and Therapy 0354
- Ophthalmology 0381
- Pathology 0571
- Pharmacology 0419
- Pharmacy 0572
- Physical Therapy 0382
- Public Health 0573
- Radiology 0574
- Recreation 0575
- Speech Pathology 0460
- Toxicology 0383

Home Economics 0386

PHYSICAL SCIENCES
Pure Sciences
Chemistry
- General 0485
- Agricultural 0749
- Analytical 0486
- Biochemistry 0487
- Inorganic 0488
- Nuclear 0738
- Organic 0490
- Pharmaceutical 0491
- Physical 0494
- Polymer 0495
- Radiation 0754

Mathematics 0405
Physics
- General 0605
- Acoustics 0986
- Astronomy and Astrophysics 0606
- Atmospheric Science 0608
- Atomic 0748
- Electronics and Electricity 0607
- Elementary Particles and High Energy 0798
- Fluid and Plasma 0759
- Molecular 0609
- Nuclear 0610
- Optics 0752
- Radiation 0756
- Solid State 0611

Statistics 0463

Applied Sciences
Applied Mechanics 0346
Computer Science 0984
Engineering
- General 0537
- Aerospace 0538
- Agricultural 0539
- Automotive 0540
- Biomedical 0541
- Chemical 0542
- Civil 0543
- Electronics and Electrical 0544
- Heat and Thermodynamics 0348
- Hydraulic 0545
- Industrial 0546
- Marine 0547
- Materials Science 0794
- Mechanical 0548
- Metallurgy 0743
- Mining 0551
- Nuclear 0552
- Packaging 0549
- Petroleum 0765
- Sanitary and Municipal 0554
- System Science 0790

Geotechnology 0428
Operations Research 0796
Plastics Technology 0795
Textile Technology 0994

PSYCHOLOGY
General 0621
Behavioral 0384
Clinical 0622
Developmental 0620
Experimental 0623
Industrial 0624
Personality 0625
Physiological 0989
Psychobiology 0349
Psychometrics 0632
Social 0451

DISCRIMINATIVE CONTROL OVER PLIANCE OF HUMAN OPERANT BEHAVIOR

BY

TERRI L. OTTO

A Thesis submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

MASTER OF ARTS

Abstract

Undergraduates were presented via microcomputer with a task requiring button pressing to move a marker from top left to bottom right of a 5 X 5 matrix of squares under a multiple fixed-ratio (FR) 18/differential-reinforcement-of-low-rates (DRL) 6-s schedule. "Go Fast" and "Go Slow" instructions specified response rates that were consistent with or opposed to, the operative schedule of reinforcement. Experiment 1 revealed that despite the imposition of social contingencies for point acquisition, and an increased payoff for doing so, participants remained "pliant" to instructions. In Experiment 2 pliant participants were exposed to schedule relevant stimuli in the absence of response-rate instructions. Participants given exposure to points only remained pliant when tested under original conditions; participants exposed also to schedule discriminative stimuli (S^Ds) did not. The results implicate discriminative stimuli as key to experimental analysis of instructional control.

Discriminative Control over Pliance of Human Operant Behavior

A number of studies have examined human performance on traditional schedules of reinforcement. These schedules include fixed interval (FI) (Weiner, 1962, 1964, 1969), variable interval (VI) (Bradshaw, Szabadi, & Bevan, 1976), fixed ratio (FR) (Weiner, 1967), variable ratio (VR) (Orlando & Bijou, 1960), differential-reinforcement-of-low-rate (DRL) (Bruner & Revusky, 1961), and extinction (EXT) (Bijou, 1958, Weiner, 1970). In many of these studies, human and infrahuman performances have differed. For example, human and infrahuman FI performances are often discrepant: Infrahumans generally exhibit a "scalloped" pattern of responding, characterized by a post-reinforcement pause followed by a gradual acceleration in response rate until delivery of the next reinforcer (Ferster & Skinner, 1957; Lowe & Harzem, 1977; Lowe, Harzem, & Bagshaw, 1978). Humans, in contrast, generally exhibit either a very low (Baron, Kaufman & Stauber, 1969; Matthews, Shimoff, Catania, & Sagvolden, 1977; Weiner, 1964, 1969) or a very high (Lippman & Meyer, 1967; Weiner, 1964, 1965, 1969) rate per each available reinforcer.

A second major difference between human and infrahuman operant behavior is that human performance, in comparison with infrahuman performance, may be insensitive to changes in the schedule contingencies, i.e., human responding may not change when the schedule of reinforcement is altered (Cerutti, 1991; Harzem, Lowe, & Bagshaw, 1978; Hayes, Brownstein,

Zettle, Rosenfarb & Korn, 1986; Matthews et al., 1977; Shimoff, Catania, & Matthews, 1981).

A number of variables have been posited to account for these discrepancies between human and infrahuman schedule performances. For example, variables such as conditioning history (Weiner, 1964, 1969), response cost (Weiner, 1962), the nature of the response (Harzem et al., 1978), and the nature of the reinforcer (Buskist, Miller, & Bennet, 1980) have been explored. Verbal behavior, however, has been the variable most widely implicated and investigated (Baron & Galizio, 1983; Harzem et al., 1978; Lippman & Meyer, 1967; Lowe, Beasty, & Bentall, 1983; Skinner, 1969). This latter body of research has been driven by Skinner's (1969) distinction between contingency-shaped behavior (i.e., behavior acquired through direct exposure to contingencies of reinforcement), and rule-governed behavior (i.e., behavior controlled by the "contingency-specifying stimuli" that establish behavior through existing verbal repertoires). As illustrations, Skinner contrasted the contingency-shaped behavior of an outfielder moving to catch a baseball from the rule-governed behavior of a ship captain moving to catch a satellite (Skinner, 1969, p. 146). In the former case, the behavior is controlled primarily by the outfielder's prior experience with the effects of movements on the consequence of catching the ball. The ship captain's behavior, on the other hand, is controlled primarily by verbal rules specifying trajectories, wind speeds, and drag coefficients, rather than by the direct consequences of trying to catch satellites.

A number of studies provide evidence that verbal rules, whether provided in the form of externally-generated instructions (Baron, et al., 1969; Buskist & Miller, 1986; Catania, Shimoff, & Matthews, 1982; Cerutti, 1991; Torgrud & Holborn, 1990) or instructions generated by the participant (Harzem, et al., 1978; Matthews, Catania, & Shimoff, 1985; Rosenfarb, Newland, Brannon, & Howey, 1992), can control human schedule performance. Shimoff, et al. (1981), for example, demonstrated that participants who acquired a low rate of key-pressing through instructions were insensitive to changing schedule contingencies. In contrast, those who were reinforced for emitting successively closer approximations to low-rate key-pressing (i.e., were shaped), were not insensitive to the changes in contingencies. Insensitivity is also obtained when subjects respond in accordance with rules that they have generated themselves. Catania, et al. (1982), for example, shaped participants' verbal performance descriptions by differentially reinforcing sentence completions describing the appropriate way to perform (e.g., "press fast" or "press slow") on a multiple, alternating VI/VR schedule. They found that even when verbal descriptions opposed the schedule contingencies (i.e., by following instructions, participants' would lose reinforcers on the operative schedule of reinforcement), pressing rates always conformed to these verbal descriptions (i.e., response rate was schedule insensitive).

In explaining the impact of verbal stimuli on human behavior, Zettle and Hayes (1982) distinguished three classes of rule-governed behavior: tracking, augmenting and pliance. Pliance, may be particularly relevant to studies of

human schedule performance (Hayes, Brownstein, Haas, & Greenway, 1986; Hayes, Brownstein, Zettle, et al., 1986). According to Zettle and Hayes (1982), pliance is rule following under the control of a history of socially-mediated consequences for a correspondence between the rule and relevant behavior. Applying this concept to studies wherein schedule contingencies oppose the verbal rules or instructions (i.e., fewer reinforcers are earned for following instructions), the instructional compliance observed (Catania et al., 1982, Shimoff, Matthews, & Catania, 1986) may be a function of a history of social reinforcement for rule-following. This social reinforcement successfully competes with the programmed schedule contingencies. One consequence of pliance, then, may be the production of instruction-controlled behavior that is insensitive to scheduled contingencies of reinforcement.

Hayes, Brownstein, Zettle, et al., (1986) investigated the phenomenon of pliance in this context. These researchers employed a task in which participants' button presses moved a lighted square from the top left corner to the bottom right corner of a light matrix. Movement through the matrix was reinforced by the acquisition of points exchangeable for chances on money prizes. The operation of pliance was most clearly revealed in the responding of participants in Hayes, Brownstein, Zettle, et al.'s Go Fast/Go Slow-condition of Experiment 2. In this condition, a multiple FR 18/DRL 6 s schedule was presented with each component operative for eight 2-min intervals for all three phases. During the first phase response-rate instructions prompting participants to either "Go Fast" or "Go Slow" were alternated every 1 min. This preparation produced

instructions that were accurate only half of the time for each 2 min component of the multiple schedule. Thus, instructions specified response rates that would facilitate the movement of the light, and the acquisition of points, during only 50% of the phase (i.e., "Go Fast" for the FR schedule and "Go Slow" for the DRL schedule). Instructions specified rates that would impede light movement and point acquisition during the other 50% of the phase (i.e., "Go Fast" for the DRL schedule and "Go Slow" for the FR schedule).

Despite the intermittent accuracy of the instructions, response rate was controlled by the instructional stimuli throughout phase 1. Instructions were followed even when the specified rates produced very few light movements (i.e., when instructions specified "Go Fast" on the DRL schedule and "Go Slow" on the FR schedule). An explanation of instructional control in terms of not discriminating the inaccuracy of the rules seemed insufficient to explain these data because participants earned points on both schedules during the time when the response-rate instructions were accurate (i.e., "Go Fast" for the FR schedule and "Go Slow" for the DRL schedule) (Hayes, Brownstein, Zettle, et al., 1986). The authors concluded, therefore, that social contingencies for rule-following produced the observed instructional control. In other words, participants exhibited pliance, as previously defined.

In subsequent phases the instruction lights were terminated. Hayes, Brownstein, Zettle, et al. (1986) indicate that failure to discriminate the inaccuracy of the instructions in the first phase does not explain pliance because participants "immediately" came under control of the schedule

components. Hayes, Brownstein, Zettle, et al. attribute the immediacy of this change to control by the point contingency, that was established in phase 1. According to Hayes, Brownstein, Zettle, et al., the effect of the instruction lights may have masked control by the points; thus, the point contingency immediately controlled performance in phase 2 when the instruction lights were discontinued. It is difficult to determine how quickly participants "immediately" responded schedule-appropriately once instructions lights were terminated, however, because rate of responding is displayed graphically in 2 min intervals (i.e., response frequency is totalled over a two minute period). Once instruction lights were terminated, it would not take long for participants to sample response rates already in their repertoire and to receive feedback from point consequences concerning these response rates.

An alternative interpretation is that the provision of instructions blocked the development of discriminative control by features of the reinforcement schedules. This interference may be analogous to that demonstrated in the literature on operant blocking (e.g., Vom Saal & Jenkins, 1970), where one pair of well-established discriminative stimuli prevents the acquisition of control by other potential discriminative stimuli with which they are simultaneously presented. In the Hayes, Brownstein, Zettle, et al. (1986) study, it is possible that instructional stimuli, being well-established discriminative stimuli, interfered with control by the features of the schedule, such as the points or the schedule-discriminative stimuli (S^Ds). According to this interpretation, participants were indeed pliant in the first phase, but were not aware that the instructions were

inaccurate. Rather, the presence of instructional stimuli with established controlling relations to behavior interfered with the discrimination of the schedule contingencies and the changes therein. The observation that participants came under immediate control of the schedules once the instructions were terminated does not discredit this interpretation: The "Go Fast" and "Go Slow" instructions of phase 1 established the repertoires of high and low rate responding necessary to facilitate contact with the schedules once the instructions were removed. Thus, the continued operation of the schedules through the provision of reinforcer points may have allowed participants to rapidly determine the appropriate response rate.

If Hayes, Brownstein, Zettle, et al.'s (1986) interpretation is correct, and participants did discriminate the intermittent inaccuracy of the response-rate instructions, certain predictions could be derived regarding the expected effects of subsequent stimulus manipulations on the behaviors of pliant participants. One prediction was that increases in the magnitude of the reinforcer might undermine pliance. According to Cerutti, (1989), consequences for compliance (e.g., socially-mediated consequences) can be overridden when the magnitude of the collateral consequences is strengthened relative to the magnitude of consequences for compliance.

A second prediction was that conveying to pliant participants the importance of earning as many points as they could, also might undermine pliance. These supplementary instructions involve additional social contingencies on point accumulation that could compete successfully with those

originally established for following response-rate instructions. The combination of these manipulations was expected to undermine pliance to a greater degree than either manipulation alone.

Under the operant blocking interpretation, by contrast, neither of these manipulations should undermine pliance because neither an increase in reinforcer magnitude nor the supplementary instructions to earn points should change the behavior of participants who did not discriminate the inaccuracy of the instructions and, therefore, speaking colloquially, believed, they were already earning as many points as possible.

The proposed study tested these predictions, and thus the two aforementioned interpretations of pliance, in the following way. Participants were exposed to a phase 1 similar to that employed by Hayes, Brownstein, Zettle, et al. (1986) in the Go Fast/Go Slow- Signalled One Session condition. Pliant participants were then assigned to one of four groups in a 2 X 2 independent-groups factorial design, with two levels of each independent variable. The independent variables manipulated were reinforcer magnitude and supplementary instructions. Reinforcer magnitude was manipulated by varying the presence versus absence of backup reinforcers for which points were exchanged. Half of the participants did not receive any backup reinforcers for accumulated points (low reinforcer magnitude [LRM] condition); the other half received backup reinforcers for points (high reinforcer magnitude [HRM] condition). Backup reinforcers consisted of chances on money prizes (lottery tickets) and the opportunity for early release from the experiment. Money or

lottery tickets are frequently used in human operant experiments as backup reinforcers (e.g., Cerutti, 1991; Torgrud & Holborn, 1990). In many cultures, including our own, money is a generalized reinforcer (e.g., Sulzer & Mayer, 1972) for almost every adult in that it is exchangeable for a wide range of back-up reinforcers. In addition, money is reinforcing irrespective of the number of dollars received in the immediate past (e.g., Sulzer & Mayer, 1972). As an additional backup reinforcer, early release from the experiment was made available. Free-time has been effectively employed to reinforce a variety of behaviors in a number of educational settings (Serna & Grayson, 1993). In my study, the use of early release from the experiment was expected to have comparable reinforcing effects.

The second independent variable, supplementary instructions, was manipulated in the following way. Within each of the reinforcement conditions, half of the participants were orally instructed to earn as many points as possible, such instruction being incompatible with the response-rate instruction (Competing Instruction [Competing] condition). The other half of the participants were orally instructed to comply with the "Go Fast" or "Go Slow" response-rate instructions presented by the computer (Congruent Instruction [Congruent] condition). Consequently, additional social contingencies existed for both conditions; it was simply a matter of whether the associated instructions were designed to maintain or to undermine pliance.

Experiment 1

Method

Participants

One hundred and thiry-two University of Manitoba undergraduate Psychology students participated in this experiment, as an option in satisfying Introductory Psychology course requirements. Participants were required to have English as a first language, so that instructions would be better understood. No attempt was made to assess the participants' knowledge of operant behavior and related topics, even though different Introductory Psychology instructors may cover the area of operant behavior at different times and may not give the same emphasis to the area. Previous findings (Catania et al., 1982) suggest that an attempt to do so may affect the participants' subsequent behavior within the session.

Apparatus

The study took place in the microcomputer laboratory in the Department of Psychology. The 7.7 X 15.2 m room contains 7 rows of 486 AT Clone computers with seven units in each row. Up to 10 units were used concurrently. The computers were programmed to control all reinforcement schedules; present rate of pressing instructions, the matrix and the S^Ds; dispense reinforcer points; and record all data. Modified keyboards were used by the participants, consisting of right and left shift keys labelled with a blue marker. Presses on these keys moved a cursor through the matrix in order to earn points. A white label with "Earn" written thereon was placed on the "enter" key. Once the cursor

had been moved from the top left to the lower right corner of the matrix, pressing the earn key advanced the point counter and reset the cursor to the upper left corner, so that the matrix again could be traversed.

Design

Phase 1. In the first phase all participants were exposed to a multiple DRL 6-s/FR 18 schedule. The order of the multiple schedule was as follows: FR, DRL, FR, DRL, FR, DRL, FR, DRL, FR. The schedules were each operative for a total of 8 min. Each component of the multiple schedule was in effect for a 2 min interval, with the exception of the first and last FR schedules which both consisted of 1 min presentations. "Go Fast" and "Go Slow" appeared on the computer screen in the upper right corner. Green and red instruction lights appeared adjacent to the "Go Fast" and "Go Slow" instructions, respectively, alternating every 1 min. Consequently, the first 2 min of response-rate instructions were concordant with the schedule in effect (i.e., FR-"Go Fast", DRL-"Go Slow"). Therefore compliance with response-rate instructions was reinforced at the outset of the phase. In addition, the last two minutes of the phase consisted of opposing schedule-instructional pairings (i.e., DRL-"Go Fast", FR-"Go Slow"). These last two preparations were used to determine whether participants met the pliance criterion: pressing at least 2 times faster in the last 1 min presentation of the "Go Fast" DRL than in the last 1 min presentation of the "Go Slow" FR.

The dependent measure was the mean response rate of participants for each 1 min schedule-instruction pairing. Only participants who met the pliance criterion were exposed to the second phase of the experiment.

Phase 2. In the second phase a 2 X 2 factorial design was employed, with back-up reinforcers and supplementary instructions both manipulated between-groups. Participants experienced the same schedule-instructional pairings as in Phase 1. The reinforcer variable consisted of two levels. One level involved the delivery of points only (LRM condition). The other level involved backup reinforcers for points earned (HRM condition). In this condition, points were exchangeable for chances on money prizes and the opportunity to complete the experiment in a shorter period of time. The supplementary instructional variable also involved two levels. Participants were either instructed to earn as many points as possible (Competing condition), or to follow the programmed response-rate instructions (Congruent condition). The dependent variable was as above.

Groups

Each group consisted of 25 participants.

HRM-Competing. Participants were given instructions that points earned were worth chances on money prizes. In addition, participants were informed that as soon as they earned the maximum number of points available, they would be released from the experiment. Participants were also told to try to earn as many points as possible.

HRM-Congruent. Participants were given the same instructions concerning the reinforcing consequences of the points as given in HRM-Competing group. However, instead of receiving instructions to earn as many points as possible, participants in this group were told that it was important for them to press fast when the instructions to "Go Fast" appeared and slowly when the instructions to "Go Slow" appeared.

LRM-Competing. Participants in this group did not receive backup reinforcers for points earned. However, they were instructed to try to earn as many points as possible.

LRM-Congruent. LRM-Congruent participants did not receive backup reinforcers for points earned. These participants were given the same instructions about pressing rate as given to participants in HRM-Congruent group.

Procedure

During both the first and second phases, a 5 X 5 matrix, 7.5 cm^2 appeared in the top left corner of the computer screen. The DRL and FR schedules were presented, together with the S^Ds (yellow rectangle and blue square). When the DRL schedule was in effect, the yellow rectangle would appear and when the FR schedule was in effect the blue square would appear, below and to the right of centre of the matrix. The instructions "Go Fast" and "Go Slow" were displayed on the screen in the upper right corner. Alternating every 1 min, a green light appeared adjacent to the "Go Fast" instruction or a red light appeared adjacent to the "Go Slow" instruction. Presses on the right or

left shift keys moved the cursor through the matrix, from the top left corner to the lower right corner. Points were provided contingent upon moving the cursor through the matrix. When the matrix had been traversed and the cursor moved into the lower right square of the matrix, a yellow "advance counter" light appeared in the lower left corner, halfway between the bottom of the screen and the matrix. Pressing the earn key advanced the point counter one point and reset the cursor to the top left corner so that the matrix again could be traversed. The point counter was located directly below the left corner of the matrix. Points, as earned, appeared as a cumulative total throughout each phase.

At the beginning of each phase a flashing cursor appeared in the upper left corner of the matrix. Points were earned for moving the cursor from the top left corner to the lower right corner of the matrix, using any path the participant chose. To move the cursor, presses on the left and right shift keys were required. When the DRL component was in effect, the first shift key press after 6 s had elapsed moved the cursor. If either of the shift keys was pressed before 6 s had elapsed, the timer would be reset and another 6 s period was required to elapse before a response would move the cursor. When the FR schedule was in effect, the cursor would move after 18 presses had occurred on either shift key. The right and left shift keys moved the cursor right and down, respectively. If, during the FR schedule, the 18th response was on the right shift key, the cursor advanced one space to the right; if it was on the left shift key, the cursor moved one space down. Similarly, when the DRL schedule was in effect, if either the

right shift key or left shift key was pressed after a period of six seconds had passed, the cursor was moved to the right or down, respectively. If the cursor was in the right hand column in the matrix, presses on the right shift key would cause the cursor to reset in the upper left corner. If the cursor was in the bottom-most row in the matrix, presses on the left shift key would also cause the cursor to reset to the upper left corner.

One point was earned each time the cursor was moved from the upper left corner to the lower right corner of the matrix. Once the cursor had been moved to the lower right corner, the earn key had to be pressed in order to advance the counter and reset the cursor to the upper left corner, so that participants could continue to earn points. Presses on the earn key had no programmed consequences, except when the cursor had been moved through the matrix to its lower right corner.

Task instructions. The experimenter provided instructions to the participants at the beginning of each phase. The instructions were read to the participants and a copy of the instructions was located at each computer terminal.

At the beginning of Phase 1 all participants were informed that they could earn points for moving the cursor through the matrix by pressing the left and right shift keys. Unlike the Hayes, Brownstein, Zettle et al. (1986) experiment, the points were not associated with any backup reinforcers in the first phase. This change was implemented for two reasons (a) to establish a large differential in the value of points for those groups exposed to the increased

reinforcer magnitude in Phase 2 (HRM conditions), and (b) to avoid any expectation of backup reinforcers for those groups not exposed to the increased reinforcer magnitude (LRM conditions). Participants were told to press the earn key when the yellow light appeared in the lower left corner in order to advance the counter and reset the cursor. The participants were also told that the best way to button press was fast when the green light next to the "Go Fast" instruction was lit and slowly when the red light next to the "Go Slow" instruction was lit (see Appendix A).

At the beginning of Phase 2, HRM-Competing and HRM-Congruent groups were instructed about the additional consequences for points earned. HRM-Competing and LRM-Competing groups were instructed to earn as many points as possible and HRM-Congruent and LRM-Congruent groups were instructed to follow the computer presented instructions as to response rate (see Appendix B).

If the participants asked any questions relating to the experiment or to the instructions, only relevant parts of the instructions, as written, were repeated.

Results

Approximately 75% of the participants (100 out of 132) met the pliance criterion (i.e., pressing at least 2 times faster in the last 1 min presentation of the "Go Fast" DRL than in the last 1 min presentation of the "Go Slow" FR pairings) and were tested in Phase 2 of the experiment.

The dependent measure of interest was the mean response rate for the last 8 min of each schedule-instructional pairing (DRL-"Go Fast"/FR-"Go Slow") in Phase 2 for those subjects having met the pliance criterion. The length of Phase 2 varied for subjects as a function of their group designation and performance during this phase, with a minimum and a maximum participation time of 8 min and 16 min, respectively. Therefore, the last 8 min were selected for analysis in order to keep the data comparable for all subjects. The last 8 min were selected rather than the first 8 min so that for those subjects who participated beyond the first 8 min, the data after maximum exposure to the variables was included.

Figure 1 shows the data for each of the four groups. Shape indicates schedule condition. Circles indicate responding under DRL and squares indicate responding under FR. Color indicates the operative instruction. Black symbols indicate responding during the "Go Fast" instruction and white symbols indicate responding during the "Go Slow" instruction.

All subjects were exposed to an identical phase 1 and had to meet the pliance criterion prior to being assigned to one of the four conditions. This pliance is evident in this first phase, in which subjects respond according to the instructions, regardless of the schedule in effect. Response rates are high in the presence of the "Go Fast" instruction (black symbols) and slow in the presence of the "Go Slow" instruction (white symbols).

The averaged data suggest that instructional control was maintained during phase 2 for all groups. Response rates are high in the presence of "Go

Fast" instruction (black symbols) and slower in the presence of the "Go Slow" instruction (white symbols), regardless of whether the FR component (square) or the DRL component (circle) was functioning. For three of the four groups, this maintenance occurred despite the availability of backup reinforcers for earning points and/or supplementary instructions to earn as many points as possible. In other words, the variables manipulated in phase 2 appear to have been relatively ineffective in undermining pliance. The averaged data also reveal a small difference in response rate depending on the schedule component. In the presence of each instruction, responding was more rapid during the FR components than the DRL components. Therefore, although subjects were pliant, small schedule effects were evident.

In order to test statistically for group differences in pliance, data for the last two minutes of schedule-instructional pairings were compared. These particular data points were selected because they represent conditions under which the operating schedule and instruction were opposed. That is, the instructions specified response rates that would impede the movement of the cursor through the matrix (e.g., the "Go Fast" instruction is paired with the DRL schedule and the "Go Slow" instruction is paired with the FR schedule). Because schedule contingencies opposed the instructions in these two pairings, pliance could be assessed.

A 2 X 2 independent-groups analysis of variance was conducted on these data, with two levels of supplementary instructions (Congruent and Competing) and two levels of reinforcer magnitude (LRM and HRM). An alpha

level of .05 was used for all statistical tests. The main effect of reinforcer magnitude was not statistically significant F (1, 99) = 2.00, nor was the effect of instruction F (1, 99) = 3.66. There was no statistically reliable interaction of reinforcer magnitude and instruction ($F < 1$). Apparently subjects, on average, remained pliant throughout phase 2, when competing instructions to earn points were present and when there was a high payoff for ignoring the computer-generated instructions.

Because group averages may poorly represent the performances of individual subjects, the individual subject data were analyzed using a Chi-square test. The frequency of pliant subjects was compared to the frequency of non-pliant subjects for each of the four groups. There was no statistically significant difference between groups, X^2 (3, N = 100) = 2.27. That is, there was no signficiant difference in the number of subjects in each of the four groups who remained pliant, despite the manipulation of reinforcer magnitude and instructions. Thus, the individual subject data confirm the graphical and statistical analyses of the group data.

Discussion

The insubstantial effect of both the manipulation of reinforcer magnitude and of supplementary instructions suggest that the pliance obtained in Experiment 1 may represent an effect of operant blocking. That is, the computer-generated instructions prevented the acquisition of control by the features of the reinforcement schedule (e.g., points, S^Ds). As a result, neither increasing the magnitude of backup reinforcers nor conveying the importance of

earning points changed the behavior of most participants (81 out of 100 remained pliaint). Generally speaking, the participants appear not to have discriminated the inaccuracy of the computer-generated instructions to which they were responding. Therefore, the pliance seen in Phase 1 and Phase 2 of Experiment 1 can be viewed as a product of instructional interference. If Hayes, Brownstein, Zettle et al.'s (1986) interpretation is correct and participants did discriminate the intermittent inaccuracy of the response-rate instructions, the manipulated variables should have successfully undermined pliance. The results of Experiment 1 also raise the possibility that the pliance obtained in Phase 1 of the Hayes, Brownstein, Zettle et al. (1986) experiment may also have resulted from participants failing to discriminate the intermittent inaccuracy of the instructions. However, because the conditions under which pliance was established in the present study (in the absence of back-up reinforcers) differed from those of Hayes, Brownstein, Zettle et al. (1986) study, this hypothesis awaits confirmation.

Experiment 2

Experiment 2 attempted to test this hypothesis, and provide further convergent evidence in support of an operant blocking interpretation of pliance. Pliance was established under conditions that systematically replicated Hayes, Brownstein, Zettle et al.'s (1986) first phase of the Go Fast/Go Slow-condition of Experiment 2. Subsequently, during a second phase, manipulations designed to allow the behavior of participants to come under the control of schedule-related stimuli were imposed. One group of pliant participants was exposed to the point

contingency and the lights associated with the schedule components, in the absence of response-rate instructions (S^Ds-Points Group). A second group was exposed to the point contingency alone (Points Only Group).

In order to ensure that these manipulations accomplished only their intended purposes (i.e., bringing subject behavior under control of the relevant schedule-related stimuli) without introducing additional variables (e.g., introducing additional social contingencies on point acquisition) a deception was employed during the second phase. Subjects in the Points Only Group and the S^Ds-Points Group were informed that the absence of the S^D lights and/or response-rate instructions was due to a computer malfunction. This deception allowed subjects to make the relevant schedule discriminations without communicating to subjects that the experimeter "wanted" them to earn points. A seemingly deliberate intervention might have placed additional contingencies on schedule-appropriate responding beyond those under investigation in Phase 3.

Once responding was under schedule control, either in the presence of the schedule S^Ds (S^Ds-Points Group) or in their absence (Points Only Group), the computer-generated instructions were reinstated and pliance was assessed once more. A third group (Control Group) serving as a control, was exposed to Phase 1 conditions throughout the experiment.

If Hayes, Brownstein, Zettle et al.'s (1986) interpretation is correct, and participants in their study were pliant <u>despite</u> discriminating the schedule contingencies, then the manipulations to increase schedule discrimination should have little effect on pliance. Alternatively, if the blocking interpretation has

merit, then providing the opportunity to discriminate the schedule contingencies should reduce the degree of pliance relative to the control group.

The rationale for employing both a group exposed to the lights and points (S^Ds-Points Group) and a group exposed to the points alone (Points Only Group) in phase 2 was to allow for a determination of which stimuli, when allowed to acquire control over schedule-appropriate behavior, may interfere with blocking by response rate instructions. It was hypothesized that the lights (putative S^Ds) associated with each schedule component were the critical stimuli. Thus, it was expected that establishing these stimuli as S^Ds for each schedule component (S^Ds-Points Group) would most effectively undermine the re-establishment of pliance. However, it is also possible that stimulus properties of point delivery on each schedule (e.g., point density or distribution) can come to control schedule-appropriate responding independent of S^D control. Indeed, Hayes, Brownstein, Zettle et al. (1986, p. 253) imply that this very mechanism explains the rapidity with which their subjects came under schedule control once instructions were eliminated. Since the S^Ds-Points Group of the present study is exposed to both the putative S^Ds and the points during Phase 2, the importance of the putative S^Ds alone to any observed reduction in pliance would be uncertain. The Points Only Group, therefore, was included to assess the degree to which the putative S^Ds are essential to the operant blocking analysis of pliance.

Method

Participants

Participants were 155 University of Manitoba Psychology undergraduates selected in the same manner as for Experiment 1.

Apparatus

The apparatus and setting were the same as in Experiment 1.

Design

Each group consisted of 32 participants. The participants were randomly assigned to one of three groups (S^Ds-Points Group, Points Only Group, Control Group). All participants were exposed to the same first and third phases. The second phase differed for all groups.

Phase 1. This phase was similar to Phase 1 of Experiment 1, with the following exceptions. The schedules were each operative for a total of 6 min. The order of the schedules was as follows: FR, DRL, FR, DRL, FR, DRL, FR, with each component in effect for a 2 min interval, with the exception of the first and last FR schedules which both consisted of 1 min intervals. As in Experiment 1, the last 2 min consisted of opposing schedule-instructional pairings. These last two pairings were used to assess the degree of pliance. Only those participants who met the pliance criterion (pressing at least 2 times faster in the last 1 min presentation of "Go Fast" DRL than in the last 1 min presentation of "Go Slow" FR) were included in the second phase of the experiment.

Phase 2. For the Control Group the second phase was identical to Phase 1. For the other two groups, S^Ds-Points Group and Points Only Group, the lights

signalling "Go Fast" or "Go Slow" were suppressed. The putative S^Ds (i.e., yellow rectangle and blue square) were also suppressed in the Points Only Group.

The schedule components were each in effect for a total of 6 min. Each component was alternated every 1 min as opposed to every 2 min. This change was implemented for a number of reasons. First, by alternating the schedules every 1 min, participants would be exposed to each component 6 times during the phase. It was anticipated that repeated exposure to the schedule components would enhance the likelihood of participants coming under control of the schedule-signalling stimuli. Second, by alternating the schedules every 1 min, the last 2 min of the phase could be used for analysis, keeping the data selected for analysis comparable in all phases. Third, a schedule-control criterion was established, requiring a response rate of at least 2 times faster during the last 1 min presentation of the FR component than during the last 1 min presentation of the DRL component. By alternating the schedule components every minute, the data used to assess schedule-control would come from the last two minutes of the phase, comparable to the data used when assessing pliance in the first phase.

There was no apparent phase break between Phases 1 and 2, except in the data. In the S^Ds-Points Group and Points Only Group where the second phase was altered by suppression of the S^Ds and/or the response-rate lights, these stimuli suddenly disappeared from the computer screens without any changes in the points accumulated or location of the cursor in the matrix. Participants in these groups were given the instructions that the termination of

these lights was a result of a computer programming failure, to continue on with the experiment, and do the best that they could. Before beginning the third phase, participants in these groups were again told that the lights disappeared as a result of a programming problem. They were also told that the lights had been reset for the next phase of the experiment. Paragraphs 4 and 5 of the instructions (see Appendix C) were re-read to all groups. Only the data for those participants in the Points Only Group and the S^Ds-Points Group who met the schedule-control criteria were included in Phase 3.

Phase 3. Phase 3 was equivalent for all groups and replicated the first phase of the current experiment. Points were reset to zero at the beginning of this phase. In order to assess group differences in pliance, the last two minutes of the opposing schedule-instructional pairings were compared.

Task instructions. The experimenter provided instructions to the participants at the beginning of Phase 1 (Appendix C). The instructions were read to the participants and a copy of the instructions was located at each computer terminal.

At the beginning of Phase 1 all subjects were informed that they could earn points for moving the cursor through the matrix by pressing the left and right shift keys. They were told that the participants with the most points would have a chance to win one of the three money prizes, and to try to earn as many points as they could. They were instructed to press the earn key when the yellow light appeared in the lower left corner, to advance the counter and reset the cursor. The participants were also told that the best way to button press

was fast when the green light next to the "Go Fast" instruction was lit and to press slowly when the red light next to the "Go Slow" instruction was lit (see Appendix C).

At the beginning of Phase 3, subjects were told that instructions were the same as the first time, and then the latter part of the instructions (paragraphs 4 and 5) were re-read to the participants. The S^Ds-Points Group and the Points Only Group were also told that the lights had been reset and the program would appear as it did at the beginning of the experiment.

If the participants asked any questions relating to the experiment or to the instructions, only relevant parts of the instructions, as written, were repeated.

Results

Data are presented for all Control Group subjects who met the Phase 1 pliance criterion (32 out of 42) and for those S^Ds-Points Group subjects and Points Only Group subjects who met both the Phase 1 pliance criterion and the Phase 2 schedule control criterion (32 out of 44 and 32 out of 69, respectively). A higher percentage of subjects were able to meet the second phase schedule control criterion in the S^Ds-Points Group than in the Points Only Group, apparently because the presence of the S^Ds in Phase 2 assisted in acquisition of schedule control.

The dependent measure of interest for the S^Ds-Points Group and the Points Only Group was the mean response rate for each 1 min schedule-instructional pairing in Phases 1 and 3, and the mean response rate for each 1

min schedule component in Phase 2. For the Control Group, the dependent measure of interest was the mean response rate for each 1 min schedule-instructional pairing for all three phases.

Figure 2 shows the mean response rate for each minute of each phase, averaged over the 32 subjects in each group. In Phase 1 as well as Phase 3, shape indicates schedule condition. Circles indicate responding under DRL and squares indicate responding under FR. Color indicates operative instructions. Black symbols indicate responding during "Go Fast" instruction and white symbols indicate responding during "Go Slow" instruction.

Phase 1. Pliance, being a criterion for inclusion in the experiment, is evident for all groups. Response rates are high in the presence of the "Go Fast" instruction (black symbols) and slow in the presence of the "Go Slow" instruction (white symbols).

Phase 2. For the S^Ds-Points Group and the Points Only Group, black triangles represent responding under FR conditions and white triangles represent responding under DRL conditions. Both groups responded differentially during the FR and DRL components. On average, subjects in the S^Ds-Points Group responded more schedule-appropriately than did subjects in the Points Only Group, responding both faster in the FR schedule and slower in the DRL schedule.

For the Control Group averaged data suggest that pliance is maintained, however, there is some change across time, with the instructional control becoming slightly weaker (i.e., response rates decrease slightly under the "Go

Fast" instruction and increase slightly under the "Go Slow" instruction). This difference reflects a slight reduction in the number of pliant subjects during this phase.

Phase 3. For the S^Ds-Points Group, when the instruction lights reappear some residual pliance is seen during the initial oppositional schedule-instructional pairings indicated by the black circles and white squares (see Figure 2). Thereafter, pressing rates during oppositional pairings conform more closely to the requirements of the operative schedules than to the response-rate instructions (i.e., higher during FR than during DRL). These data contrast sharply with those of Phase 1 where pliance was maintained throughout the phase. Unlike the S^Ds-Points Group, the Points Only Group shows a high degree of pliance in the third phase (see Figure 2). Although there is some loss of pliance over time, reflecting a reduction in the number of pliant subjects, the Phase 3 data for the Points Only Group are clearly more comparable to their Phase 1 data, than is the case for the same data for the S^Ds-Points Group. Indeed, the Points Only Group shows a degree of pliance comparable to that of the Control Group, which continued to show pliance, although to a lesser degree that it did in either of the preceding phases. Again, the difference reflects a slight reduction in the number of pliant subjects during this phase. Overall, the relatively poor pliance of the S^Ds-Points Group by the end of Phase 3 is markedly at variance with the performances of the two other groups.

In order to test statistically for group differences in pliance, response-rate data for the last two minutes of schedule-instructional pairings in Phase 3 were

compared. These data points represent conditions under which schedule and instruction are opposed (i.e., "Go Fast"-DRL and "Go Slow"-FR) and, therefore, under which pliance can be assessed. A one-way analysis of variance was conducted on these data to assess group differences. The effect of group was statistically reliable, F (2, 93) = 10.61, p = .0001. A Tukey a (.05) indicated that the S^Ds-Points Group was statistically different from the Points Only Group and the Control Group. There was no statistically significant difference between the Points Only Group and the Control Group. Thus, statistical analysis confirmed the graphical data in suggesting substantially poorer Phase 3 pliance on the part of the S^Ds-Points Group.

Because group averages may poorly represent the performances of individual subjects, the individual subject data were analyzed using a Chi-square test. The frequency of pliant subjects was compared to the frequency of non-pliant subjects for each of the three groups. There was a statistically reliable difference between groups, X^2 (2, N = 96) = 24.2, p < .001, suggesting that the frequency of subjects who remained pliant in the third phase differed among the groups. Chi-square analysis revealed significant differences between the S^Ds-Points Group and the Points Only Group X^2 (1, N = 64) = 10.57, p < .01, and the S^Ds-Points Group and the Control Group X^2 (1, N = 64) = 12.25, p < .001, but not between the Points Only Group and the Control Group X^2 (1, N = 64) = 0.7. Thus, the individual subject data confirm the graphical and statistical analyses of the group data.

Overall, the results of Experiment 2 suggest that an operant blocking interpretation may be validly applied both to the pliance exhibited in Phase 1 of the present study, and to the data of Hayes, Brownstein, Zettle et al. (1986). Once participants had been exposed to the reinforcement schedules in the presence of schedule-related stimuli (S^Ds and points), and in the absence of response-rate instructions, pliance was difficult to re-establish. These results suggest that the rule-following in Phase 1 may not have been pliance in the sense discussed by Hayes, Brownstein, Zettle et al., (1986). That is, participants had not discriminated the intermittent inaccuracy of the response-rate instructions yet followed them due to overpowering social contingencies. Instead, they followed instructions because they had not discriminated that doing so was not the most effective means of earning points. Exposure to the points and S^Ds, without interference from the instructional lights, enabled subjects to discriminate the schedule components. The blocking of control by schedule-relevant stimuli was thus removed, and pliance became difficult to re-establish. Indeed, for the S^Ds-Points Group, 23 out of 32 subjects remained under schedule control when the response-rate instructions were reinstated.

The results for the Points Only Group suggest that the acquisition of control by the S^Ds rather than control by the reinforcer points was crucial in preventing the blocking by the instructional stimuli. For this group, when the instruction lights reappeared in Phase 3, 22 out of 32 subjects followed the response-rate instructions. The Points Only Group apparently failed to discriminate the intermittent inaccuracy of the response-rate instructions without

exposure to the S^Ds. In other words, exposure to the reinforcer points alone (despite their discriminative control over behavior in Phase 2) was insufficient to prevent the blocking of schedule control in Phase 3. The relative inefficiency of point exposure in reducing pliance is underscored by the similar degrees of pliance shown by the Points Only Group and the Control Group in Phase 3.

One criticism that can be offered with respect to Experiment 2 is that the deception may have been unsuccessful. Thus, it is possible that social contingencies in addition to those manipulated in Phase 3 came into play. If so, the high breakage of pliance in S^Ds-Points Group may have been due not to the prevention of blocking, but to the introduction of an additional demand for point acquisition. As a counterargument to this criticism, the Points Only and S^Ds-Points Groups data were signficantly different in Phase 3 (e.g., 9 out of 32 participants were pliant in the S^Ds-Points Group and 22 out of 32 participants were pliant in the Points Only Group). If the deception had been unsuccessful, it would be anticipated that both groups would be affected in a similar manner (e.g., same rates of pliant/non-pliant behavior) in Phase 3.

General Discussion

The present experiments were designed to investigate the phenomenon of pliance and its controlling variables. In pursuit of this purpose, the present experiments suggest that pliance may owe its actualization to factors in addition to the presence of social contingencies. In Experiment 1, when the collateral consequences for non-pliant behavior were increased relative to the consequences for pliant behavior, they were ineffective. This was true even

when there were social contingencies established for non-pliant behavior in conjunction with the collateral consequences. The ineffectiveness of these variables seems consistent with an operant blocking analysis: the notion that the response-rate instructions interferred with acquisition of control by features of the schedule. If schedule-relevant features had been consistently discriminated, manipulation of these variables would be expected to influence pliance.

Experiment 2 provided convergent evidence for this hypothesis. Pliance was established under circumstances that replicated Hayes, Brownstein, Zettle et al. (1986). For participants subsequently allowed to make contact with the schedule discriminative stimuli, few complied with the intermittently inaccurate instructions when they reappeared. Those subjects who had not made contact in the same way with the discriminative features of the schedule continued to obey the intermittently inaccurate instructions.

The results of the present experiments have more general implications for conceptual analyses of rule-following and for the study of rule-governed behavior in general. For instance, the demonstration that apparent pliance (rule following under the control of socially mediated consequences for a correspondence between the rule and the relevant behavior) may reflect the operation of other processes (e.g., operant blocking) offers a reminder that behavior analysts must pay careful attention to the controlling variables for behavior. This is particularly important when technical terms (e.g., pliance) that specify controlling relations are employed.

The rule-following exhibited in Experiment 2 may indeed have been pliance for some participants. For example, 9 out of 32 participants in the S^Ds-Points Group followed the response-rate instructions when they were re-established in Phase 3, despite having been under schedule-control in Phase 2. In contrast, for the behavior of participants whose rule-following was apparently "unblocked" through exposure to the point contingencies in Phase 2 (Points Only Group), the term pliant may be inappropriate to describe their Phase 3 performance. Rather, these subjects (22 out of 32) may have responded to response-rate instructions as tracks (rules that control behavior because of the "apparent correspondence between the rule and the way the world is arranged" Zettle & Hayes, 1982, p. 81). Perhaps rules produce insensitivity not only because they can prevent subjects from contacting certain consequences (e.g., Galizio, 1979), but because they prevent behavior from coming under the control of the schedule-relevant stimuli. Thus, the present data expand our knowledge regarding the mechanisms by which rules function to promote insensitivity to collateral consequences.

It is conceivable, however, that the apparent Phase 3 pliance of the nine instruction-compliant subjects in the S^Ds-Points Group, may be illusory. It remains possible that, despite exposure to the schedule relevant stimuli (S^Ds and points) and responding schedule-appropriately during the second phase, that they were again "blocked" when instructions were reinstated. The reintroduction of the response-rate instructions may have reestablished contextual conditions similar to those of Phase 1, where instruction following

occurred, despite fluctuations in the density of the reinforcement obtained (i.e., instructions were sometimes congruent with and sometimes opposed to, the operative schedule). Thus, participants may have assumed (in Phase 3) that point acquisition rates now vary again (as in Phase 1) but instruction following is still the best way to earn points.

Future research could investigate this possibility by testing for pliance on other tasks where the competing contingencies are clearer. If these participants were to show generalized instruction following over a number of tasks, when the competing contingencies are discriminable, there could be greater confidence that rule-following was due to social contingencies (i.e., pliance). What is clear now is that careful experimental analysis is required to ensure that exclusive reliance on pliance as a construct explaining human operant behavior in particular circumstances is justified.

References

Baron, A., & Galizio, M. (1983). Instructional control of human operant behavior. The Psychological Record, 33, 495-520.

Baron, A., Kaufman, A., & Stauber, K. A. (1969). Effects of instructions and reinforcement feedback on human operant behavior maintained by fixed-interval reinforcement. Journal of the Experimental Analysis of Behavior, 12, 701-712.

Bijou, S. W. (1958). Operant extinction after fixed-interval schedules with young children. Journal of the Experimental Analysis of Behavior, 1, 25-29.

Bradshaw, C. M., Szabadi, E., & Bevan, P. (1976). Human variable-interval performance. Psychological Reports, 38, 881-882.

Bruner , A., & Revusky, S. H. (1961). Collateral behavior in humans. Journal of the Experimental Analysis of Behavior, 4, 349-350.

Buskist, W. F., & Miller Jr., H. L. (1986). Interaction between rules and contingencies in the control of human fixed-interval performance. The Psychological Record, 36, 109-116.

Buskist, W. F., Miller, H. L., & Bennet, R. N. (1980). Fixed-interval performance in humans: Sensitivity to temporal parameters when food is the reinforcer. The Psychological Record, 30, 111-212.

Catania, A. C., Matthews, B. A. , & Shimoff, E. (1982). Instructed versus shaped human verbal behavior: Instructions with nonverbal responding. Journal of the Experimental Analysis of Behavior, 38, 233-248.

Cerutti, D. T. (1989). Discrimination theory of rule-governed behavior. Journal of the Experimental Analysis of Behavior, 51, 259-276.

Cerutti, D. T. (1991). Discriminative versus reinforcing properties of schedules as determinants of schedule insensitivity in humans. The Psychological Record, 41, 51-67.

Ferster, C. B., & Skinner, B. F. (1957). Schedules of reinforcement. New York: Appleton-Century-Crofts.

Galizio, M. (1979). Contingency-shaped and rule-governed behavior: Instructional control of human loss avoidance. Journal of the Experimental Analysis of Behavior, 31, 53-70.

Harzem, P., Lowe, C. F., & Bagshaw, M. (1978). Verbal control in human operant behavior. The Psychological Record, 28, 405-423.

Hayes, S. C., Brownstein, A. J., Haas, J. R., & Greenway, D. E. (1986). Instructions, multiple schedules, and extinction: Distinguishing rule-governed from schedule-controlled behavior. Journal of the experimental Analysis of Behavior, 46, 137-147.

Hayes, S. C., Brownstein, A. J., Zettle, R. D., Rosenfarb, I., & Korn, Z. (1986). Rule-governed behavior and sensitivity to changing consequences of responding. Journal of the Experimental Analysis of Behavior, 45, 237-256.

Kazdin, A. E. (1982). Single-case research designs: Methods for clinical and applied settings (pp. 233-239). New York: Oxford University Press.

Lippman, L. G., & Meyer, M. E. (1967). Fixed-interval performance as related to subjects' verbalizations of the contingency. Psychonomic Science, 8, 135-136.

Lowe, C. F., Beasty, A., & Bentall, R. P. (1983). The role of verbal behavior in human learning: Infants performance on fixed-interval scheduled. Journal of the Experimental Analysis of Behavior, 39, 157-164.

Lowe, C. F., & Harzem, P. (1977). Species differences in temporal control of behavior. Journal of the Experimental Analysis of Behavior, 28, 189-201.

Lowe, C. F., Harzem, P., & Bagshaw, M. (1978). Species differences in temporal control of behavior II: Human performance. Journal of the Experimental Analysis of Behavior, 29, 351-361.

Martin, G., & Pear J. (1988). Behavior modification: What is it and how to do it (3rd ed.). New Jersey: Prentice Hall.

Matthews, B. A., Catania, A. C., & Shimoff, E. (1985). Effects of uninstructed verbal behavior on nonverbal responding: Contingency descriptions versus performance descriptions. Journal of the Experimental Analysis of Behavior, 43, 155-164.

Matthews, B. A., Shimoff, E., Catania, A. C., & Sagvolden, T. (1977). Uninstructed human responding: Sensitivity to ratio and interval contingencies. Journal of the Experimental Analysis of Behavior, 27, 453-467.

Orlando, R., & Bijou, S. W. (1960). Single and multiple schedules of reinforcement in developmentally retarded children. Journal of the Experimental Analysis of Behavior, 3, 339-348.

Rosenfarb, I. S., Newland, C., Brannon, S. E., & Howey, D. S. (1992). Effects of self-generated rules on the development of schedule-controlled behavior. Journal of the Experimental Analysis of Behavior, 58, 107-121.

Shimoff, E., Catania, A. C., & Matthews, B. A. (1981). Uninstructed human responding: Sensitivity of low rate performance to schedule contingencies. Journal of the Experimental Analysis of Behavior, 36, 207-220.

Shimoff, E., Matthews, B. A., & Catania, A. C. (1986). Human operant performance: Sensitivity and pseudosensitivity to contingencies. Journal of the Experimental Analysis of Behavior, 46, 149-157.

Skinner, B. F. (1969). Contingencies of reinforcement: A theoretical analysis. New York: Appleton-Century-Crofts.

Svartdal, F. (1993). Working harder for less: Effect of incentive value on force of instrumental response in humans. The Quarterly Journal of Experimental Psychology, 46(A), 11-34.

Torgrud, L. J., & Holborn, S. W. (1990). The effects of verbal performance descriptions on nonverbal operant responding. Journal of the Experimental Analysis of Behavior, 54, 274-291.

Vom Saal, W., & Jenkins, H. M. (1970). Blocking the development of stimulus control. Learning and Motivation, 1, 52-64.

Weiner, H. (1962). Some effects of response cost on human operant behavior. Journal of the Experimental Analysis of Behavior, 5, 201-208.

Weiner, H. (1964). Conditioning history and human fixed-interval performance. Journal of the Experimental Analysis of Behavior, 7, 383-385.

Weiner, H. (1965). Conditioning history and maladaptive human operant behavior. Psychological Reports, 17, 935-942.

Weiner, H. (1967). Cost to payoff contributions to preference under fixed-ratio contingencies with humans. Psychological Reports, 20, 31-35.

Weiner, H. (1969). Controlling human fixed-interval performance. Journal of the Experimental Analysis of Behavior, 12, 349-373.

Weiner, H. (1970). Instructional control of human operant responding during extinction following fixed-ratio conditioning. Journal of the Experimental Analysis of Behavior, 13, 391-394.

Zettle, R. D., & Hayes, S. C. (1982). Rule-governed behavior: A potential theoretical framework for cognitive-behavioral therapy. In P. C. Kendall (Ed.), Advances in cognitive-behavioral research and therapy (pp. 73-118). New York: Academic Press.

Appendix A

Phase 1 Instructions - All Subjects

Please read these instructions silently as I say them aloud. This is an experiment in learning, not a psychological test. We are interested in certain aspects of the learning process which are common to all people.

There will be two sessions, with a short break between them. Please do not talk to one another during this break.

Occasionally a small yellow light will appear above the "Ready" indicator in the lower left corner of the screen. When it does, press the "earn" key to advance the counter one point. Your getting the small yellow light to appear involves the right and left shift keys, marked with the blue dot, and the cursor in the matrix. The yellow light will go on when the cursor is moved through the matrix from the top left corner to the lower right corner, using the right and left shift keys.

The best way to push the shift keys is rapidly when the green light and "Go Fast" instruction appears, and to push them slowly, with several seconds between each push, when the red light and the "Go Slow" instruction appears.

If you have any questions, ask them now because during the session I will not be able to answer any questions.

Appendix B

Phase 2 Instructions - Pliant Subjects

HRM-Competing Group

Points are now worth chances on money prizes. For every four points you earn you will be given one chance to draw for money amounts, including $0.01, $0.05, 0.10, $0.25, $1.00, $5.00, $20.00 and $50.00. The maximum number of points you can earn is 12. As soon as you earn the 12 points, the experiment will come to an end and you will be given the opportunity to draw for money prizes. Thus, the faster that you earn points, the sooner that the experiment will be over for you. If you are really fast at earning points, the experiment can be over in 5 or 10 minutes. Alternatively, if you are really slow in earning points, you could be here for the full hour

Try to earn as many points as you can.

HRM-Congruent

Points are now worth chances on money prizes. For every four points you earn you will be given one chance to draw for money amounts, including $0.01, $0.05, 0.10, $0.25, $1.00, $5.00, $20.00 and $50.00. The maximum number of points you can earn is 12. As soon as you earn the 12 points, the experiment will come to an end and you will be given the opportunity to draw for money prizes.

It is important that you press fast when the instruction saying "Go Fast" appears and slowly, with several seconds between each press when the instruction saying "Go Slow" appears.

LRM-Competing

Instructions are the same as the first time. Try to earn as many points as you can.

LRM-Congruent

Instructions are the same as the first time. It is important that you press fast when the instruction saying "Go Fast" appears and slowly, with several seconds between each press when the instruction saying "Go Slow" appears.

Appendix C

Phase 1 and 2 Instructions - All Subjects

Please read these instructions with me as I say them aloud. This is an experiment in learning, not a psychological test. We are interested in certain aspects of the learning process which are common to all people.

There will be two sessions, with a short break between them.

Occasionally a small yellow light will appear above the "Ready" indicator in the lower left corner of the screen. When it does, press the "earn" key to advance the counter one point. Try to see how may points you can get. At the end of the experiment, the subject with the most points in a single session will get $40. The next highest will get $20. The next highest will get $10. You will have two sessions today, and each one will count separately toward the money.

Your getting the small yellow light to appear involves the right and left shift keys, marked with the blue dot, and the cursor in the matrix. The yellow light will go on when the cursor is moved through the matrix from the top left corner to the lower right corner, using the right and left shift keys. The best way to push the shift keys is rapidly when the green light next to the "Go Fast" is lit, and to push them slowly, with several seconds between each push, when the red light next to the "Go Slow" is lit.

If you have any questions, ask them now because during the session I will not be able to answer any questions.

Table 1

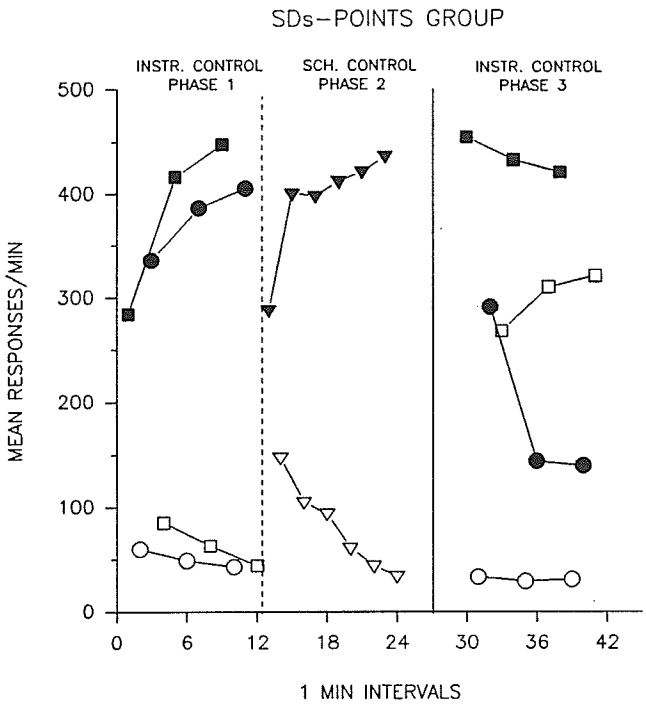
Frequency of Pliance versus Nonpliance in Phase 3

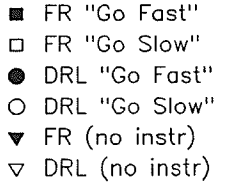
	Phase 3		
	Pliant	Not Pliant	Total
S^Ds-Points Group	9	23	32
Points Only Group	22	10	32
Control Group	23	9	32

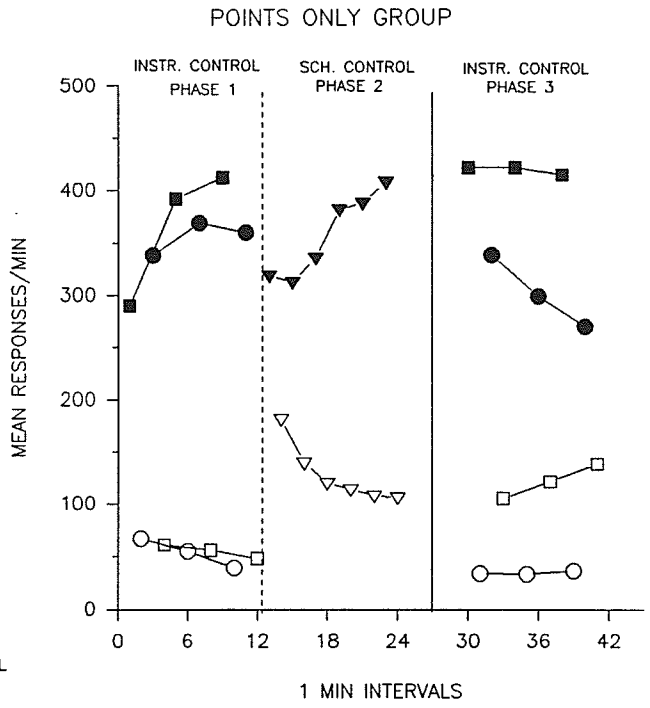
Figure Captions

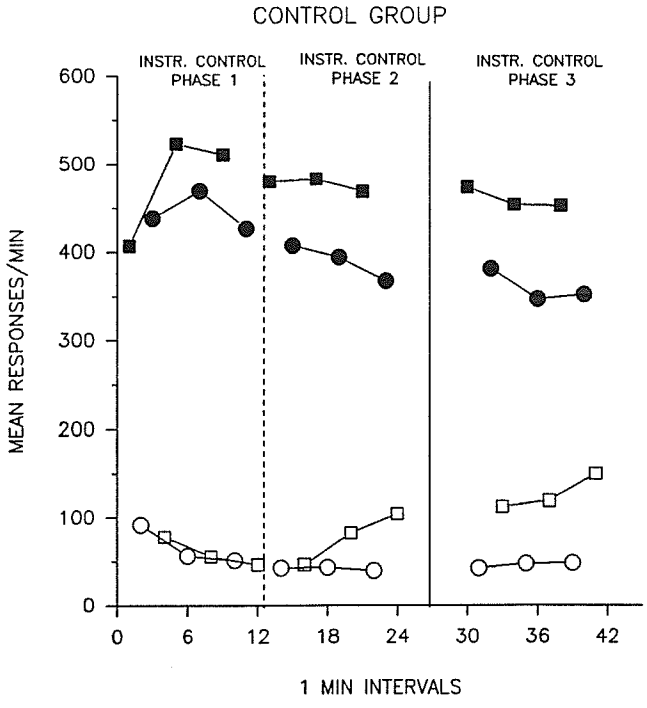
Figure 1. Mean response rates for Phase 1 and Phase 2 for all groups (HRM-Competing, HRM-Congruent, LRM-Competing, LRM-Congruent).

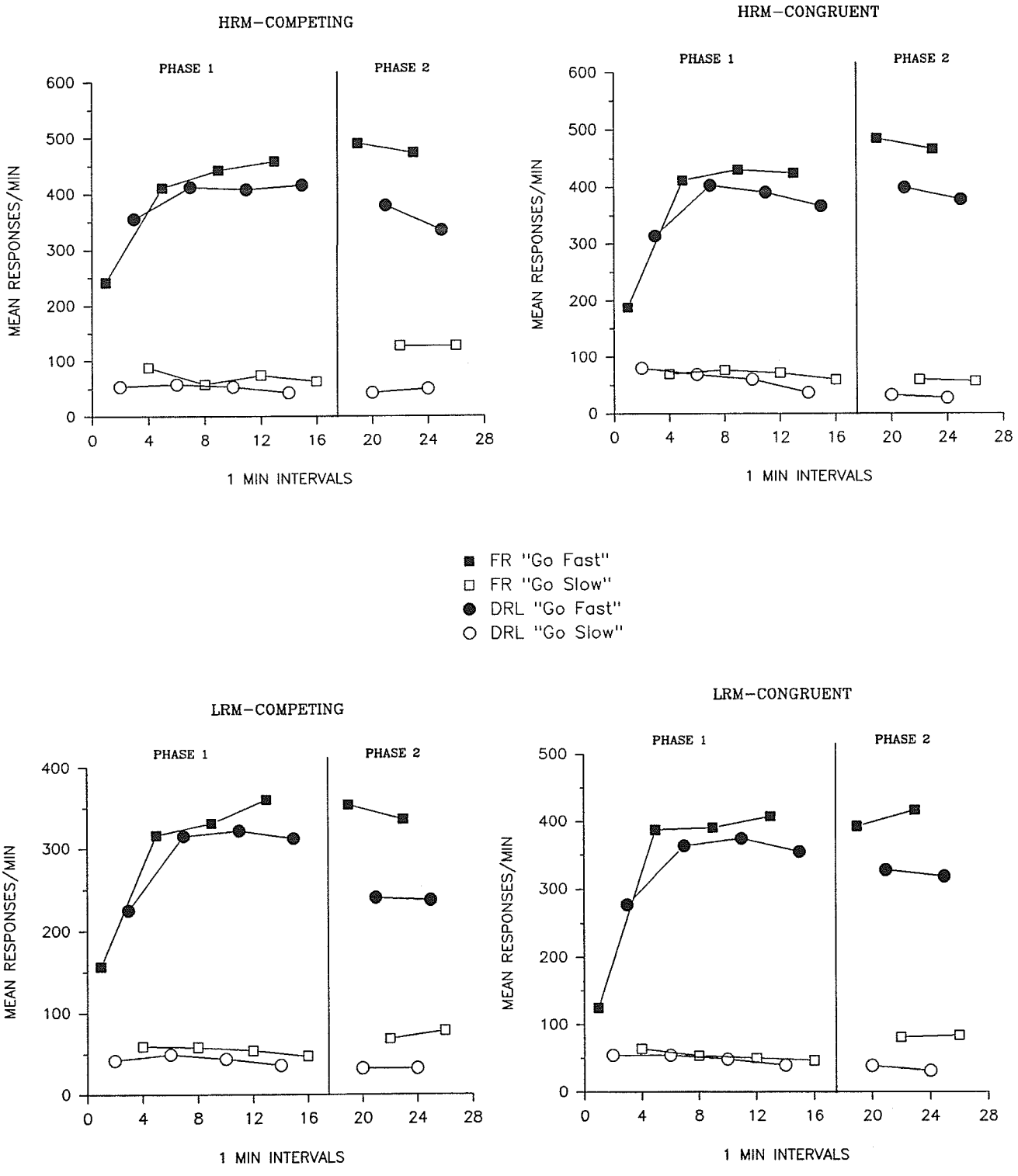
Figure 2. Mean response rates for Phase 1, Phase 2 and Phase 3 for all groups (S^Ds-Points Group, Points Only Group and Control Group).


SDs–POINTS GROUP
INSTR. CONTROL PHASE 1
SCH. CONTROL PHASE 2
INSTR. CONTROL PHASE 3
MEAN RESPONSES/MIN
500
400
300
200
100
0
0
6
12
18
24
30
36
42
1 MIN INTERVALS


FR "Go Fast"
FR "Go Slow"
DRL "Go Fast"
DRL "Go Slow"
FR (no instr)
DRL (no instr)


POINTS ONLY GROUP
INSTR. CONTROL PHASE 1
SCH. CONTROL PHASE 2
INSTR. CONTROL PHASE 3
MEAN RESPONSES/MIN
500
400
300
200
100
0
0
6
12
18
24
30
36
42
1 MIN INTERVALS


CONTROL GROUP
INSTR. CONTROL PHASE 1
INSTR. CONTROL PHASE 2
INSTR. CONTROL PHASE 3
MEAN RESPONSES/MIN
600
500
400
300
200
100
0
0
6
12
18
24
30
36
42
1 MIN INTERVALS


HRM–COMPETING
PHASE 1
PHASE 2
MEAN RESPONSES/MIN
1 MIN INTERVALS
HRM–CONGRUENT
PHASE 1
PHASE 2
MEAN RESPONSES/MIN
1 MIN INTERVALS
FR "Go Fast"
FR "Go Slow"
DRL "Go Fast"
DRL "Go Slow"
LRM–COMPETING
PHASE 1
PHASE 2
MEAN RESPONSES/MIN
1 MIN INTERVALS
LRM–CONGRUENT
PHASE 1
PHASE 2
MEAN RESPONSES/MIN
1 MIN INTERVALS