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EFFECTS OF STRATEGICALLY INDUCED INFERIORITY RISK AND SUPERIORITY DEPRIVATION ON RELATIVE GAIN ACHIEVEMENT IN MIXED MOTIVE GAMES

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A first experiment reported in this paper had 30 subjects play 100 trials of a Maximizing Difference Game against a simulated partner who followed one of two modified delayed matching strategies. Half of the subjects met a strategy designed to make them inferior, the other half a strategy making them superior in terms of relative gain maximization. The inferior group showed significantly more relative gain achievement than the superior group. In a second experiment 98 subjects played 100 trials of a Mutual Fate Control Game against one of seven pre-programmed strategies, entailing different levels of inferiority risk and superiority deprivation. The results fully supported the predictions that the amount of inferiority risk, as a primary factor, and of superiority deprivation, as a secondary factor, should be directly related to the amount of relative gain achievement and inversely related to the amount of joint gain achievement.

INTRODUCTION

Social motivation as proposed by McClintock (1972) may be considered as truly social as soon as an actor behaving in a context of social interdependence evaluates the attractiveness or value of an outcome state not only in terms of the outcomes he receives, but also in terms of the outcomes that it affords others with whom he is interdependent. If anywhere individuals exist, who are socially motivated to the point that they take account of the outcomes of others, then we should definitely find them in experimental game situations. Indeed, experimental games are always imbedded in a social matrix, in so far as the interdependence finds expression in mutually determined outcomes for both self and others.

The present study focuses on two major problems of the motivational interpretation of research on gaming. One has to do with the measurement of the strength of a particular social motive. The other raises the question of how to conceive theoretically the motivating factors whereby manipulations of the social context may affect the strength of a given motive.

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The clean measurement of a particular social motive, namely the competitive one (defined as relative gain maximization) was first explicitly attended to by McClintock and McNeel (1966). They designed a Maximizing Difference Game[1], as illustrated in Figure 1, wherein

		PLAYER 2	
		X	Y
PLAYER 1	A	3 3	O 3
	B	3 O	O O

FIG. 1. MAXIMIZING DIFFERENCE GAME (outcome of player 1 is in the upper left corner of each cell)

choosing the B or Y alternative must be indicative of an underlying competitive desire to have more points than the other. In fact the B or Y-choice not only fails to maximize altruistically the other's gain or cooperatively the joint gain, as did already most mixed motive games, but in contrast with the frequently used Prisoner's Dilemma Game (PDG), whose formal characteristics can be found in Luce and Raiffa (1957), it also excludes potential individualistic speculations of own gain maximization.

However, there is an ambush in the case of repeated plays of the same game making rather hazardous the interpretation of mere frequency or proportion of B and Y-choices as direct manifestation of the intensity of the competitive motive. As noted by McClintock (1972) choice preferences may not only reflect immediate motivational goals, but also strategic means designed to affect the other's subsequent choices in order to achieve motivational goals more successfully later on. Moreover, we may think of pre-programmed strategies of the other, against which a pure B-counter-strategy even in a MDG is not maximally instrumental to maximize relative gain.

In the light of these strategical interferences we would like to use another motivational measure instead of the raw choice preference. Suppose the experimenter knows the other's strategy exhaustively, as is the case when pre-programmed strategies of a simulated partner are introduced. He can then deduce what minimal and maximal gain

[1] Game in which the only motivation for a B or Y choice is to beat the other player by maximizing the difference between his outcome and one's own, in other words, by maximizing the relative gain.

realization can be achieved against that particular strategy. So, e.g. the proportion relative gain achievement (PCOMP) becomes a reasonably good indicator of the competitive motive, for it expresses how much is effectively achieved of what was potentially achievable against the given strategy.

Along the same line of reasoning we may find out what kind of characteristics of the social context are capable of affecting the intensity of a motivational orientation. It seems worthwhile to us to abstract two major variables out of the game situation, since they are present in each game experiment implying repeated trials: that is, the outcome structure defined by the matrix and the strategy of the other, although the last one is not always kept under control.

Motivationally interpreted, there is much to be said for the outcome structure, as it creates the expectation of a range of attainable values, while the other's strategy restricts this range. So, if one hundred trials must be played with an outcome structure of the MDG of Figure 1, the subject may expect a maximal relative gain of $+500$ and a minimal relative gain of -500. But, if his partner selects Y throughout the whole session, then the relative gain range of the subject may be said to be restricted strategically to 0 maximally and -500 minimally. It seems reasonable to assume that such a restriction would have some motivational implications.

If we assume that a competitively motivated subject tries to avoid negative differences between own and other's score and to approach positive ones, then we may consider a strategical restriction of the positive part of the range as preventing the subject from positively valued outcomes, whereas the other's lack of restricting strategically the negative part of the range, may be seen as threatening the subject with negatively valued outcomes.

In the remainder of this article we will call the former superiority deprivation and the latter inferiority risk.

We hypothesize that these two characteristics of the other's strategy, defined relative to the outcome structure, do have motivational relevance for the subject, in that sense that inferiority risk as well as superiority deprivation may enhance the competitive motivation. More specifically we shall submit to an empirical test the hypothesis that the magnitude of superiority deprivation and inferiority risk is directly related to the intensity of the competitive motive.

EXPERIMENT 1

In the first experiment we confronted subjects with two kinds of simulated partners: One who entirely deprived the subject from superiority and partially inflicted inferiority risk, thus creating a losing or inferior (INF) subject; and one who entirely freed the subject from inferiority, depriving him only partially from superiority chances, thus creating a winning or superior (SUP) subject. According to our main hypothesis the INF subject should become more competitively motivated than the SUP subject.

In addition, this study served two other purposes. Using the MDG of Figure 1, we wanted to compare the traditional proportion of B-choices (pB) with pCOMP, as alternative measures of the intensity of the underlying competitive motivation. We also tried to design the strategies of the simulated partner so that it would be possible to check whether our motivational explanation could stand against an interpretation in terms of social reinforcement, as was suggested among others by Gallo, Irwin and Avery (1966).

Simply taken we may assume that social reinforcement should operate as follows in the considered MDG: since a X-choice always rewards the opponent, whereas a Y-choice does not, the simulated partner could induce the subject to select progressively more A-choices by systematically rewarding more A's than B's. In fact the differential reinforcement of subject's A and B-choices has been put at an extreme with the so called tit-for-tat or delayed matching strategy, wherein each A of the subject on a given trial is followed by a X of the simulated partner on the subsequent trial, and each B of the subject by a Y of the simulated partner. In order to investigate the explanatory power of a social reinforcement interpretation we designed both strategies of our simulated partner on the pattern of the delayed matching. If social reinforcement would be operative, then we had to expect an increase of subject's A-responses over trials against both strategies, because either rewarded with a X-choice substantially more A than B-responses of the subject.

METHOD

Pre-programmed strategies: Against INF the simulated partner selected Y on the first trial. If on trial t subject's A was either the second, fifth, tenth, nineteenth, thirty-sixth or sixty-nineth A out of an uninterrupted series of A-responses, the simulated partner selected Y on trial t+1, thus mismatching subject's A. On any other trial the simulated partner matched the subject's response of the previous trial. — Against SUP the simulated partner selected X on the first trial. If on trial t subject's B was either the second, fifth, tenth, nineteenth, thirty-sixth or sixty-nineth B out of an uninterrupted series of B-responses, the simulated partner selected X on trial t+1, thus mismatching subject's B. On any other trial the simulated partner matched the subject's response of the previous trial.

Introspective data: A questionnaire filled in by the subjects after completion of 100 experimental trials contained, among other items, two motivationally relevant questions. The first asked which outcome state: AX, AY, BX or BY they had preferred the most. The second one asked for one reason for their preference, to be selected from a list of eleven possible reasons: (1) to try to get as many points for myself as possible; (2) to keep the lead; (3) to catch up with the other player; (4) to help the other get more points; (5) to get as many points as possible for both of us; (6) to get the other player to play differently; (7) to try something new; (8) to learn something about the game or the other player; (9) for no precise reason; (10) because my choice has not a single influence on the points we get; (11) for another reason (explanation given).

PCOMP: Over 100 trials INF could achieve a lowest relative score (RS) of —170 points and a highest RS of 0 points. Thus his RS effectively accumulated over 100 trials will be converted into PCOMP by the formula $\text{PCOMP} = \frac{\text{RS} + 170}{170}$. — Over 100 trials SUP could achieve a lowest RS of 0 points and a highest RS of +170 points. Thus his RS effectively accumulated over 100 trials will be converted into PCOMP by the formula $\text{PCOMP} = \frac{\text{RS}}{170}$.

Subjects: Subjects were 30 male undergraduate Flemish students enrolled in introductory psychology courses. At random half of the subjects were assigned to the INF-group, and the other half to the SUP-group. One confederate played the role of the dyad member against all subjects in both experimental groups. He was of comparable age, seemingly as naive as the subjects themselves and unacquainted with them. By all indications, this confederate was perceived as a real subject by each participant.

Furthermore, in order to assure that incoming subjects would be naive regarding the nature of the experiment, they were required to sign an affidavit committing themselves to secrecy. No subjects had to be discarded, because careful post-experimental questioning affirmed that all subjects were really naive regarding the experimental game.

Apparatus[2]: The experimental apparatus of each subject consisted of the following equipment: a. an adaptation of the matrix of Figure 1 which displayed the four possible outcomes attending the two choices which the subject and the other player could make, with lights indicating the outcome of their joint choices on each trial, b. two push-buttons by which each subject indicated his choice, c. a red start signal noting the beginning of each trial, d. two digital display boards which provided the subjects with a continuous cumulative record of their own and partner's score, and e. a screen which visually isolated the subjects from each other and from the experimenter.

General procedure: An experimental session passed as follows. Subject and confederate were introduced simultaneously in the experimental room. They took place at either side of the table, thus becoming player

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[2] Equipment expenses were covered by a grant of the U.S. National Institute of Mental Health awarded to Charles G. McClintock.

1 or 2 by chance. For reasons of clarity, however, we will always consider the subject as player 1 and the confederate as player 2. Each player was seated in front of his game equipment. The tape instructions were identical for both conditions and neutral in terms of suggesting competitive or cooperative behavior. No communication was allowed. The nature of the game was explained using four demonstration trials. It was emphasized that the outcome for each player would be a result of their joint choices. Their maximum possible earnings were also communicated. Each matrix point had a monetary value of .05 Belgian Francs. In order to assure belief in this monetary reward, the subjects read an affidavit, signed by a senior member of the psychology department, which testified in very explicit terms that the subjects would be able to keep the money they had gained by the end of the game. All subjects played the game of 100 trials. As soon as both players had responded on a given trial, their mutual choices were displayed in the appropriate cell of their game board, and the cumulative scores were updated. A red light then signaled the beginning of the following trial. Upon completion of the experiment the subjects filled in the questionnaire. Finally, they were paid the money they had gained during the game.

RESULTS

Introspective competition score: We tried to compute an introspective competition score out of the subject's answers on the post-session questionnaire. We assigned +1 to each subject claiming to prefer BX, since this expresses preference for a state of competitive gain; —1 to a AY-preference, this being a competitive loss preference; and 0 to either a AX- or BY-preference, because these two states afford equal points to each player. Likewise we evaluated the checked reasons on the already quoted list as follows: +1 for the competitive reasons (2) and (3), +.5 for the individualistic reason (1), 0 for the cooperative reason (5), and —.5 for the altruistic reason (4). All but six subjects checked one of these first five motivational reasons. Four subjects chose reason (11) and gave sufficient explanations to reassign their account to one of the first five reasons and to give them score-points accordingly. The remaining two subjects gave strategic reason (6), which was re-evaluated in terms of one of the motivational reasons, taking into account their expressed outcome preference. Finally we obtained an introspective competition score for each subject by adding his points for expressed reason to his points for preferred outcome. This score has a range from —1.5 for the least and +2 for the most competitively motivated. The results of this transformation are given in detail in Table 1. It can be seen that in accord with our hypothesis INF-subjects reached a higher introspective competition score than SUP-subjects. Analysis of variance performed on his score yields a significant effect ($F_{1,28} = 5.53$, $p < .05$), indicating that subjects risking inferiority through partner's strategy judged themselves as more competitive than subjects receiving superiority chances from partner's strategy. As far as introspection may be trusted, our strategical manipulation seems to have succeeded in creating more and less competitively motivated subjects.

TAB. 1. INTROSPECTIVE COMPETITION SCORE IN INF AND SUP

	outcome preference			reason				mean
	AY (—1)	AX/BY (0)	BX (+1)	altr. (—.5)	coop. (0)	indiv. (+.5)	comp. (+1)	introspective comptetition score
INF	0	7	8	0	5	4	6	+1.07
SUP	3	7	5	3	6	6	0	+ .23

pCOMP and pB: We hypothesized that, if subjects really become differentially motivated by discrepant characteristics of inferiority risk and superiority deprivation inherent in the other's strategy, this should find expression in our pCOMP-measure. So, INF was predicted to achieve a higher pCOMP than SUP. This prediction was fully supported, since INF reached on the average pCOMP = .803, as opposed to pCOMP = .427 for SUP. Furthermore, as Figure 2 shows, the differentiation between both

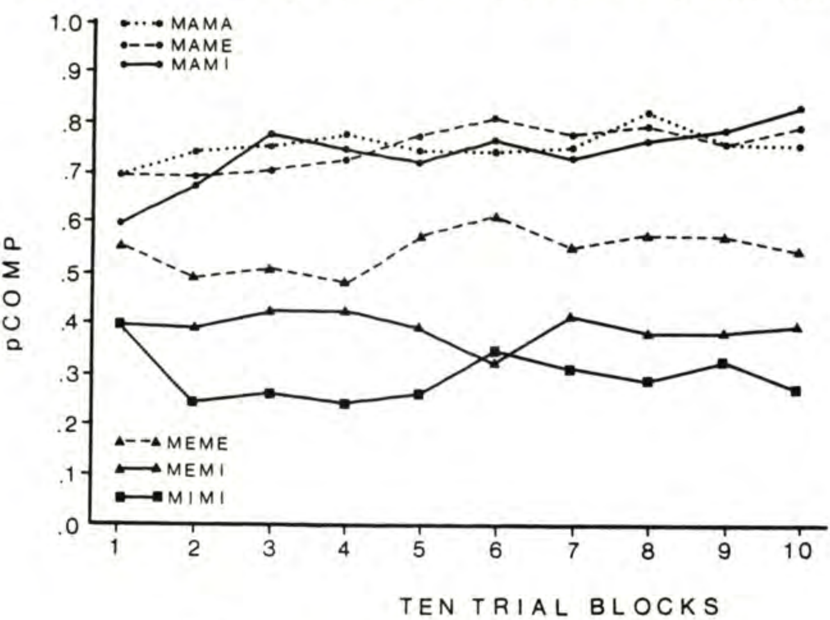

FIG. 2. EVOLUTION OF pCOMP AND pB (Experiment 1)

groups became progressively more important over trial blocks. An analysis of variance performed on these data revealed that the main effect of the strategy as well as the interaction of strategy with trials was significant (respectively $F_{1,28} = 21.35$, $p < .01$ and $F_{9,252} = 4.79$, $p < .01$). Apparently our strategies had not only an over-all effect regarding PCOMP, but also became more effective the longer the subjects were confronted with it. Concerning the traditional PB measure the mean PB (.623 for INF and .496 for SUP) as well as the evolution of PB over trial blocks (see Figure 2) pointed into the predicted direction. Neither effect, however, was sufficiently strong to reach significance. As suggested in the introduction one reason for this may be that, given the goal to achieve a specified relative gain, adjusting the PB level is only one strategical mean among others. Actually this explanation gains in credibility after examination of the variability. So, for INF as well as SUP there was a substantialy larger variability between subjects for PB than for PCOMP. The difference becoming even more distinct over trial blocks. In fact, this indicates that less divergent PCOMP levels (goal achievement) were attained by more divergent PB levels (strategical means)

Reinforcement explanation: Our strategies were designed in such a way that both reinforced on a subsequent trial a subject's A-choice substantially more often than his B-choice. During the game, an INF-subject was never reinforced for his B, and could be reinforced for 50 to 100% of his A's, according to his on counter-strategy, whereas a SUP-subject was always reinforced for his A, and could be reinforced for 0 to 50% of his B's, again depending on his own counter-strategy. When we examined the reinforcement ratios which were effectively obtained, we observed the proportions displayed in Table 2.

TAB. 2. PROPORTION OF REINFORCEMENT IN INF AND SUP

	INF	SUP
reinforcement of A	.81	1.00
reinforcement of B	.00	.29

According to these partial reinforcement schedules we should expect both INF and SUP to produce progressively more A's, it being the more reinforced alternative in each case. Nevertheless no significant increase of A's over trials could be detected. The main effect of trials for both groups combined was non-significant ($F_{9,252} = 1.00$, $p > .05$). Taken separately, SUP displayed an only slightly ascending A-slope, whereas the slope of INF was even descending, entirely contrary to the reinforcement explanation. However, neither trend proved to be significant.

Perhaps there is another way to apply reinforcement principles in our situation. In fact it is reasonable to assume that not the single A-response is reinforced, but rather a whole response sequence or counter-strategy. Conversely, we might say that the subject progressively learns to adopt that instrumental counter-strategy that enables him to get as many reinforcements as possible. If this reasoning does make sense, then we have to expect an increase of X-reinforcements over trials. The range of potential, reachable X-reinforcements was certainly large enough (from 0 to 93% for INF; from 7 to 100% for SUP) to show a possible increase. Inspecting our data, we noticed that the X-slopes of either simulated partner were indeed slightly ascending as predicted. But analysis of variance again revealed no significance in the evolution of X-reinforcements, neither for the main effect of trials ($F_{9,252} = 1.32$, $p > .05$) nor for the interaction with strategies ($F < 1.00$).

In the light of the relative weakness of a traditional reinforcement explanation, it seems useful to re-evaluate the very meaning of reinforcement within the social context of game experiments. Assuming that the mere X-choice of the partner is reinforcing for the subject, because it gives the latter points and monetary rewards, whereas a Y-choice does not give him these rewards, is in effect reducing the motives of the subject to the only individualistic, own gain maximization considerations of "economic man". This viewpoint fails to take account of the implications that points and rewards given to the socius could have on the reinforcement value of a particular consequence. So, if the subject is competitively motivated, then a X of his partner is much more reinforcing when he himself selects a B, than when he chooses A. X may even be as competitively reinforcing as Y, as is the case for the outcome states AX and BY. In fact, for the competitively motivated subject, it should not be the mere X-choice of his partner, but the relative gain attached to an outcome state that should be reinforcing.

Such an enlargened view of the reinforcement concept was fully confirmed by our results. The INF-subject seems to have learned those counter-strategies, which were instrumental in getting progressively more competitive reinforcements. For that matter we observed an increase of PCOMP over trials, which proved to be significant in the INF-group. A separate trend-analysis revealed that only the linear component was responsible for the significant trial effect ($F_{9,126} = 4.06$, $p < .01$). To the contrary for the SUP, competitive reinforcements were probably not attractive enough to initiate learning of those instrumental counter-strategies. In fact a slow, although non-significant, decrease of PCOMP was observed in the SUP-group. This might indicate that the attractiveness of competitive reinforcements did not stay sufficiently high in this group to engender competitively instrumental learning.

EXPERIMENT 2

The second experiment was primarily designed to test in much more detail our main hypothesis, that there should be a direct relation between the magnitude of strategically induced inferiority risk and supériority deprivation on the one side, and the intensity of the competitive motive on the other side. Encouraged by our first experiment we maintain PCOMP as a valuable measure of the underlying competitive motive. However, we were afraid, judging from the already high PCOMP-level in INF, of falling victim to a ceiling effect, that could wipe out differences in PCOMP between groups, presumably even more competitively motivated than INF in the former experiment. We therefore adapted some structural characteristics which had already been empirically proven to reduce competition.

We first altered the outcome structure of the game as seen in Figure 3. This game may be called Mutual Fate Control Game (MFC)[3] according to the mutual fate control notion introducted by Thibaut and Kelley (1959), otherwise already present in an embryonic state in the Minimal Social Situation of Sidowski, Wyckoff and Tabory (1956).

PLAYER 2

PLAYER 1	X	Y
A	6 / 6	0 / 5
B	5 / 0	0 / 0

FIG. 3. MUTUAL FATE CONTROL GAME

The advantage of the MFC over the MDG is that it can be decomposed, and most important for our aim, that the same game structure seems to elicit less competitive choices in a decomposed format[4] than in a matrix format, as we already found in a PDG-study of Evans and Crumbaugh (1966).

Another feature was also introduced with the same intention. In contrast with the first experiment wherein double cumulative score feedback was continuously given to the subjects, we gave no cumulative score feedback at all in the second experiment, since the already cited study of Gallo, Irwin and Avery (1966) indicated that the omission of cumulative score feedback significantly reduced PB in a MDG.

With these precautions taken, we designed seven pre-programmed strategies inducing different degrees of inferiority risk and superiority

[3] In such a game the choice selected by one player completely determines the outcome the other will receive on each trial.

[4] In this format players are not confronted to the matrix structure. E.g. for the matrix of Figure 3 they only have to choose between "Give him 3" or "Give him 0" on each trial, and they simply receive what was given.

deprivation. The minimal relative gain a subject might expect over 100 trials with the given outcome structure was —300 points, and the maximal +300 points. The first strategy had a range from —300 to 0, and was thus maximal on inferiority risk and superiority deprivation (MAMA). The second strategy yielded a range from —300 to +150, or maximal inferiority risk and medium superiority deprivation (MAME). The third strategy had a range from —300 to +300, or maximal inferiority risk and minimal superiority deprivation (MAMI). The fourth strategy had a range from —150 to +150, or medium inferiority risk and superiority deprivation (MEME). The fifth strategy had a range from —150 to +300, or medium inferiority risk and minimal superiority deprivation (MEMI). The sixth strategy restricted the whole range to 0, and was thus minimal on inferiority risk and maximal on superiority deprivation (MIMA). The seventh strategy had a range from 0 to +300, or minimal inferiority risk and superiority deprivation (MIMI).

If we assume that the tendency to avoid inferiority is much more stronger than the tendency to approach superiority, as was demonstrated by Messick and Thorngate (1967), then we have to predict the intensity of the competitive motive to decrease along the following rankorder:

$$\text{MAMA} > \text{MAME} > \text{MAMI} > \text{MEME} > \text{MEMI} > \text{MIMA} > \text{MIMI}$$

We thus predicted PCOMP to vary according the assumed rankorder. Against MIMA however no PCOMP could be computed, because relative gain invariably stays at 0 meaning equality. We therefore also computed the proportion joint gain achievement (PCOOP) as a measure of the cooperative motivation. Leaning on the fact that in much game research cooperative behavior is taken as being the opposite of competitive behavior, we suspected that the rankorder of PCOOP against the different strategies should be exactly the reverse of the PCOMP rankorder. It was possible to compute PCOOP in all cases except MAMI. In fact PCOOP is a distinct variable from PCOMP only against MAME and MEMI. In all other cases they are always exactly each others complement (PCOOP = 1—PCOMP). The pre-programmed strategies being less complex than in the first experiment, most distinctions between dependent variables are vanishing now. So, it does not make much sense to compare PCOMP with PB in the present experiment since PB and PCOMP (or the complementary PCOOP) are just other names for exactly the same variable in all cases except MAME and MEMI.

METHOD

Pre-programmed strategies: MAMA started with Y on the first trial and unconditionally continued selecting Y over all 100 trials. MAME started with X against one half and Y against the other half of the subjects and continued selecting X on trial t+1 following AX or BY on trial t, and Y on trial t+1 following AY or BX on trial t. MAMI started with X against one half and Y against the other half of the subjects, and continued selecting X on trial t+1 following BX or BY on trial t, and Y on trial t+1 following AX or AY on trial t. MEME started with X against one half and Y against the other half of the subjects, and continued selecting X on trial t+1 following AY or BY on trial t, and Y on trial t+1 following AX or BX on trial t. MEMI started with X against one half and Y against the other half of the subjects, and continued selecting X on trial t+1 following AY or BX on trial t, and Y on trial t+1 following AX or BY on trial t. MIMA started with X against one half and Y against the other half of the subjects, and continued selecting X on trial t+1 following AX or AY on trial t, and Y on trial t+1 following BX or BY on trial t+1. MIMI started with X on the first trial and unconditionally continued selecting X over all 100 trials.

Experimenter effect: Seven experimenters, i.e. three females and four males, conducted the operations. Each experimenter played all seven strategies twice. They all were ignorant of the hypotheses, so it was possible to control for experimenter effects by including them as a second independent variable in a factorial design.

PCOMP and PCOOP: PCOMP and PCOOP were computed in the same way as was done for PCOMP in the first experiment, i.e. taking account of the RS accumulated over trials for PCOMP, and of the joint score (JS) accumulated over trials for PCOOP. For MAMA $\text{PCOMP} = \frac{\text{RS} + 300}{300}$, and $\text{PCOOP} = \frac{\text{JS}}{300}$. For MAME $\text{PCOMP} = \frac{\text{RS} + 300}{450}$, and $\text{PCOOP} = \frac{\text{JS} - 150.}{450}$. For MAMI $\text{PCOMP} = \frac{\text{RS} + 300}{600}$, and PCOOP can not be computed since there is no variation freedom for JS. For MEME $\text{PCOMP} = \frac{\text{RS} + 150}{300}$, and $\text{PCOOP} = \frac{\text{JS} - 150}{300}$. For MEMI $\text{PCOMP} = \frac{\text{RS} + 150}{450}$, and $\text{PCOOP} = \frac{\text{JS}}{450}$. For MIMA PCOMP can not be computed since there is no variation freedom for RS and $\text{PCOOP} = \frac{\text{JS}}{600}$. For MIMI $\text{PCOMP} = \frac{\text{RS}}{300}$ and $\text{PCOOP} = \frac{\text{JS} - 300}{300}$.

Subjects: Subjects were 98 Flemish boys between 12 and 15 years old attending a summer vacation camp. They were equally and randomly assigned to the seven pre-programmed strategies. Upon beginning all subjects were unacquainted with the nature of the experiment. All subjects participated in pairs, thinking they were playing against each other, whereas in fact they were playing against a pre-programmed strategy introduced by the experimenter through false choice feedback. None of the subjects was aware of this experimental deception.

Material: The material consisted of: a. a long rectangular table, each subject taking place at a short side and the experimenter in the middle of a long side, b. two large screens placed across the whole width of the table, thus isolating visually from each other the experimenter as well as the subjects; game relevant communication could be passed by cards through a small groove within each screen, c. for either subject two own choice cards, one with a number 3 and the other with a number 0, d. for the experimenter four other's choice cards, two having a 3 and two having a 0, e. forms which enable the experimenter to note down incoming own choice cards from either subject and returned other's choice cards to either subject on each trial.

General procedure: Fourteen subjects were introduced simultaneously in a large experimental room. Pairs were constituted and randomly conducted to one of the seven tables, each one being served by a different experimenter. Each experimenter gave oral instructions to his pair of subjects until it was sure that both subjects completely understood the rules of the game. It was explained that on each trial both had to make a choice between giving 3 or 0 points to the other by selecting the appropriate own choice card. After the experimenter had noted down their choices, they would be informed about the choice of their partner by an other's choice card. It was stressed that at the end of the game all points they had received from their partner would be added up and converted into a proportional amount of sweets. Except for the exchange of play cards no other communication was allowed during the trials. All subjects played the game for 100 trials. As soon as both subjects had given their own choice card to the experimenter on a given trial, they received an other's choice card from him according to one of the pre-programmed strategies. They, however, believed this other's choice card to reflect truly the choice of their partner. As soon as all cards were given gack to their owners, a following trial could be started. Upon completion of the experiment all participants received the same amount of sweets.

RESULTS

A separate analysis of variance was performed on PCOMP and on PCOOP. No significant experimenter effects were found either on PCOMP or on PCOOP. On the other hand, strategical manipulation had a significant main effect on PCOMP ($F_{5,42} = 13.94$, $p < .01$) as well as on PCOOP ($F_{5,42} = 4.78$, $p < .01$). In order to appreciate the observed differences

TAB. 3. MEAN PCOMP AND PCOOP AGAINST THE PRE-PROGRAMMED STRATEGIES

	MAMA	MAME	MAMI	MEME	MEMI	MIMA	MIMI
PCOMP	.754	.748	.739	.546	.388	—	.293
$p < .05$	a*	a	a	a,b	b,c	—	c
$p < .01$	a	a	a	a,b	b		b
PCOOP	.246	.408	—	.454	.490	.559	.707
$p < .05$	a	a,b	a,b,c	a,b,c	b,c		c
$p < .01$	a	a,b	—	a,b	a,b	a,b	b

* mean results having the same letter are not significantly different at the indicated level of significance.

between strategies in the light of our predictions, we compiled in Table 3 the mean PCOMP and PCOOP for each strategy, along with the results of a Dunn's test for multiple comparison between strategies.

There is a striking similarity between the observed rankorder and the predicted one. All PCOMP means followed the predicted direction. Conversely, the PCOOP means of MAME, MEMI and MIMA, which were independent with regard to PCOMP, inserted themselves in the predicted sequence between the PCOOP means of MAMA, MEME and MIMI, which were already fixed by complementarity to PCOMP.

When we take account of the significances, much more support seems to be given to the assumed motivational effect of inferiority risk than that of superiority deprivation. Among the seven possible comparisons between experimental groups with variable inferiority risk and constant superiority deprivation three were significant: two on the .01 level for PCOMP, and one on the .05 level for PCOOP. In contrast, none of the seven possible comparisons between experimental groups with variable superiority deprivation and constant inferiority risk were significant.

The analysis of variance on PCOMP also revealed a significant effect of trials, both alone and in interaction with strategies (respectively $F\ 9{,}378 = 2.48$, $p < .01$ and $F\ 45{,}378 = 1.57$, $p < .05$). The significant interaction effect means that several strategies yielded different PCOMP-slopes. We therefore present the PCOMP evolution over trial blocks for the six strategies involved in Figure 4. Except for MEMI and MIMI which show a slight decrease, all other strategies engendered a

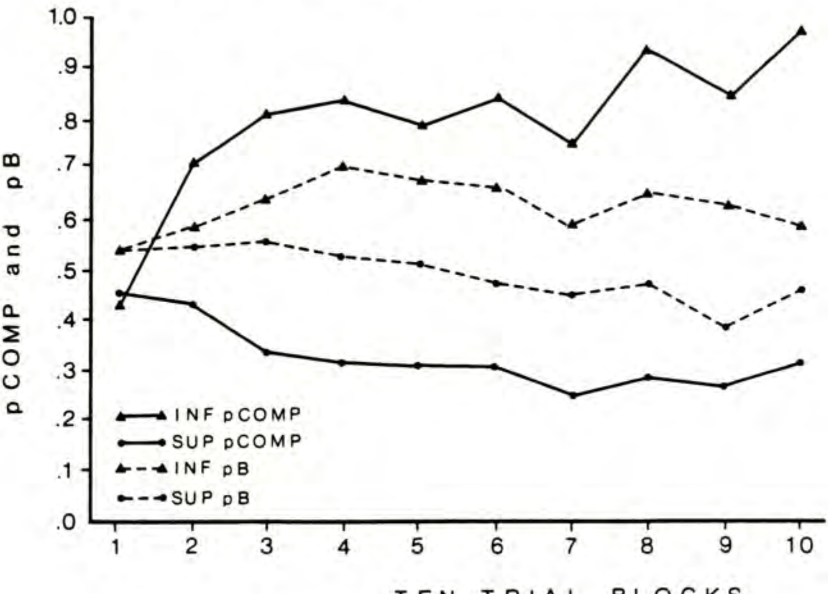

FIG. 4. EVOLUTION OF PCOMP (Experiment 2)

progressive increase of PCOMP over trials. However, trend analyses, performed separately on each strategy, revealed that there were only significant linear trial effects for MAME and MAMI (for MAME: $F_{1,63} = 10.75$, $p < .01$, and for MAMI: $F_{1,63} = 20.26$, $p < .01$).

Finally, the main effect of trials can very well be explained by the fact that the majority of strategies yielded a PCOMP increase over trials. Indeed a trend-analysis again revealed that only the linear component could be taken as responsible for the significant trial effect ($F_{1,378} = 18.08$, $p < .01$) and that the slope is evidently ascendent.

A possible reason for the fact that the progressive differentiation between strategies over trials was not as considerable as in the first experiment, could be that the strategies of the second experiment were much simpler than those of the first experiment. So, the subjects did not have as much to learn, indeed, they seemed to have already found the correct procedure for achieving their motivational goal within the first twenty trials.

GENERAL DISCUSSION

The attempt to demonstrate the motivational relevance of an achievement proportion such as PCOMP was fairly successful. In fact, our data suggest that, at least under conditions wherein sufficient knowledge of partner's strategy enables the experimenter to define the upper and lower limits of one's relative gain range, the PCOMP measure might be a valuable indicator of the underlying competitive motive. Indeed, when we assume that the experimental groups of the first experiment had been made differentially competitively motivated, as was supported by the introspective assertion of the subjects, then their motivational differences were clearly and significantly expressed by PCOMP.

There are, however, many limitations concerning the PCOMP measure. Technically considered, the only practical way to compute PCOMP is to use pre-programmed strategies of a simulated partner. This may not be a truly objectionable restriction though, since our actual knowledge of the interaction process may not be complete enough for us to leave the partner's strategy uncontrolled. In effect it may be wise, given the so often observed impact of other's strategy, to keep this factor under control even if it is not itself an independent variable of the experimental design.

But there is also a more fundamental problem. Theoretically, it seems very risky to assume a perfect parallel between motivation and achievement. There are numerous instances of not reaching a goal to which one is nevertheless intensely motivated. So, one should at least take account of the degree of availability of the means by which a goal can be reached, before making inferences about motivation. In fact, the gradual increase of distance between the POMP of both groups in the first experiment, as opposed to the almost immediate PCOMP differentiation between the groups of the second experiment, could very well be explained with reference to a factor of means availability. Indeed, given the higher complexity of strategies in the first experiment, it seems reasonable to assume that it took longer for the subjects to discover the means for attaining their motivational goals.

In summary, one could say that, assuming the measurement of PCOMP is applicable, it is valuable to use it as an indicator of the competitive motive in contrast with the traditional PB, which clearly fails to take account of strategical interferences attached to an interaction proces strung out over numerous trials. However, further research should have to determine how the difficulty of instrumental counter-strategies does affect final goal achievement.

Concerning our main hypothesis about the motivational effects of strategically induced inferiority risk and superiority deprivation, the data of both experiments fully supported the predictions. The amount of inferiority risk, and to a lesser degree the amount of superiority deprivation, was directly related to the competitive motive as measured by PCOMP, and inversely related to the cooperative motive as measured by PCOOP. Giving a greater weight to inferiority risk than to superiority deprivation, it was even possible in the second experiment to establish predicted rankorders of six PCOMP- and six PCOOP-values, which were completely identical with the observed rankorders. These results clearly stress the importance of a motivational interpretation.

Moreover, in comparing this motivational view with a classic reinforcement explanation, as was done in the first experiment, we noticed the relative weakness of the latter approach. First, it is not so much a single choice alternative, but rather a whole counter-strategy that should be considered as the reinforced behavior. Second, a single choice of the partner should not indiscriminately be identified as the "reinforcer" as soon as it is own gain maximizing for the subject. For, if the subject is competitively rather than individualistically motivated, then the "competitive reinforcer" is not only a consequence of his partner's but also of his own choice.

In summary, we can assume that our subjects learned those instrumental counter-strategies which were effective to reach their pursued level of competitive rewards. In turn, this desired level seemed to be a function of the characteristics of inferiority risk and superiority deprivation engendered by the partner's strategical restriction of the potential relative gain range inherent in the outcome structure of the game.

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