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THE SOCIAL FACILITATION OF APPROACHING OF GOLDFISCH (CARASSIUS AURATUS) IN AN APPROACH-AVOIDANCE SITUATION

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The concept of social facilitation is defined in the introduction as a descriptive term and clearly distinguished from explanations of this phenomenon. In the experiment goldfish which had learned to traverse a simple maze for food were divided into two groups of twenty-five. In a first phase individual retraining was given to assure that both groups react quickly in the maze and perform equally well. In the experimental phase fish received electric shocks at the end of the maze, alternated with trials without shock. Fish of group B were tested alone, fish of group A together in the approach-avoidance situation. Fish tested in groups approach significantly quicker than those tested alone. The observed social facilitation of approach responses in the fearful situation can be explained by the hypothesis of fear reduction due to the presence of companions. Therapeutic applications of the social stuation are finally proposed.

INTRODUCTION

Allport (1924) first introduced into psychology the term social facilitation, though phenomena covered by this name could already be found in the history of animal psychology under the title of instinctive imitation (Morgan 1896). Both terms, however, have been used ambiguously : they serve to describe both the phenomenon of more intense activity of individuals when in a group and an explanation of this phenomenon. A clear distinction between the studies on a descriptive level and those on the level of explanation should be made. The first level consists in carefully determining conditions in which the phenomenon of social facilitation is observed. Wijffels, Thinès, Dijkgraaf & Verheijen (1967) preserve the term as a descriptive name and give this definition : social facilitation of a certain type of behaviour can be said to have occurred when it must be concluded that a behaviour (performance) of one subject exercises an influence on another subject in the sense that this latter subject by perception of this behaviour is set to perform, or to intensify, the same behaviour that belongs to his ready repertoire of behaviour patterns (no matter if it exists by reason of learning, maturation or other way). Once one has established a case of social facilitation an explanation can be sought. Asch (1952) remarks that explanations should be more than simple restatements of the quantitative results. He states that most interpretations have an ad

hoc quality, because when performance increases under group conditions it is said that social facilitation is at work; but if in the same conditions the opposite effect is obtained an opposed factor is said to be at work: social inhibition or social interference. Allport (1924) observed that people perform more quickly in a group when giving word associations, making multiplications and cancelling vowels. This he called social facilitation and he defined it as the fact that a subject in a co-acting group is released by the sight and sound of others to give the same reactions or to increase such reactions. The explanation, however, he also called social facilitation, but now conceived it as a mechanism of generalised self-imitation. The explanation is that people usually both hear and see themselves work and so these stimuli become conditioned stimuli by contiguity at the work; the sight and sound of others at work should be generalised auto-conditioned stimuli. Whilst admitting Allport (1924) sought a real explanation in terms of a learning process, it must be concluded that he introduced the mentioned confusion in the term social facilitation.

In animals social facilitation refers to phenomena where members of a group are all engaged in the same activity, be it innate or acquired, e.g. eating, cleaning, pressing bars etc. and that they do so at a higher rate (releasing each other) than when alone. Surveys of the literature are found in Allee (1935, 1938, 1965), Crawford (1939), Smith & Ross (1952), Thorpe (1963), Zajonc (1965, 1966), Simmel, Hoppe & Milton (1968). These authors speak of social facilitation and understand it, as Allport did, as mutual stimulation of group members. Thorpe's definition, however, reminds us of the older concept of instinctive imitation. He says that social facilitation can be described as contagious behaviour where the performance of a more or less instinctive pattern of behaviour by one member will tend to act as a releaser for the same behaviour in others. Warden, Jenkins & Warner (1934) speak of instinctive imitation when an activity is set off by a social stimulus but the act itself belongs already to the natural repertory of the animal. They oppose it, following Morgan (1896), to intelligent or rational imitation where an animal suddenly performs a totally new act after observing it in another (i.e. observational learning). The classic example of instinctive imitation is that of chickens pecking on the ground for food (Morgan 1894). The ambiguity of the term lies in the fact that Morgan and other authors mean that while animals imitate behaviours that have been called instincts, they also do so 'by instinct'. An inborn tendency to imitate has been postulated by Morgan, Woodworth, Tarde and others (see Miller & Dollard 1941). Washburn (1926) postulates an inborn nervous connection between certain sensory and motor centers, e.g. the sight of a companion eating automatically activates the eating response. Thus, here, the explanation is not given in terms of learning, as Allport did, but sought in the inborn make-up of the animal.

Recently the problem of social facilitation has been brought back to

the psychologist's attention by Zajonc (1965, 1966, 1972) and Simmel et al (1968). Zajonc' explanation consists in the drive-heightening that should be caused by the sheer presence of a companion in a subject, animal or man. This postulated higher general drive state in an organism makes him emit or intensify dominant behaviour, i.e. behaviour most probable in a situation, as eating in front of food. A detailed presentation of Zajonc' theory can be found in Cottrell (1972). Tolman (1968) proposes another explanation called the 'disinhibition hypothesis', stating that a companion reduces the inhibitions of a subject in performing a behaviour. This fear reduction can explain why chickens eat more during the first 5 minutes in a new situation when they are in a group. Of course this explanation is only useful in situations where subjects are inhibited by fear provoking stimuli from giving their normal responses. Wilson (1968) also attributes his social facilitation to a case of fear reduction.

The social facilitation of responses in fearful situations and the hypothesis of fear reduction by companions has been studied in other species and different situations. Wheeler (1966, 1968) speaks of behavioural contagion when a subject, having an internal restraint against performing a response, is led to do so when he sees that response in a companion. As an example the case is cited of pedestrians crossing against a red light, after seeing an experimental initiator cross first (Lefkowitz, Blake & Mouton 1955). Bandura (1965) speaks of a disinhibitory effect when a subject increases socially disapproved behaviour after observation of this behaviour in another person. Studies in this line are relevant for clinical psychology, in search of methods to treat phobia's making subjects approach fearful situations or to lose fear reactions. Jones (1924), Bandura, Grusec, & Menlove (1967) & Ritter (1967) demonstrated fear reduction in subjects watching a peer approach the feared stimulus. Using the approach avoidance paradigm, this same fear reduction has been demonstrated in rats (Rasmussen 1939, Morrison & Hill 1967), cats (Masserman 1943), and pigeons (Hake & Laws 1967). Davitz & Mason (1955) find that fearful rats explore more together than alone, although even more so with fearless companions. In perspective of behaviour therapy, Baum (1968, 1970) and Uno, Greer & Goates (1972) studied forced exposure to a fearful situation as a method of fear-response prevention and found that the therapeutic effect is augmented by the introduction of fearless companions (as in Hall 1955).

The hypothesis, based on this prior evidence, to be tested here is that goldfish in groups will give an acquired approach response more quickly than when alone in a approach (swim a maze for food) – avoidance (presence of an electric shock) paradigm.

METHOD

SUBJECTS

In a previous experiment (Wijffels 1969) fifty goldfish (*Carassius auratus*), from 6 to 8 cm in length, learned to swim a maze for food. These same fish were the subjects of this experiment.

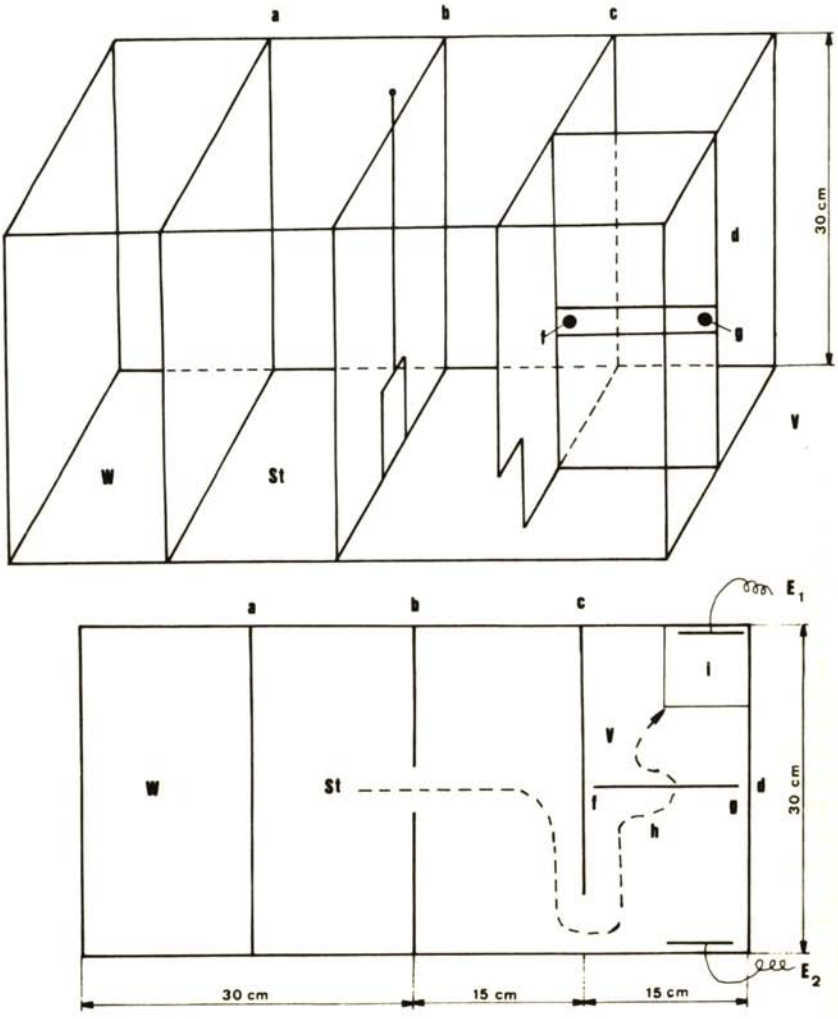

FIG. 1. AQUARIUM EQUIPPED WITH MAZE AND ELECTRODES. Explanation of the symbols: W = Living-room, st = starting-place, a, b, c, and d are vertical screens, h = fish has to swim up, v = feeding room, i = feeding cup (for *Tubifex*-worms), f = lamp, g = photocell, dotted line = the path the fish must swim, E1 and E2 = electrodes.

MATERIAL

Ten aquaria equipped with maze and electrodes, as shown in Fig. 1, were used. The partitions in the aquaria were (non-transparent) aluminium and plexiglas sheets and the water was 20 cm deep and at 20°C. The electrodes were galvanised messing blades (7 × 14 cm).

PROCEDURE

Ten groups of five fish were formed and placed in the living rooms (w in Fig. 1). Two trials were given per day and lasted a maximum of 90 minutes. Completion times were recorded, i.e. the time taken to swim from the starting point (S_1) to the end of the maze (v) where the food was placed (i). This record was taken automatically when fish performed in isolation (by interruption of the light (f) falling on the photocell), or made by direct observation in case of group performance. The individual differences in the coloration and in the shape of the spots on the skin permitted individual recognition of each fish in a group.

The two electrodes placed at the end of the maze (E_1 and E_2 in Fig. 1) gave, in the experimental phase, periodically (9 sec and 9 sec off) electric shocks (14 volt, 17 milli-ampère A.C.). The periodical interruption was because in some preliminary trials with continuous shock the fish appeared slightly paralysed and swam jerkily. The interruption thus gave the fish the opportunity to swim back to the starting place where the shocks were milder. The intensity of the shocks was determined empirically and higher intensities were avoided because then the fish turn on their backs and lie on the ground.

DESIGN

The ten groups of five fish were matched for prior experience: date of purchase, date and condition in which they learned the maze. A first retraining phase of 6 trials was given, then, in the second

		retraining phase	experimental phase	
			with shocks	without shocks
	N	trials 1-6	trials 7, 9, 12, 13, 15	trials 8, 10, 11, 14
5 groups A	25	alone '	together	together
5 groups B	25	alone '	alone	alone

TAB. 1. THE EXPERIMENTAL DESIGN. ' = Except trial 4: together.

experimental phase, trials with shocks (7, 9, 12, 13, 15: with symbol! in Fig. 2) were alternated with trials without shocks (8, 10, 11, 14). No food was given in the trials with shock. The design is given in Tab. 1. The retraining was given to each fish in isolation, except trial 4, where each group of five were together in the maze. In the experimental phase the 10 groups were divided into two conditions. In condition A twenty-five fish performed in groups of five, whilst in condition B twenty-five fish swam the maze alone.

The results are presented graphically in Fig. 2 and 3; Fig. 2 giving the median completion times per trial for each group and Fig. 3 the medians for each condition. It can be seen, during the retraining phase, that both groups show a definite recognition of the maze, perform equally well and improve slightly over the trials. The performances of both groups were affected when electric shocks were present, this apparently being more marked for the isolated fish. Moreover, while the fish in groups appear to recover completely in the trials without shocks, this recovery is only partial for the isolated fish. Because of these differences further statistical analyses were made.

trial	7!	8	9!	10	11	12!	13!	14	15!
group A	14	25	15	24	25	20	17	25	15
group B	12	19	12	18	21	14	10	20	9

TAB. 2. NUMBER OF ARRIVALS OF GROUP A (together) AND GROUP B (alone) IN THE EXPERIMENTAL PHASE. ! = with shock. In the retraining phase both groups give always 22 or more reactions (maximum = 25).

As can be seen in the figure, the effect of the shocks consists in a retardation of the reactions of the fish. Many times fish slowed up to such a degree that they did not arrive within the 90 minutes that a trial period lasted. Table 2 gives the number of arrivals of both groups in the experimental phase. These data confirm the results on basis of the median completion times, what can be expected because a non-arrival was treated as a very slow reaction (> 90 min). For this reason no separate analysis is required of the numbers of arrivals.

COMPARISONS WITHIN GROUPS

The median completion times of the twenty-five fish of each condition were compared by means of the sign test (Siegel 1956). Compared with the retraining phase both groups need more time to complete the maze when shocks are present ($pa < .001$, one side test). In the trials between shock trials the isolated fish are significantly slower compared with the retraining phase ($pa = .004$), while the difference for the grouped fish in the same comparison do not reach significance ($pa = .094$, two side test). Both groups perform significantly slower in the shock trials than in the non-shock trials during the experimental phase (A $pa < .001$, B $pa = .021$, one side test). The tests for comparison with the shock trials are one sided because a deterioration can be predicted; the test for comparison between the retraining phase and the intermittent non-shock trials are two sided because no difference can be predicted a priori.

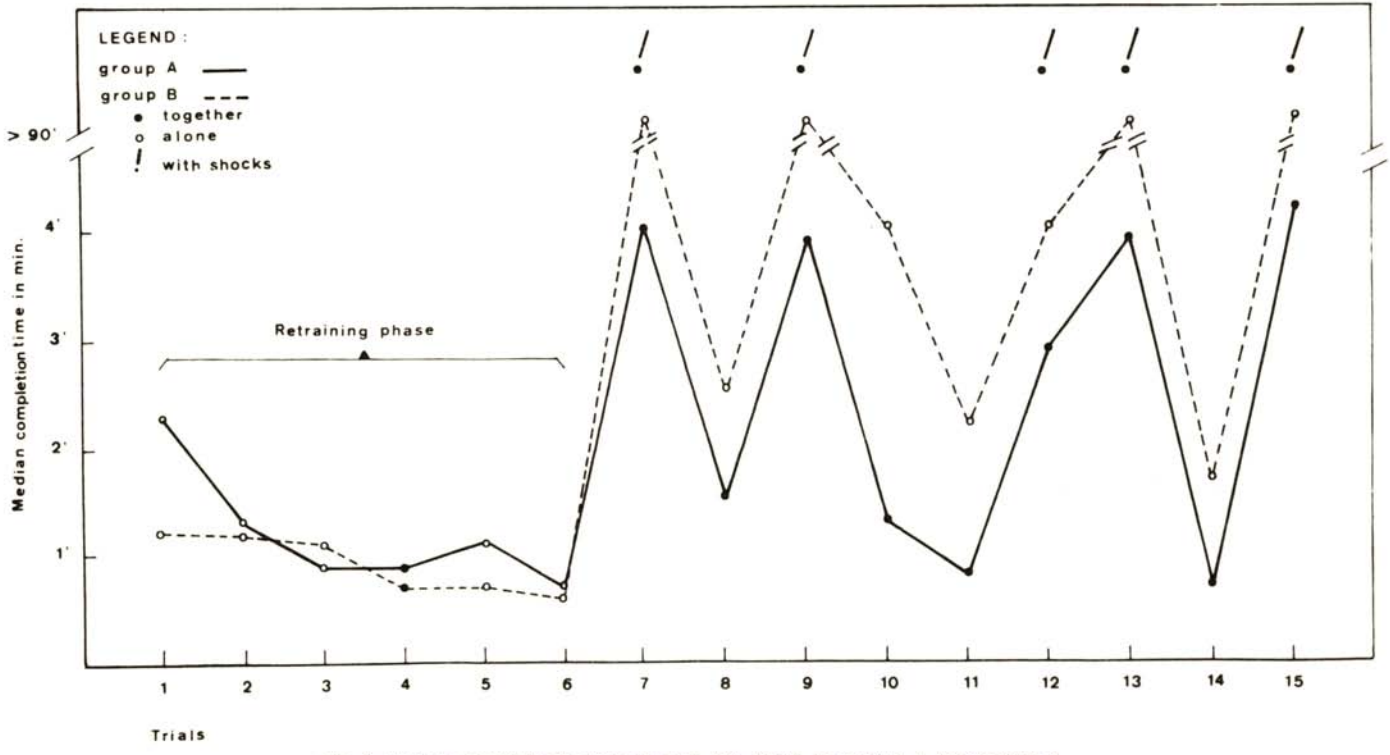

FIG. 2. MEDIAN COMPLETION TIME IN MIN. PER TRIAL OF GROUP A AND GROUP B

The median completion times of the twenty-five fish of group A were compared with those of the twenty-five fish of group B by means of the Mann-Whitney U test (Siegel 1956). In the retraining phase the groups did not differ significantly ($p_a = .62$, two side test). The observed differences in completion times during the shock trials (Fig. 2) did not appear to be significant ($p_a = .15$, one side test), but are highly significant in the non-shock trials ($p_a < .001$, two side test). However, it is significant that group A completes the maze quicker in each of the five shock trials and always has more arrivals ($p_a = .031$, one side test; sign test).

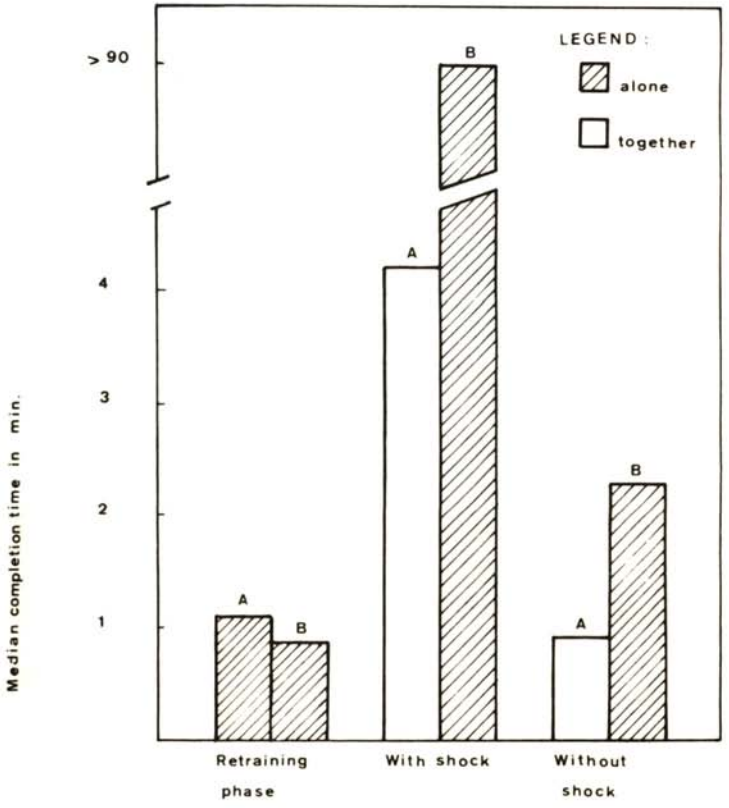

FIG. 3. MEDIAN REACTION TIME OF GROUP A AND GROUP B PER CONDITION

The administration of electric shocks at the end of the maze was an effective hindrance for the fish, because both groups are significantly retarded as compared with the phase of retraining. The shocks were, however, not too harmful because fish of both groups, and more than half of group A (the social condition), arrived in the shock trials. Social facilitation of the performance was found in the 5 shock trials as grouped fish arrive always more and quicker. The surprising result of this experiment lies, not in the shock trials, as originally expected, but in the intermittent non-shock trials. Here the isolated fish are slower (and give less arrivals) than grouped fish and they are also retarded compared with their retraining phase. The grouped fish however, recover completely and perform as well as if they had never received shocks in the maze (i.e. as good as in the retraining phase). The retardation of the isolated fish in the non-shock trials is surprising because no physical obstacle withholds them from the end of the maze. Therefore, another reason must be found. As an hypothetical explanation it is postulated that all fish remember the shock in the non-shock trials, but that companionship reduces fear (= memory of shock). Therefore, both groups must remember the shock, but only the solitary fish are inhibited by fear, and in groups the social factor makes the fish 'more courageous and more self-reliant' (as Rasmussen 1939 said of rats in comparable conditions). Welty (1934) speaks also of a quietening effect of the group in goldfish (learning a maze). Morrison & Hill (1967) think that timid members of the group are given some assurance by the presence of bold companions. The fear reduction may be due to the distraction offered by others, as first hypothesized by Davitz & Mason (1955), but also by innate reassurance or learned assurance from the presence of others. The learned-reassurance hypothesis received some support in the experiment of Morrison & Hill (1967) with rats in an approach-avoidance situation. The results of the present experiment represent a further proof of social facilitation of approach responses in a fearful situation and are interpreted by means of the hypothesis of a fear reduction by companions. Prior evidence has been presented in the introduction.

Both conditions of the experimental phase can be considered as fearful situations: the shock trials because of the administration of electric shocks, the intermittent non-shock trials because the isolated fish show a clear retardation that can only be explained by their memory (or expectation) of shocks. So it has been found that companions facilitate performances, although still hampered, in presence of fear provoking stimuli (shocks), and bring about a total recovery of normal performances while only the memory (expectation, fear) of harmful stimuli inhibits the animals.

As concerned social facilitation of performances of the maze in a non-fearful situation, trial 4 gives some information. The goldfish are

tested then in groups, before they ever received shocks in the maze. No social facilitation is found because the fish of groups A and B do not perform quicker than at trials 3 and 5, where they react alone in the maze (only 28 of 50 fish perform quicker in groups compared with their mean performance at trials 3 and 5). In a prior study (Wijffels et al. 1967) other fish (*Barbus ticto* Hamilton) performed in a similar maze quicker in groups than alone. This difference however progressively disappeared when alternation of conditions (alone/together) was repeated many times. In that study the fish were displaced from one aquarium to another and this may have provoked some fear. Habituation to this procedure possibly eliminated the fear and consequently diminished the social facilitation. Therefore it seems that social facilitation occurs mainly in fearful situations where fear reduction due to companionship can operate.

An objection against the interpretation of social fear reduction, could be that the grouped fish received less harmful shocks because they protect each other physically, thus having less fear of the shocks. Against this it can be said that goldfish do not school in a strict way or swim the maze in parallel. In fact they react to each other but don't follow each other systematically. So the fish in groups have been alone many times between the two electrodes, were the shock is most severe. In fact there have been even more fish at the most harmful place (more arrivals at the end of the maze – Tab. 2) in the grouped condition.

Another possible explanation of the social facilitation of approach responses observed in this experiment is offered in the theory of Zajonc (1965, 1966). Zajonc assumes that organisms in groups have a higher general drive state than in isolation and therefore execute their dominant responses in a certain situation more intensively. The concept of general drive however is imprecise and multidimensional with physiological, behavioural and theoretical correlates (Bindra 1959, Duffy 1962) and must not necessarily be postulated (Hinde 1968). Moreover anxiety is accepted as an emotional basis of general drive. In the line of Zajonc' theory the observed social facilitation could be explained by higher drive state of the grouped fish, which could be due to higher anxiety. Such an interpretation goes, however, diametrically against the major evidence of the litterature about the effect of the group in anxiety reduction.

On basis of the results of this experiment and the other evidence of animal studies, it can be suggested as a practical application, to use the group situation in clinical therapy, to help people to overcome their fear. Although it is not proper to infer similarities of mechanisms from apparent similarities of behaviour, studies in animals can be relevant for human psychology in furnishing fructuous research hypotheses. Here the hypothesis is that in man companions may also facilitate the performance of well-learned behaviours, that are under inhibition. The second hypothesis is that this facilitation is brought

about by reduction of fear. The group situation has been used in behaviour therapy mainly as a time (and money) saving procedure. Here it is argued that the group could also provide a better treatment and be specially effective in what is called 'assertive training' (as pleaded by De Moor and Orlemans 1974).

It must be noted that in working with groups where all of the members have some fear, one risks getting a mutual contagion and spread of fear and the outburst of panic behaviour. Such cases of contagion of fear have indeed been observed in animals (Thorpe 1963). Verheijen (1956) has shown such social facilitation of fear responses in fish, releasing panic in one group (with alarm substance) while in a juxtaposed aquarium members of the same species display the same panic as they observe. The same phenomenon has been observed by Baerends & Baerends-Van Roon (1950) in fish and Church (1959) in rats. Perhaps it can be stated this way that contagion of fear is only at work in some special occasions (as extreme fear), and that generally the group reduces fear of the members, even when all members experience it.

Shaklee (1968) distinguishes the effect of socii in an actual fearful situation, and the lasting effect on a subject which has been in companionship, but afterwards confronts the fearful situation alone. The latter is the durable success of a social therapy, the first the therapeutic situation itself. It would be interesting to plan comparable experiments to test the relative effectiveness of pharmaca and socii for both situations: actual release and durable change. Concerning the effect of socii, the effect of fearful and calm socii, must be studied further. At first sight it may seem that the calming effect is more probable with calm companions. Most experiments cited in the introduction use this type of companion. This experiment, as that of Davitz and Mason (1955), however, shows that even in companionship of fearful subjects fear reduction can take place.

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