more often than males change their name after marriage and thus the addresses and the names which we had found in the former records might no longer be true.

RESULTS

Study 1

The results of the first study correspond to earlier findings about typical antecedent conditions of career drop-out. These are mainly motivational deficits and a lack of social support. The drop-outs described themselves as having less endurance than the non drop-outs and as getting less emotional and task-oriented support from their coaches, especially after failure. They had more difficulties in coping with failure and tended toward a more feminine gender identity. In addition the drop-outs described themselves as being less affiliative, less extraverted and as shyer. In particular they described themselves as more passively waiting for social contacts rather than actively seeking them. But social skills and an openness to social stimuli are in the long run facilitating conditions for a successful sport career.

Though drop-outs as well as non drop-outs complained about several, partly rather serious injuries during their career it were the drop-outs who took the injuries as a reason to terminate their career. Therefore one might speculate that drop-outs and non drop-outs do not differ so much in their history of injuries but more in their psychological resources to cope with them and to continue their career. Potential drop-outs obviously should get more social support and more motivational training in order to prevent them from terminating their career prematurely. In addition some of the drop-outs complained of serious identity problems after having terminated their career. These were better solved when having a good system of social support (especially friends and family).

Study 2

In the second study the athletes made judgments about the end of their career in retrospect and described their further devolopment in life. The athletes are highly educated, 61% of them having a university exam. At the time of our mail survey 84% of the males, but only half of the females were working in the labor force. Those who carried out a profession often were not employed according to their education.

When asked about the positive and negative aspects of their involvement in elite sports males and females showed similarities but also some differences in their answers. The main reasons for pursuing a sport career are for both groups 'the physical challenge', 'self-esteem', 'journeys' and 'will to win'. More females than males emphasize 'flow' and 'friendships' (figure 1). With regard to the main agents of social support across their

Figure 1 Main reasons for involvement in elite sports

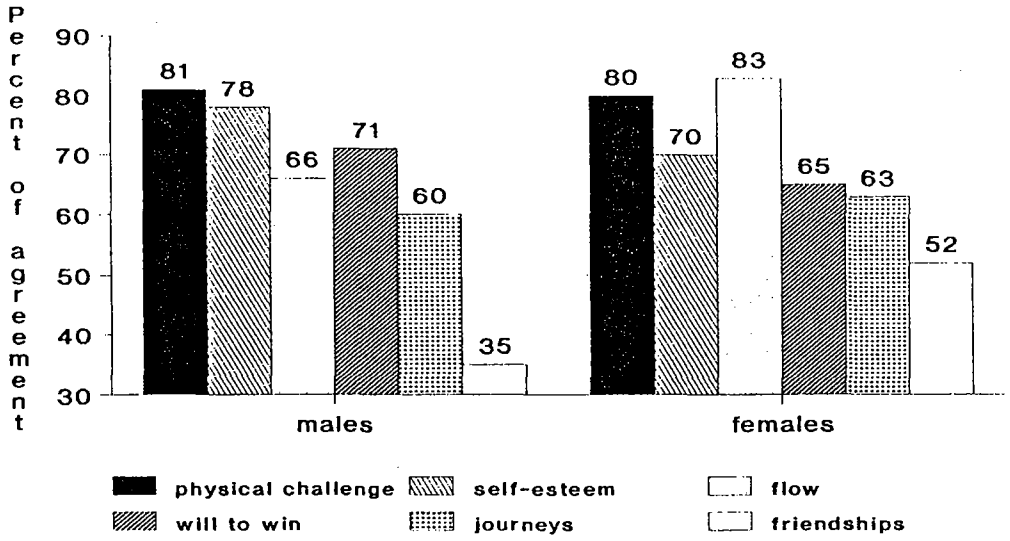
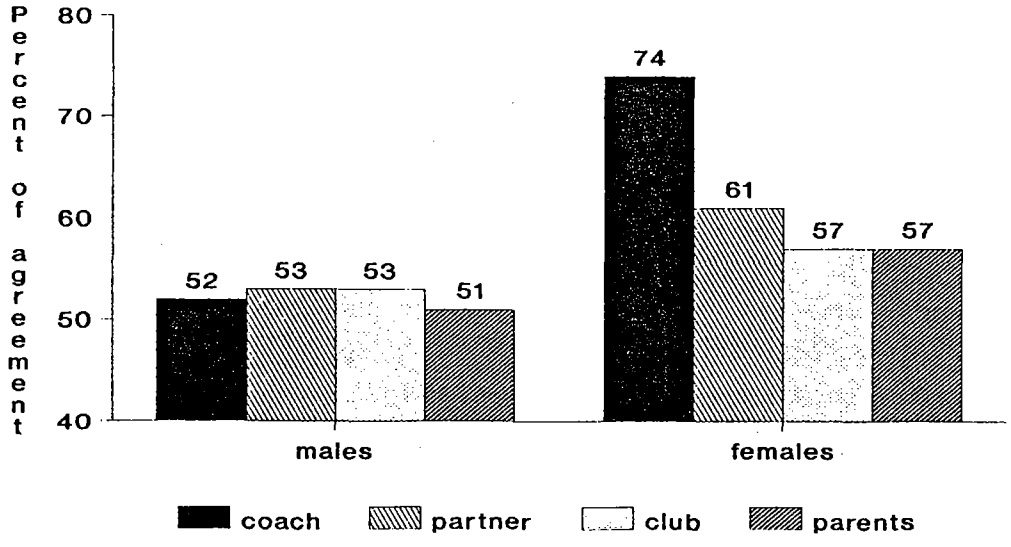


Figure 2 Agents of social support across the sport career



percent of subjects rating high support

career both, males and females, give the highest rankings to the coach, their partner, their club, and their parents, with females giving even more importance to the coach than males (figure 2). The female athletes also rate the quality of the coach's support more positively than the males: Seventy percent of the females, but only 52% of the males rate it highly positive.

When asked about the negative aspects of elite sports in general a majority does not mention negative aspects at all. Those who do either mention health problems (more than 30% of the subjects) or the unbalanced kind of life in elite sport (30% of the females, 18% of the males). But when asked about the negative aspects of elite sports for women in particular more athletes see disadvantages, mainly a lack of support for the professional career, a lack of financial support, incompatibility of sport career and family life, and problems in family planning.

Why did the athletes terminate their career? The main reasons are 'job involvement', 'health problems', and 'age, the time was ripe'. Each of these reasons was mentioned by nearly 50% of the subjects. Most of them remembered neither very positive nor very negative feelings and changes after retirement. It seemed as if in retrospect the life event of terminating the sport career and continuing with a new (professional) career was not critical at all. Only 20% of our subjects remembered positive emotions and consequences and even less (7%) remembered negative aspects. But 11% of the males and 22% percent of the females remembered problems like identity problems, depression, or isolation. What did our subjects miss after retirement? Journeys, the challenge of physical training and of competition were mentioned most often (by c. 50% of the athletes).

CONCLUSIONS

Though both studies are rather different with regard to the sample, the design, and the methods (the first one being a prospective, the second one a retrospective study) they show some similar results. Firstly one can see that only a minority of athletes gets psychological problems after career termination. But those who do should get some psychological advice as was also suggested by Sinclair & Orlick (1994). Secondly both studies show that the social support system is a very critical variable for career development. Not only is social support very important for getting involved into an athletic career but also for a better adjustment to a life after the sport career. And thirdly we can see many similarities in the meaning and importance of elite sport for male and female athletes, and some differences, mainly with regard to the perceived disadvantages of women in sport and in life in general, and with regard to the importance of the coach.

Women emphasized the coach's support more than men, a result that is also corrobarated by the findings of Holz & Friedrich (1988) with a sample of active athletes.

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[1]Funded by the Federal Institute of Sport Sciences, Germany

THE LIFE LINE INVENTORY : A NEW TOOL FOR INTERVIEWING THE ATHLETE IN TRANSITION CAREER

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Key words

Post-sport Career Transition, Neuro-Linguistic Programming, Systemic Approach, Retirement from Sport, Athletes Career Transition.

Introduction

Transition career of top level athletes has been described in different models inspired by thanathology or social gerontology (8). The transition model seems to propose a more realistic view of the athlete's situation : Scholossberg's model, often described is based on three interactional factors : the characteristics of the transition, the individual and the environment (10).

The systemic analysis provides a holistic vision of the athlete's situation, including those three components. From that point of view transition career has been described as a particular moment where the athlete may have the feeling of being social handicaped (2), according to the model used by Kielhofner (6) in occupational therapy.

The athlete's identity has been constructed mainly in the sport area as well as his values, beliefs and roles (2). Broom explains that it is "necessary from an early age to make sport a primary, if not almost exclusive focus of attention" (in 4)
According to J.M.Crook and S.E.Robertson (4), factors related to a successful retirement are :

- anticipatory socialization
- identity and self esteem
- personal management skills
- social support systems
- voluntary versus unvoluntary retirement.

NLP approach in the interview of the athlete

If NLP refers to neurology by analyzing our thinking process and to the language we use (9) (12), it refers also to the programming of our behaviour (1). So it "relates our words, thoughts and behaviour to our goals" (7).

R.Dilts (5), has developped a model where learning can happen at different levels : environment, behaviour, capability, belief, identity and spiritual (figure 1).

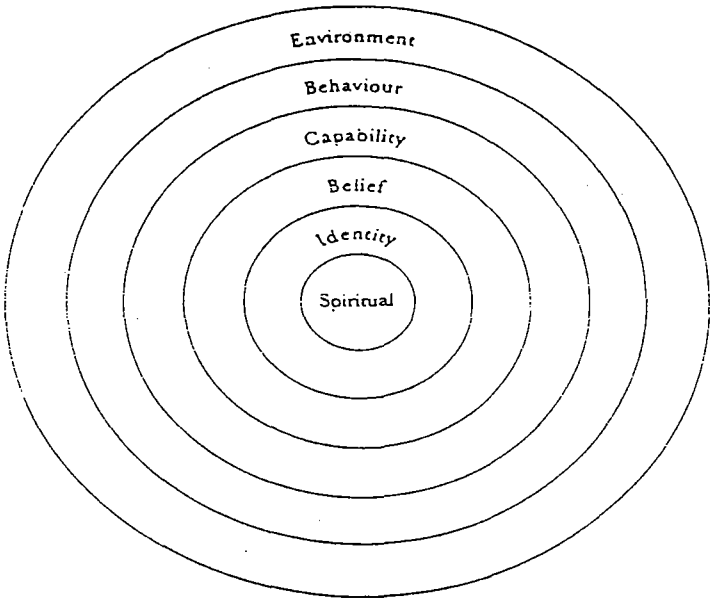

figure 1. Neurological levels described by R.Dilts (in 7)

These studies pointed out the importance of personnality and the socio-cultural background to rebuild a new professionnal life, where the identity is the main axis of intervention.

If the athlete's identity has been based on sport pratice and if there is no way to go further in that direction, the idea is to help the athlete to transfer his capabilites in other area and to make him fore conscient of the ressources he is completely able to use or tho develop.

Who we are is accessible by *what we do* and *why we do* it : the identity way be reached by the meaning of the behaviour, including beliefs and values.

However, sport psychologists do not have many tools to help the athlete in that direction. This lead us to create a specific intervention tool and to accompany the interview with a psychological intervention based on the neuro-linguistic programming.

Material and method

The life line drawn

At first, it seems necessary to have a good idea of what is in athlete's mind relating to the situation. This is the reason why we ask them to draw their life line.
"NLP is about our subject experience : how we think about our values and beliefs, and how we create our emotional states (7)"
The procedure is personalized in the way the athlete draw the life line : on a straight horizontal line, on a straight oblique line, on a curve, with different levels...(see annexe 1, figure 2).
After the first part of the test including the personal drawing but also listing meaningfull events as described below, we propose them another design which is the beginning of the psychological intervention .The pattern is traced spirally which creates a symbolic huge difference : in the first case, a line ends and there is no "continuum" of achievement possibilities.
The spiral is the sign of an unfinished process where the first part is in connexion to the athlete's sport career and the second part to his new professional direction. The unwedging of the second curve on the left and upper side is the symbol that the anterior experiences may serve as foundations to a new orientation. It is absolutely not a end, a break or a failure but it is another life slice. The subject has not to start again from the beginning but to develop himself in a new direction which may lean on the feedback of the past (annexe 1, figure 2). This point of view allows us to reduce or to relative the athlete's reponse classically described in stages related to the stock, denial, depression and acceptance.

Listing events

The same reasons lead us to ask the athlete to describe 10 events, meaningfull to them. In any case, they have been asking to explain why such event was meaningfull, which refers to the values and beliefs and which are the roles win or left related to the event.
With these events, it is possible to have the access of the "core values" of the athlete. "Core values" are the cluster of values you can draw from the significant experiences in your life.

According to Kielhofner (6), the values refers to the temporal orientation, the meaningfull of the activity, the occupational goals and the personal standards.
The core values may refer to the beliefs of the subject : tie within values constructe beliefs.

NLP intervention may also be away to sap some beliefs which do not serve the ahtlete and changing beliefs is such a powerfull way to change behaviour.

Psychological intervention to let the beliefs saping

Present analyze

The first intervention step is to change the athlete belief that stopping a sport carrier is a failure : NLP point of view is that "there is no failure, only feedback" the more that "the belief that failure is real is one of the most common and limiting beliefs that there is. Believe instead that there are no errors, no mistakes, only results and outcomes" (7).

Values analyze

To have an access to the core values of the athlete allow us to place in hierarchical order the priorities and to research a realistic equivalent available in his future life.

Anticipatoring the future

In fact, after making their life balance, one important thing for the athletes is to be able to anticipate the future.

Defining an objective :
To have a clear idea of an objective allows us to build it on solid foundations. The athlete professionnal plan has to respect the 7 criteria to formulate a coherent objective, as proposed in a NLP intervention.

Anchoring resource:
According to O'Connors (7) "One way to have more choices about your emotional state is to transfer positive resources from the past experiences via an association or anchor", providing the wellknown example of the lucky mascots used by the athletes to prepare themselves to the competition.
The athletes use to make some association to enhance their resources and it is not a problem to let it done for future events.

Developing strategies:
Some mental strategies of the athlete may be changed if they are not adapted to himself or may be developed if they are missing.

Discussion

In some studies, the athlete's life has been represented on a classical time line to evaluate the critical periods of their sport pratice (11) (13). Our purpose is on one hand to let the athletes free to draw their own life line which may present some variability in the design but is related to the way they feel their life. On the other hand, we propose them a spiral pattern, which is quite new, to begin our psychological intervention. According to Wylleman (13), "there is still a need for more accentuated research on the retirement and social intergration of top-level athletes". We would like to add that other people have to cope with the same kind of problem, even if they are not top level athletes : a part of our research deal with athletes who did not reach the top level but have sacrifice their youth with intensive sport pratice. Another part of our activity deals with physical education teachers who become unable to give their lessons, due to injuries or age. According to Zaichowsky and al. (14), "as amateur sports become more professionalized in nations through the world, the need for better understanding elite ahtletes and coaches career transition needs and implementing programs to help meet their needs will increase". With amateur sport pratice, in obligation to stop definitively or momentarily, the life line inventory may be usefull to help them to recover themselves and to build a better future.

The avantage of the inventory consists in the easiness to let it pass and in the short time it takes. The analyze is individualized as well as the psychological intervention. This clinical point of view is based on the fact that each athlete reacts with his psychological components in his own environment. If there is an absolute necessity to enhance our theorical frame with model validation, it may not let us forget the field reality.

In the psychological service regarding to sport career, it is possible as described by Stambulova to use the "crisis for the weal of development of an athlete"(11).

Working on beliefs and values provides more consciousness and gives a large understanding about who we are. It allows the subject to reach a goal by a different way, respecting his core value. Consequently, the congruence of the subject is completely respected.
"If you change just one belief, you will also change a lot of your behaviour." (7)

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Annexe 1

figure 2 : the spiral life line

CAREER TRANSITIONS OF MALE CHAMPIONS

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KEY WORDS

career transition, male champions, identity, narcissism, separation, mourning, reinvestment

INTRODUCTION

For a better understanding of how male top-level athletes handle their career transitions it is necessary to consider in particular the impact of the psychic and social dimensions during this transition. Importants studies (Werthner & Orlick, 1986; Baillie & Danish, 1992; Sinclair & Orlick, 1993) contribute in extricating the difficulties and specific needs of athletes when facing, voluntarily or not, their career end. Necessary preparation programs for athletic retirement are proposed (Zaichkowsky, Kane, Blann, & Hawkins, 1993; Sinclair & Orlick, 1994) for this stage of life often described as stressful and traumatic (Ogilvie & Taylor, 1993).

At the same time, psychodynamic contributions (Carrier, 1989) as well as direct investigations with the concerned individuals (Messner, 1992) or personal contributions of the concerned champions (Antoniadis, 1981) are rare. Our interest consists in studying the male condition in the sport setting with the objective of better understanding the significance of sports careers to male champions. The practical works of psychodynamic inspiration (Beisser, 1977) and sociological inspiration (Messner, 1992), in regard to the relationship between the investment in sport and the masculine condition, question especially the defensive means (ritualisation, heroism, machoism, etc.) which men use to structure their gender identities.

We regard career transition as a period of revelation concerning the athlete's ability to maintain the cohesion of his identity. Thus, investigating the psychosexual function of physical activity might give us the opportunity to reflect upon the relationship between the participation in high-level sports and the evolution of identity construction. While focusing on the lives and careers of male champions and their identity concept, we ask the following question : how do they live the loss of their roles as active champions, taking into consideration their capacities to change their identifications ?

METHODS AND PROCEDURE

Our study is based on in-depth-interviews (1-2 hrs) with 20 Greek and 15 French male retired champions with international careers in the most popular national disciplines (Greece : football, basketball, volleyball, track and field, waterpolo ; France : football, tennis, track and field, swimming, fencing, judo). All champions retired during the last five years (between a couple of months and five years ago) and participated in some of the most important competitions such as the Olympic Games, the World and European Championships or the Davis Cup.

During the interviews, we trace both the athlete's family life and sports career being especially interested in the origins of sports motivation, the value of sports in their families, the "sacrifices" related to their sports career, identity benefits linked to their sports career, the acquired status (familiar, social and economic) through sports, the reasons for ending the career, the way the athlete prepares for and handles transition, the role sports play today in his life, his plans for the future, his ideas about gender and sports, etc.

DISCUSSION

In order to deepen certain points we limit our discussion to four themes which have been extricated through content analysis:

- structuring identity through the practice of top-level sports
- sports : "the best of all drugs"
- the champion's narcissism facing the challenge of time
- the cultural dimension : the active champion's image and status

Structuring Identity Through the Practice of Top-Level Sports

The everyday life of a top-level athlete demands a spartan discipline where emotional and sexual relations are subordinate to the demands of the sports career. This way of life can serve as an efficient means of protecting against sensitiveness and inner weakness for the young puberterian, the adolescent and the adult athlete. If there is any link between inhibition and sport activity, we have to search for it on the emotional level. The champions who talk about the necessity to "have a macho-attitude when going into a competition" admit that there is no

place for feelings, neither during practice nor during competition. On the other hand, success in sport may procure pleasures which the "athlete-connoisseur" often describes as overstepping the limits of what other personal activities offer. Thus, a world famous football (or soccer) player declares that "the feeling linked to the shooting of a goal can be much stronger than sensations felt during sexual orgasm."

Those interviewed confirmed that their identity as champion reinforced their psychic structure through gratifications which accompanied their career (sports and economic success, social recognition, being an idol, etc.). As a consequence, this reinforcement may function as a "one way" identification if the individual uses the sports hero's identity as his exclusive identification and satisfaction source. This identity monopoly is illustrated by a world famous champion who says : "When I was playing I had an identity, but outside sports I was nobody."

Some athletes neglect other possible sources of identification which are indispensable for maintaining one's "inner equilibrium" during and after transition. This negligence of other spheres of personal evolution is reinforced in certain sports by the athlete's protection through a clan of coaches, managers, familiy members, etc. In this structure, the athletes are cared for and detached from many responsibilities and realities. The question of the athlete's autonomy is a critical point of discussion as illustrated by one of the interviewed champions who describes the image of a "glass house" with the association of the fragility that accompanies those who leave this microcosm. We can remark that physical activity has a modeling effect on the process of identity formation : existing through sports can cut both ways, namely liberation and inhibition.

In order to better seize the complexity of male identity, it seems necessary to conceive it as a construction (Stoller, 1968). Thus, the male identity is particularly influenced by the immediate environment (the family) and successive identifications (to the father, to idols, to the coach, etc.) during infancy and puberty. We remark that the foundations of this construction are sometimes very fragile, especially since the intervention of a social learning process creates certain norms which demand the inhibition of "feminine sides" (e.g.: "You aren't allowed to cry because you are a boy" or "football is only for boys").

In this context, the exploit of supposed viril attitudes, so-called 'phallic narcissistic' (Fain, 1990), constitutes a present aspect in many champions' discourses, for instance, the devaluation of certain feminine attitudes (the excessive weakness associated with female

charateristics). The identification to these male characteristics by a young athlete is made easier since he finds them regularly represented in his idols. From this point of view, we can consider sports as a continuation of the personal learning of gender identity.

Sports : "The Best of All Drugs"

Asking champions about how sports (particularly high-level sports) can contribute to the individual's evolution reveals quite homogenous answers : physical activity gives the possibility to have an efficient body, to travel, to live intense moments, to prove something, to be with friends, to be protected from the negative influences that might occur during puberty and adolescence (alcohol, smoking, drugs, "bad" relations, ...). Moreover, the theme of drugs occurs quite frequently during the interviews : The champions evoke the need for physical activity and competition while being out of the sports setting and they do not hesitate to characterise sports as "the best of all drugs" or a "dose".

For example, the champion Mark finished his successful sports career upon the death of his father in order to take over the family law firm. This 30 year old man who succeeded in both international competition and university studies describes the first few months after retiring as "horrible" especially since the lack of sports caused him a series of problems :

"I had problems with my body, my nerves, I couldn't wake up. When I was a player I needed only six hours of sleep, even after hard days. Now, without practice, without being bodily tired I can sleep twelve hours and when I want to wake up, I want to sleep for an hour longer. This is clearly linked to the end of my career. And there are many other things : sexual appetite, being nervous, stress. I cannot imagine something more like drugs than sports."

This change from intensive physical activity to no activity at all, made him preoccupied by his bodial transformation (gaining weight, loss of muscular mass), his nervousness, the fall of his libido and a general state of anxiety. He did not only lose his father but he was also forced to fit into a new role (lawyer) where there is no place for playing. Mark lost an entity through which he existed, especially when he adds that "since I can remember, I have been doing sports. As long you play and as long you feel like a child, you stay young." He accepts the new responsabilities but suffers from the lack of the source of satisfaction and identification linked to playing. According to his definition, he is no longer young and so the separation from sports produces a real longing in the champion, signifying his addiction to sport. Instead, he establishes another addiction, that of sleeping, by doubling the quantitiy of his former

sleeping time. For him, youth and sport seem to belong together and it seems as if through sleeping he tries to delay the daily confrontation with time and loss.

The Champion's Narcissism Facing the Challenge of Time

Questions around identity issues may arise : How can champions prepare for bodial and social aging in a realistic and effective way ? How does the champion answer classical questions such as "Who am I ?" or "What am I doing now ?" For many champions, the act of giving up the role of the elite athlete signifies an unprepared loss of an essential base of their identity; unprepared because they ignored the fact that the life of a sports hero is a short one or because an injury or an accident forced them to end their career.

Considering the maintenance of identity through time as a major problem of the aging process (including the problematic nature of multiple vicissitudes and all kinds of loss), the concept of narcissism constitutes a decisive element for the understanding of aging phenomenas. To explain narcissistic vulnerability it is necessary to address the identity concept. The individual's psychic structure is given the task of maintaining identity through real and imaginary threats, traumatisms, frustrations, but also through the specific difficulties of each type of libidinal economy (Bianchi, 1984).

The loss of an external object, quite often idealised as is the case for the sports hero, is painful and reveals the Achilles heel of each narcissistic structure. As a matter of fact, the champion's transition demands certain capacities which require the work of disinvestment and of mourning. Successfully passing this life stage depends on a psychic structure favouring more elaborate ways (mutation of identifications) over regressive ways (i.e. superfluous idealisation of youth or closing oneself in an unrealistic world). Realising what is lost and accepting the symbolical castration are the two main conditions for work of mourning. In this way, we refer to the quality of a strong identity base : the individual who succeeds in altering his identifications will know how to readjust himself elsewhere and overcome the loss of this source of satisfaction and identification.

The Cultural Dimension : The Active Champion's Image and Status

The sports press of France and Greece constantly use an irrational vocabulary to describe the state in which sport can put an individual: *madness, delirium, fatality, immortality, gods, etc.*

The regular resurgence of historical and mythological elements which are integrated into the present sports reality manifests the human need to evoke the past and the supernatural. This phenomenon leads us to the question : What does the champion represent in the eyes of the public ? Why do French tennis players became again the *Musketeers* after winning the Davis Cup in 1991 ? Why, on the other side of the Mediterranean, do the most important sports clubs bear names like *Ares, Olympus, Apollo, Hercules, Orpheus, Orestes* ?

From this point of view it is not astonishing to observe not only children and adolescents but also adults with tendancies of identification and idealisation : reflecting upon the dialectic between super-ego, ideal ego and ego ideal, we might describe the ideal ego as the basis of heroic identification (Lagache, 1958). The young athlete's identification to exceptional and prestigious personalities (idols, celebrities) can be the starting point towards a strong career investment. An associative chain linking gods (expression frequently used by the champions in order to classify their status towards the public) to immortality risks to be established favouring this "identification-idealisation" (an essentially narcissistic formation) based on the ideal ego.

Greek mythology offers us a good example of the proximity between man and god: Zeus, the ruler of the gods, was never described in any oral or written stories as an example of perfection. According to Homer, many of his adventures were less than heroic and embodied many of the same desires of man. As Zeus is worthy of the image of man who created him, we can imagine "how this proximity helped the Greeks to act, to think and to create as *isotheoi* (equal to the gods)" (Nicolaidis, 1988).

The champion's image and status in the cultural context is based on what his personal history represents for the public and their collective memory. The collective ideal becomes efficient through the convergence of individuals who replace their ego ideals by the same object (Laplanche & Pontalis, 1967). The sphere between on the one hand, objectal investment through the public (spectators, future champions, other athletes, etc.) and on the other hand, the champion's narcissistic investment is another dimension which illustrates the dilemma for the retiring star. The task of accepting his death as an active champion demands the abandon of such a gratifiying position : preparing for the life of a human mortal for those who were quasi-gods in the imagination of the crowd signifies the renouncing of a means of satisfying one's auto-erotic needs. Refusing immortality implicates the temporal dimension of the reality principle which opens the way to work of separation and mourning.

CONCLUSIONS

In general, the interviews gave us the impression that the champions were quite pleased to talk about their situation in a way different from their usual interviews with journalists. On the other hand, most of the men have already distanced themselves from their career termination, especially if they have been successful in their new professional role. This distance does not prevent them from encountering difficulties when speaking about themselves as men and not as the champions they once were. This well-defined role protects them when exhibiting their conficts, their preoccupations, their desires or their needs.

Considering male identity as a construction, sports signifies a means of structuring the boy's and young man's identity (Chamalidis, 1994). Man's wish to structure his masculinity through sports can manifest itself, for example, in the need to prove in an almost dramatic way the superiority of men over women. The hypervaluation (through the status, the public, the money) allows certain athletes to play up the so called masculine (being competitive, brave, agressive, destructive, powerful, sovereign) and narcissistic qualities inhibiting an essential part of their emotional life (sensitiveness, emotions, etc.). From this point of view, further investigations are necessary if we look to Michael Klein who states that "the insufficient theoretical discussion of masculinity in sport corresponds to the uncertainty of the male role in modern society in general." (Klein, 1990).

As in all stages of transition, retirement from high-level sports requires adaptation which tests the individual's narcissistic structure. In this context, the career end is a crucial period concerning the capacity of maintaining the cohesion of one's identity. At the same time it means a chance for the reevaluation of one's limits and those of one's desire. One of the interviewed champions reminds us that the male condition can be an essential part of this dimension. Calling himself a former "macho", he confirms that the personal collaboration with a female psychologist during the end of his career contributed to "a healthier sense of self".

No technique, no theoretical knowledge can ever replace the necessary act of identifying oneself with the figures of the elderly, age and death. "*Si vis vitam, para mortem.* If you want to live, prepare for death." (Freud, 1915).

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THE TRANSITION OUT OF SPORT: A PARADIGM FROM THE UNITED STATES

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The athlete in the United States follows a course different from that of athletes in other countries. In the United States, organized sport on the community level serves only youth below secondary school age, and adults interested in continuing in sport after their education is completed. With rare exceptions, such as community swim teams which exist in some towns where the schools do not have swimming pools, sport is the province of the educational community from the time the athlete enters high school until the athlete completes her/his education. Gifted athletes then move to professional sport, or to Olympic training. Despite the fact that studies in the United States have consistently found the transition to be a stressful time for athletes (Baillie, 1992; Blann and Zaichkowsky, 1986; Coakley, 1988; Greendorfer and Blinde, 1985; Kane, 1991; McPherson, 1987; Ogilvie and Taylor, 1993; Zaichkowsky, Kane, Blann & Hawkins, 1994), there appears to be little offered to athletes on a systematic basis to help them transition successfully.

Schools and colleges may address transitional issues, but this is usually done in the broader context of the transition from student status to worker/adult status. It is usually carried out through programs offered by counseling centers or career service centers. Elite student athletes are, for the most part, simply expected to make the transition successfully without special

attention. Few professional teams offer programs to assist their athletes in dealing with the transition from their sport careers. This failure is usually attributed to the desire of the teams and coaches to keep athletes focussed on their work while they are competing (Crook and Robinson, 1991; Lipsyte, 1987; McPherson, 1987), and to an unwillingness to spend money on athletes once they are no longer competitive. However, the National Basketball Association (NBA) does offer career counseling, but only if an athlete requests it. The National Football League (NFL) currently focusses on degree completion programs for its players, rather than on career education programs. Players organizations attempting to fill in the gap tend to offer programs which focus on entrepreneurship (Lipsyte, 1987). The United States Olympic Committee (USOC) offered career counseling for Olympic athletes in 1988, but this program is currently unfunded.

Because so little is done by government or by the organizations that deal with elite athletes, the issues of transition out of sport are being addressed by sport psychologists (Baillie, 1992; Kane, 1991; Ogilvie & Howe, 1986; Zaichkowsky, Kane, Blann & Hawkins, 1994). The trend among these psychologists is to view the transition as encompassing more than just a career transition. This paper is an attempt to present an holistic view of the transition, seeing it not just as a career change, but as a life event that affects the athlete on several levels.

The paradigm presented is the result of a study of 19 former professional athletes from the NBA, the NFL, the National Hockey League (NHL), and Major League Baseball (MLB) and of their wives. The paradigm has been used in the study of other elite athletes (Hawkins, Blann & Zaichkowsky, 1993), and is being used in individual work with athletes who are transitioning into their post-sport careers. In this paper, the term "metagonic transition" is used

to describe the transition of the elite athletes out of their sport careers and into their post-sport careers. The term is derived from "meta" meaning change, and "agon", meaning challenge. The metagonic transition is viewed as a life event that affects not only the athletes, but also those who are close to them, but for the purposes of this paper, there will be a concentration on the transition into the new career.

Stages of transition.

The data indicate that for most, the metagonic transition began before the last competition. This initial stage seemed to serve the athletes much as a terminal illness warns of impending death and allows the grieving to begin while life continues. It was a conflicted time, when the athletes first recognized that their sport careers were ending, but competition continued. For most, this stage lasted for about one year, but few seemed to undertake any meaningful preparation for a new career, and most appeared to be in denial. This stage ended, and the second began, with the last competition.

This second stage usually lasted from 2 to 6 months. A distinction must be made between those who entered the metagonic transition because of aging or chronic injury, for whom this was often a very positive time of physical and emotional recovery from the rigors of their sport career, and those who had simply been cut, for whom this stage was more difficult. Denial was present in virtually all athletes at this stage, and little attention was being paid time to future career plans. The problems for the athletes in this stage seemed to develop when it continued for too long beyond the normal off-season, when the loss of structure began to seem threatening, and felt like a loss of control. It was usually

at this point that athletes began to deal with the existential question of what they would do with the rest of their lives, answering which necessitated choosing a new career.

The third stage was more problematic, and started when the athlete began to focus on the future. The stage appeared to last more than 5 years, and it was during this time the work of identity transformation was undertaken. This occured on the levels of self and career, and while these two are intertwined, the process was fulfilled differently for each

On the level of self, control issues emerged in the attempt of athletes to provide structure for their lives independent of coaches and agents who previously gave them the feeling of control. Many of the athletes experienced emotional lability which made them feel further out of control, but which originated in the loss of self-confidence and feelings of confusion engendered by their new state. Most athletes at this stage talked to no one about their concerns, and often felt isolated from other athletes, realizing for the first time that they had made few solid friends outside of sport. This loss of social support can become critical for people who feel developmentally or socially behind others of their cohort group, a condition which is sometimes attributed to athletes' intense focus on sport from an early age (House, 1987).

On the level of the career, the athletes experienced the same four factors, control, affect, social support and developmental stage, operating. The need to focus on another career, one which seldom gives as much pleasure and meaning to their lives as their sport careers did (Houlston, 1987; Wolfe and Lester 1989), is difficult but necessary if a feeling of control

is going to be established, and if the next stage is to be reached. Finding the necessary focus was complicated by the difficulty many of the athletes had in making a real committment to another career, their affectual state being one of decreased confidence. The need for a mentor emerged as the athletes realized their need for social support in their careers, and as they realized that others who were just entering the career they had chosen were often from a much younger cohort group. Most moved through several careers in this intermediate time, searching for one which satisfied them and to which they could feel committed.

The beginning of the fourth stage seemed marked by acceptance: acceptance of a changed socio-economic scale, and of a career that would not satisfy as thoroughly as the first one did. The former athletes in this stage were focussed and were beginning to feel skilled in their new careers, and were usually beginning to feel more in control. Those who appeared to reach this stage were out of their sport for seven or more years, and some who were out longer had still not reached it.

CONCLUSION

The transition is a difficult time for most elite athletes in the United States, a time of adjustment for which they are not really prepared. It would be helpful for athletes to know that the metagonic transition may take up to seven years to complete, rather than the one or two years many have been led to believe is sufficient. The false expectations created by this expectation can make athletes feel that they are failing when in fact they may be moving through the transition in good time.

This paper has been an attempt to consider the metagonic transition of

elite athletes from the United States in a holistic and systematic way The metagonic transition need not remain a time of mystery. The rewards for a sport career are often enormous, both personally and financially. The hidden costs, which are all personal, can also be enormous. Until athletes and former athletes begin to acknowledge these costs, both to themselves and to each other, the costs will continue, and will probably increase.

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ACCOUNT-MAKING AS A TREATMENT MODEL FOR DISTRESSFUL REACTIONS TO ATHLETIC RETIREMENT

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Key Words

Account-Making; Retirement

Introduction

Research in the area of career transitions among elite athletes, is itself, in a period of rapid and extensive transition. A steady stream of anecdotal, theoretical, and empirical explorations has emerged over the past twenty-five years and brought attention to the factors involved in the process of disengaging from organised sport (Ogilvie & Taylor, 1993). A number of these studies have examined the overall phenomenon and identified that chronological age, deselection, free choice, and injury are the most frequent structural factors involved in retirement from athletics. Research on the termination process has also offered a variety of perspectives on how to assist athletes prior to and during inevitable career transitions. Thus, it appears that as the demands associated with competitive sport have increased over the years, so has the research regarding career termination issues among elite athletes.

Numerous scholastic and anecdotal efforts examining elite athletes have advocated that a significant number experience difficulties upon retirement from sport (e.g., Allison & Meyer, 1988). While these writings have proposed that distressful terminations are manifested in a variety of dysfunctional ways, several contrasting studies have revealed minimal or no evidence of difficulties associated with disengagement from organised sport (e.g., Greendorfer & Blinde, 1985). The sport scientific community has continually addressed this discrepancy by utilising various explanatory models to conceptualise the disengagement process. Social gerontological theories, for example, have been applied to sport in order to equate the athletic

retirement process with retiring from the workforce. Thanatological models, in a similar fashion, have utilised Kubler-Ross's (1969) theory of death and dying to explain distressful reactions to athletic retirement. Both of these perspectives have, however, received considerable criticism for not portraying the disengagement process from a developmental point of view. While models of transition (e.g., Schlossberg, 1981) have provided sound frameworks for research in the area, they fail to offer characterisations of the entire process of retirement from sport (Taylor & Ogilvie, 1994).

Recognising that there is a lack of theoretical models into the widespread phenomenon, Taylor and Ogilvie (1994), as well as Gordon (1995), recently developed conceptual models of athletic retirement. These models, which examine the entire course of athletic retirement, focus on: 1) identifying the causal factors that initiate the career termination process; 2) specifying the factors related to adaptation to retirement; 3) describing the available resources that will affect the response to retirement; 4) indicating the quality of the adaptation to retirement; and 5) discussing the treatment issues for distressful reactions to retirement. As Taylor and Ogilvie (1994) have stated, the strength of these models is that once specific retirement difficulties are demonstrated, appropriate therapeutic interventions can be recommended. There have not, however, been any systematic investigations into specific intervention techniques for individuals experiencing athletic retirement difficulties.

Distressful Reactions to Retirement

While it is apparent that retirement from sport does not automatically cause anxiety, it is clear that the potential for trauma always exists (Sinclair & Orlick, 1993). Although the question remains as to whether the tip of the iceberg is being seen, researchers have been consistent in their concern for what might be the hidden significant number of athletes who experience difficulties upon retirement from the world of sport (Ogilvie & Taylor, 1993). As demonstrated in Table 1, a review of eleven studies which have specifically examined and documented distressful reactions to retirement from sport indicates that 18.8% (n=400) of the elite-level

athletes surveyed required significant emotional adjustment. As in other studies which have computed average effect sizes with athletes (e.g., Vanden Auweele, De Cuyper, Van Mele & Rzewnicki, 1993), the total sample in this review (N=2120) covers a wide range of sports and athletic levels. Nevertheless, these results suggest that a population of former athletes exists who may require treatment of retirement-related difficulties. It is, therefore, suggested that further attention be given to the development of therapeutic interventions for distressful reactions to retirement.

TABLE 1. Weighted Effect of Studies Measuring Severe Emotional Adjustment to Retirement from Sport

Reference	Sample	Emotional Adjustment
Mihovilovic (1968)	n = 44 (Professional; 44 Males)	6.8% serious psychic state, abandoned, fear future (p.83)
Svoboda & Vanek (1982)	n = 163 (Olympic; 30 Females/ 133 Males)	17.68% had yet to recover psychologically (p.171)
Greendorfer & Blinde (1985)	n = 1124 (Collegiate; 697 Females/ 427 Males)	17% indicated some or extreme dissastisfaction with self (p.107)
Werthner & Orlick (1986)	n = 28 (Olympic; 14 Females/ 14 Males)	32.1% had a very difficult time in the transition (p.344)
Allison & Meyer (1988)	n = 28 (Professional; 28 Females)	30% had feelings of isolation & loss of identity (p.218)
Curtis & Ennis (1988)	n = 96 (Elite Amateur; 96 Males)	14.6% experienced quite a feeling of loss (p.95)
Blinde & Stratta (1991)	n = 20 (Collegiate; 18 Females/ 2 Males)	80% indicated the feelings often paralleled to death & dying (p.8)
McInnally, Cavin-Stice, & Knoth (1992)	n = 367 (Professional; 367 Males)	26% experienced moderate to severe adjustment in emotional life (p.4)
Sinclair & Orlick (1993)	n = 199 (Amateur; 100 Females/ 99 Males	11% felt generally dissastisfied about life (p.143)
Wylleman, De Knop, Menkehorst, Theeboom, & Annerel (1993)	n = 44 (Olympic; 7 Females/ 37 Males)	14% were confronted with severe emotional problems (p.904)
Parker (1994)	n = 7 (Collegiate; 7 Males)	85.7% reflected negative expressions & experiences (p.299)
Total	N = 2120	18.8% (400 retired athletes)

A Proposed Intervention Program

What follows is a proposed intervention which addresses a method for treating distressful reactions to athletic retirement. The first phase in this program consists of identifying individuals who have experienced an unhealthy transition out of elite-level sport. It is suggested that a conceptual model (e.g., Gordon, 1995; Taylor and Ogilvie, 1994), which examines the retirement process from inception to completion, be utilised to identify the reasons for retirement, factors related to adaptation, available resources that affect the response, and quality of adaptation. Once these factors have been identified, those individuals who have experienced an unhealthy career transition should be assessed in a follow-up survey. It is proposed that Harvey, Weber and Orbuch's (1992) Account-Making Model be utilised in this second phase, as the focus needs to be on whether these individuals have worked through their athletic retirement experiences. The advantage of this reaction to loss and steps toward recovery model is that it reflects an emphasis on account-making, and represents an idealised scheme where all individuals do not necessarily go through the same sequence. While thanatological models have already been suggested as a way to characterise unhealthy career transitions, they do not indicate what enables individuals to progress through the transition stages to reach closure (Taylor & Ogilvie, 1994), a Gestalt principle indicating final stability. Therefore, the Account-Making Model, as further described below and illustrated in Figure 1, appears to be an effective means for identifying athletes who continue to experience a distressful reaction after retirement from sport.

Starting Stages It is theorised that people initially are stunned by the discovery of a major personal loss, such as retirement from sport. This is followed by an emotional outcry and a third phase identified as denial. This stage represents the early turning point in the recovery process because for a brief period after the loss, denial may be a natural and useful coping mechanism. However, it is likely that there will be no significant movement toward recovery if a person continues to deny that the retirement occurred or is about to occur.

Middle Stages The middle stages in the model are critical to successful healing because individuals must move beyond denial and work through an often uncontrolled experience of intrusive thoughts, emotions and images about the transition. The event must be confronted directly by developing an account of what it involved, what one feels about it, and how one can go on with one's life in the future. While an account is a story-like construct containing attributions, trait inferences, description, emotional expression, and related material regarding the self and the outside world, account-making is be defined as the process of developing an account (Harvey, Weber & Orbuch, 1992).

End Stages Feelings of completion of the account, and hence acceptance of the transition, appear to be vital to the recovery and adaptation processes. When a former athletes recovers and is ready to move on with their life, they will have developed an increased sense of control over thoughts and feelings about the event, a willingness to feel the pain of the event and possibly a sense of having gained skills in coping during the process. The final stage in the account-making sequence is that of giving back to future generations what one has learned (one's account). This concept of generativity (Erikson, 1963) sums up how people may feel the need to give back to others what they have learned through their own change of identity.

To conclude, a brief sketch of an intervention program designed to assist individuals who have yet to reach the final stages of the Account-Making Model is proposed. This final phase could consist of having former athletes return to their athletic teams and discuss their retirement experiences with athletes in the midst of their careers. Such a dynamic program would assist current athletes in planning for their post-athletic careers, as well as help former athletes move toward feelings of controllability and, eventually, closure. As Sinclair and Orlick (1993) have suggested, sport organisations should be encouraged to maintain contact with their former athletes because they are a valuable resource in terms of their specific sport knowledge. It would seem ideal to have transitional athletes work through their own distressful reactions in a primary preventive setting because, as Parker (1994) has suggested, they have a lot to say and perhaps no one to tell.

Fig. 1. Account-Making Model
Revision of Model in Harvey, Weber & Orbuch (1990)
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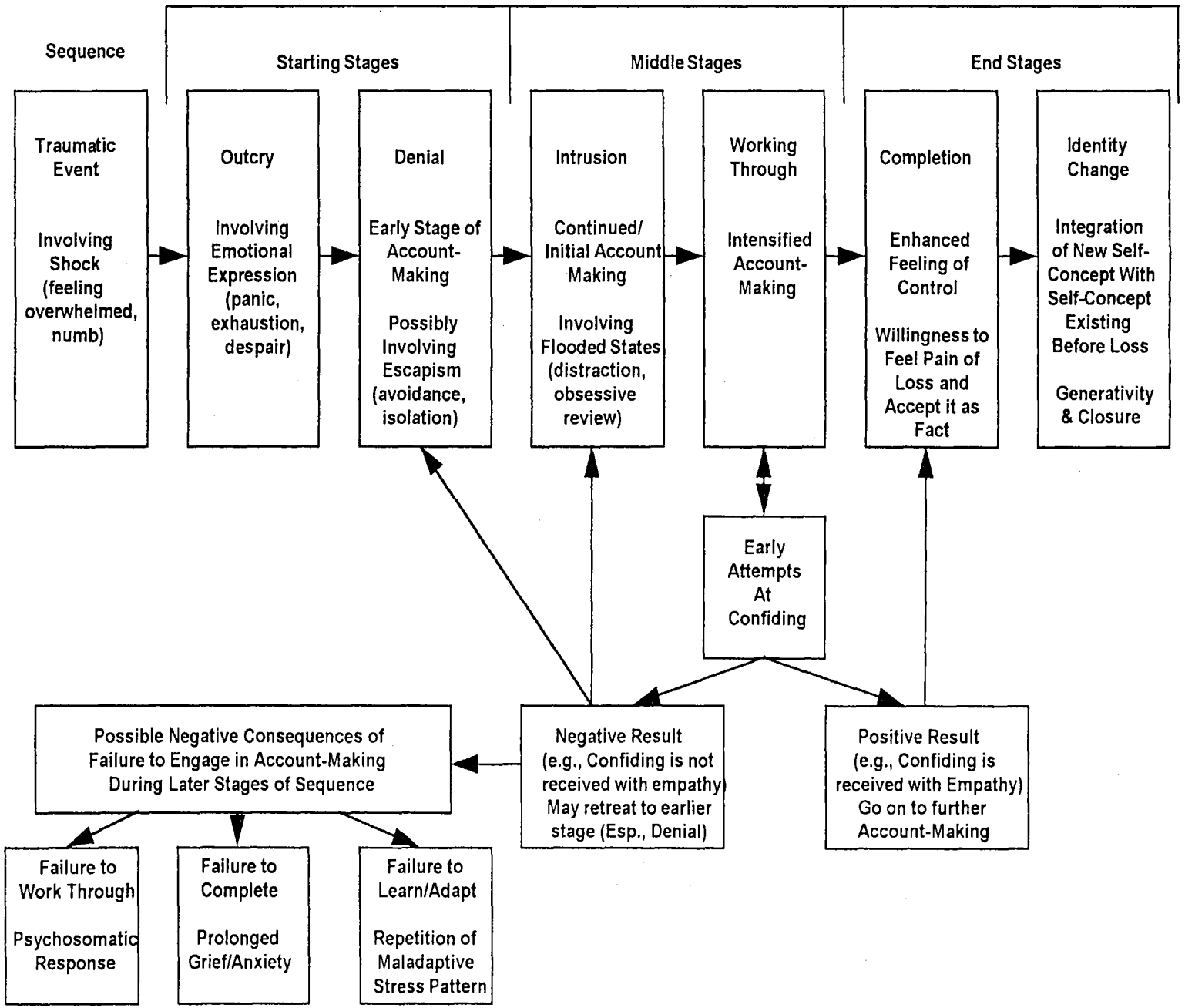

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CAREER TRANSITION OF ATHLETES: WHAT HAS TO BE DONE?

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RECOMMENDATION NR. 1

There is always an end to a sport career as an athlete. (In woman-gymnastics this end comes normally before a girl finishes school.) Only a few athletes find a job within sports. Therefore, most athletes need to prepare a professional career outside sports.

☞ It seems wise for athletes to always keep in mind this need for a "second wind" and to stay in contact with educational programmes of some sort.

RECOMMENDATION NR. 2

The main reasons for leaving sport beside the age are injuries, failures, and changes of the environment. Zaichkowsky et al. (1993) put emphasis on the fact that each athlete is surrounded by his or her "own world", which is also subject to changes.

☞ We should carefully analyse the inside and outside of athletes "in transition" to gain more knowledge for adequatly coaching athletes in career transition.

RECOMMENDATION NR. 3

Heikkala (1995) shows that top athletes are not well represented neither in sports associations (by unions) nor in executive councils of sports organisations.
The athletes as a group are not very powerful, too often elite athletes are represented only individually by personal managers.

☞ Elite athletes incl. former athletes have to develop more interest to participate in decision-making boards of sports organisations.

CONCLUSION

Sports federations - on local and national level - have to guarantee assistance in preparing the career transition of athletes.
In order to do so, according to Murphy (1995), sports federations have to better understand the career process, and the need to develop athletes in job-relevant skills, and to offer a counselling service with sports related assessment centers. Finally, this should result in an adequate job placement, mostly outside and sometimes inside sport.

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CAREER TRANSITIONS OF RUSSIAN ATHLETES

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KEY WORDS

Sports Career (SC), The Analytic Model of Sports Career, Career Transitions.

INTRODUCTION

This research is based on the Analytic Model of Sports Career (Stambulova, 1994), considered it as a multiyear activity with predictable stages of athletes' development and transitions. Seven predictable transitions (crises) of elite SC were identifyed by the Analytic Model:

1. The beginning of sports specialization
2. The transition to special intensive training in the chosen sport
3. The transition from mass popular sports to high-achievement sports
4. The transition from junior sports to adult sports
5. The transition from amateur sports to professional sports
6. The transition from culmination to the end of the SC
7. The ending of SC

METHOD & SUBJECTS

During 1991-93 students-athletes were offered to write essays "My Sports Career", using a tentative plan based on the Analytic Model. Content-analysis (Iadov, 1987) of 402 essays allowed to create a list of propositions " Sports Career Transitions" consisted of seven parts (see above) with 101 propositions in total.

In 1994 90 Russian athletes of international and national level (43 males and 47 females) were offered to express their agreement or disagreement with these

propositions from the point of view of their own SC. Answers were anonymous.

RESULTS

In analysis of empirical data the most relevant propositions, which can describe every SC transition, were distinguished.

The Beginning of Sports Specialization

There were 20 propositions about this transitional period, which were divided into 6 groups for better analysis.

1. The propositions about initial sports motivation. "Interest to sport in general" was distinguished by 69% of subjects (by males (M.) more often than females (F.) as a main motiv for starting sports activity. Another important motives were: "selection to the sport group" (65%); "parents influence" (26%); "friends example" (20%). Almost all subjects agreed with the proposition about "parents support" during the first stage of SC.

2. The propositions, reflecting young athletes ideas about chosen sport event. 46% of M. and 21% of F. had "unclear ideas about chosen sport". 42% of M. reported about "deception of expectations", connected with the content of training sessions.

3. The propositions about content of training. Almost all subjects distiguished " technical preparation " and "physical preparation" as the main parts of training process. A half of subjects were unpleasantly surprised by "routine character of training work".

4. The propositions about athletes attitude to a coach. 69% of young athletes were very fond of their coaches. Almost the same persentage of subjects experienced coach's emotional support in difficult situations. But 53% "didn't often understand coach's explanations" and about the one fourth part of subjects was frightened of a coach and felt a lack of attention and support.

5. The propositions about relation to first competition. About a half of young athletes had a fear of competitions (F. more often than M.). 42% of M. and 14% of F. were disappointed by their performances. But 62% of F. and 46% of M. considered the first competition as the most important event of the initial period of SC.

6. The propositions about relations inside sport group. Majority of young athletes felt theirselfs comfortable in sport group. 77% "had many friends" there.

Generalizing all data about this first transition of SC, it's possible to describe it by the following propositions (short forms): "Interest to sports in general","Unclear ideas about the chosen sport","Routine character of training", "Importance of physical and technical preparation","Great importance of first competition", "Fear of first competition" "Fonding of a coach", "Many friends in sport group", "Parents support".

The Transition to a Special Intensive Training

It was characterized by 25 propositions, divided into 6 groups:

1. The propositions about goals and ideals. In this period 47% of M. and 55% of F. began "to train seriously i.e. for results". About a half of subjects had sport ideal as concrete example for imitation (F. more often than M.).

2. The propositions about technical preparation. For 70% of athletes this transition was connected with renewing and expanding their technical variety. The every third person had to reformate former technical skills.

3. The propositions about new loads and athletes health. All subjects reported about increasing of physical and psychic loads in this period. 26% experienced "a fear of loads" and almost the same number - "a fear of injuries". Really 18% of M. and 31% of F. had their first serious traumas. 6% of M. and 11% of F. began to use drugs.

4. The propositions about problems in competitions. As the main new problem in competitions athletes reported

"absence of reliability". 70% of subjects experienced serious failures in competitions and the same number awared a necessity of a special psychological preparation to sport performances.

5. The propositions about relations with a coach and teammates. Majority of athletes were still satisfacted with their relations with a coach. But 18% of M. and 26% of F. were under a hard pressure of their coaches.

75% of athletes were content with their position in sport team and relations with teammates. But the every fourth F. reported that "relationships inside team spoiled".

6. The propositions about coordination between sports and other activities. The one third part of the subjects marked essential difficulties in combining sport and studies. 22% of M. and 46% of F. had to give up other hobbies.

So the main propositions, which can describe this transition are the following: " Set on training for results", "Copying ideals ","Very hard loads", "First serious traumas", "Absence of reliability in competitions", " Importance of psychological preparation to competitions","Satisfaction with relations inside team","Difficulties in combining sports and other activities", "First self-restrictions".

The Transition from Mass Popular Sports to High-achievement Sports. The Transition from Junior Sports to Adult Sports.

As recovered at the first stage of this study (Stambulova, 1994), these two transitions are linked very closely, because if athletes enter high-achievement sports they automatically start to take part in adult's competitions, regardless of chronological age.

There were 28 propositions, divided into 5 groups, which described these transitions.

1. The propositions about new goals and changing life style. In this period of SC 62% of M. and 74% of F. considered sport goals as main life goals. So they began to live according to the principle: "Sport - first, all other things - last".

2. The propositions about new features of training. Athletes reported as the most important feature "the transition from coping modeld and ideals to searching individual path in sports". A half of subjects started to be more keen on sport theory and sport sciencies, including sport psychology.

3. The propositions about new problems in competitions. Majority of athletes experienced "pressure of selection for the most prestige competitions", "difficulty in showing good results during all sport season". 15% of M. and 8% of F. used drugs in this period.

4. The propositions about social recognition. Social recognition and support were very important for majority of subjects. 26% of M. and only 7% of F. agreed with the proposition: "I was tend to" the star fever".

5. The propositions about relations with a coach and teammates. The one third part of athletes reported about deterioration in relationships with a coach (mutual misunderstanding, conflicts and so forth). 24% of M. and 26% of F. had to change a coach during this period. 30% marked growing of tension in relation inside sport team.

So the most important statements for description of these two transitions are: "Great sport goals and plans", "Life subordinated to sports ", "Transition from coping ideals to searching individual parth in sports" "New interest to sport theory","Pressure of selection for main contests", "Great importance of social recognision", "Falling-off in relations with a coach and mates".

The Transition from Amateur Sports to Professional Sports.

It's a new transition for Russian athletes, therefore only 18 subjects reported about it.

There were 13 propositions about this period of SC. The majority of subjects agreed with the following statements (short forms): "Need for new knowledges"," Difficulty of independent training","Difficulty of being out of home for a long time". More typically that social recognition among professionals is more important for athletes than money. 30%

of subjects consider that it is impossible to be good at professional sports without using drugs.

The Transition from Culmination to the End of SC.

This transition is connected with a plateau or decreasing of sport results due to many reasons (chronic fatigue, consequences of injuries and disordes, young opponents, and so forth). Here more than a half of subjects marked the following statements: "Anxiety about future", "Thoughts about SC termination", "Making plans for the new professional career", "Concerns about searching reserves to maintain sport results at a high enough level", "Great role of previous sport experience".

The Sports Career Termination

There were 13 propositions about this transition, which were divided into 4 groups.

1. The propositions about reasons of SC termination. As the main reasons athletes reported: "absence of future in sports" (72%); "new life interests" (68%); "psychological fatigue" (57%); "consequences of sport traumas and disordes" (46%).

2. The propositions about emotional reactions. 58% of subjects experienced emotional problems, feelings of sadness and "emptiness". The one third part agreed with the statement: "I had hard transitional period after the end of SC".

3. The propositions about new life problems. Athletes identifed three main spheres of new life problems: "new professional career"; "new circle of communication"; "family".

4. The propositions about general relation to sports after SC termination. 88% of M. and 94% of F. agreed with the statement: "I am very grateful to sports for all that it gave me."

The main characteristics for description of this transition might be the following: "Psychological fatigue", "Emotional problems, feelings of "emptiness" and sadness",

"Problems with starting new professional career", "New communication circle", "Great gratitude to sports".

CONCLUSIONS

1. Transitions are very important points of SC because every transition is connected with appearance of new problems, which athletes have to resolve for successful continuation of SC as a whole.

2. Psychological descriptions of SC transitions identify not only problems and difficulties of athletes in these periods, but stress some positive features of every transition, which can play an important role in coping with problems.

3. The specific features of seven predictable transitions of SC of Russian athletes can be a base for creation the system of Psychological Management during all SC.

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S.3.3. COGNITIVE AND BEHAVIOR MODIFICATION STRATEGIES IN EXERCISE PSYCHOLOGY

Chairperson : ST. BIDDLE

HOW TO HELP LOW-ACTIVE WOMEN FEEL BETTER ABOUT EXERCISING

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Key Words: RPE, Psychological affect, Activity level.

INTRODUCTION

A major challenge to exercise leaders and health promoters is to encourage low-active individuals to become regular exercisers. This paper extends previous work by Parfitt, Markland and Holmes (1994) which considered the psychological affect of high- and low-active subjects at moderate and high exercise intensity levels. In their results, Parfitt et al (1994) indicate that high- and low-active subjects differ in psychological affect when working at a moderate and high exercise intensity. The high-active subjects (both men and women) were significantly more positive in the 90% workload condition than the low-active subjects. However, there was no difference between the groups in the 60% workload condition ($p < 0.001$). The *affect* or *distress* schema in Leventhal and Everhart's (1979) parallel-processing model was proposed as one explanation for the group differences at the higher workload, with low-active subjects having a more negative affective schema concerning exercise at high intensities.

Psychological affect was also assessed during and after exercising at each workload and was shown to be significantly lower in the last minute of exercising in the 90% workload condition compared to any other time or workload. This temporal factor may also be related to the affect or distress schema, with the physiological cues being more acute during the exercise bout, but decreasing following cessation of exercise. Importantly, this implies that, regardless of experience, the 90% workload was interpreted negatively during the exercise bout, but relatively positively afterwards.

These two results imply that low-active individuals should be encouraged to exercise at moderate workloads, and that both high- and low-active individuals should be encouraged to focus upon how they feel after exercise has ended in order to facilitate them interpreting their physiological cues more positively. This line of argument sits comfortably with previous research concerned with exercise intensity and emotional response (e.g., Moses, Steptoe, Mathews & Edwards, 1989). If subjects do not interpret their exercise experience positively,

they are unlikely to adhere to exercise. However, it could be argued that the study by Parfitt et al. (1994) was limited in so far as only two workloads were considered. It could be that with a greater range of exercise workloads the differences between the high- and low-active individuals becomes more marked. Consequently, in this paper we report a study in which high- and low-active women were required to exercise at 3 different levels of perceived exertion and report their psychological affect in the last 20 s of exercise and 5 min. post exercise. It was hypothesized that low-active subjects would be more negative than the high-active subjects, especially at the higher exertion level and affect would be more negative in the last 20 s of exercise than 5 min. post exercise.

METHOD AND PROCEDURE

Subjects

Subjects (n=27) were self-reported high-active (n=16) and low-active (n=11) women. Table 1 provides biometric data on the subject population.

TABLE 1. Means and Standard Deviations of the Subjects Biometric Data

	High Active		Low Active		
	M	SD	M	SD	
Age	27.00	6.80	24.27	10.63	
Self-report activity	3.59	1.30	0.54	0.68	**
Estimated VO2 Max	3.01	0.40	2.28	0.59	**
Height	60.37	6.40	60.68	7.20	
Weight	157.50	41.90	163.76	5.37	

** P<0.001

Instrumentation

Self-Report Questionnaire. This instrument required subjects to indicate how frequently they participated in physical activity and whether this had been typical behaviour over recent years. Subjects were informed that activities such as running, swimming, aerobics, squash and team games constituted physical activity in this instance. Subjects also provided details of their date of birth and contact address.

Rating of Perceived Exertion. General (i.e. total inner feelings of effort) ratings of percieved exertion (RPE) were assessed with the Borg 6-20 Category Scale (Borg, 1970). The exercise level subjects worked at was regulated using the RPE in an *effort production* protocol.

Feeling Scale. Rejeski and colleagues' (Hardy and Rejeski, 1989; Rejeski, Best, Griffith and Kenney, 1987) Feeling Scale (FS), which measures psychological affect during exercise, was used. This is a bipolar scale that ranges from +5 to -5 with verbal anchors of +5 = *very good*, +3 = *good*, +1 = *slightly good*, 0 = *neutral*, -1 = *slightly bad*, -3 = *bad*, and - 5 = *very bad*. The instructions followed those of Hardy and Rejeski (1989, p309) with the addition of one phrase. Following the sentence "Additionally, feelings may fluctuate across time," the phrase "and after" was added to the next sentence so that it read: "That is, one might feel good and bad a number of times during and after exercise." This phrase was added to enable changes in psychological affect to be assessed both during and after the exercise session.

Procedure

The experiment was conducted on an individual basis in the exercise physiology laboratory. A four-phase protocol was used in the data collection: Familiarization, Trial 1, Trial 2, Trial 3. These phases are described in more detail below.

Familiarization. Subjects entered the laboratory and were welcomed by the investigator. Subjects were given a brief description of the tasks to be performed and were asked to sign a statement of informed consent before taking part in the experiment. Subjects then completed the short self-report quesionnaire before having practice at regulating their level of exercise exertion using the RPE. Subjects were instructed to use the 6-20 range of the RPE to vary their

workrate, and become familiar with the scale. Subjects were also shown the FS and asked to indicate their present feeling to familiarize them with this scale.

Trial 1. Subjects were seated on an electronically braked cycle ergometer and connected to on-line gas analysis equipment. Subjects were requested to cycle at one of 3 different levels of RPE (9, 13 or 17) and report their psychological affect in the last 20 s and 5 min. after performing a steady-state exercise bout. Subjects then had a 15 minute rest before commencing their 2nd trial.

Trial 2 and 3. The procedure for Trial 1 was repeated with subjects working at a different level of RPE. All subjects completed exercise bouts at each of the three RPE levels. The order of exercise level was balanced across subjects to ensure that results were not confounded.

RESULTS

A mixed-model, three factor, Group (high-active vs. low-active) by Time (-20 s, vs. +5 min.) by RPE (9, 13 and 17), analysis of variance with repeated measures on Time and RPE indicated main effects ($p<0.001$) for each independent variable. High-active subjects were more positive ($M = 2.06$) than low-active subjects ($M = 0.92$); subjects were more positive at +5 min ($M = 2.27$) than at -20 s ($M = 0.92$); and subjects were more positive as the RPE reduced (RPE 9, $M = 2.33$; RPE 13, $M = 1.73$; and RPE 17, $M = 0.73$). Interactions were also recorded for Group by RPE ($p<0.046$) and Time by RPE ($p<0.001$). Follow up tests indicated that low-active subjects felt less positive at RPE 17 than at RPEs 9 and 13, and less positive than the high-active subjects at RPEs 9, 13 and 17 (see Fig. 1). In addition, all subjects felt more positive five min after exercising than in the last 20 s of exercising, especially at RPEs of 17 (see Fig.2).

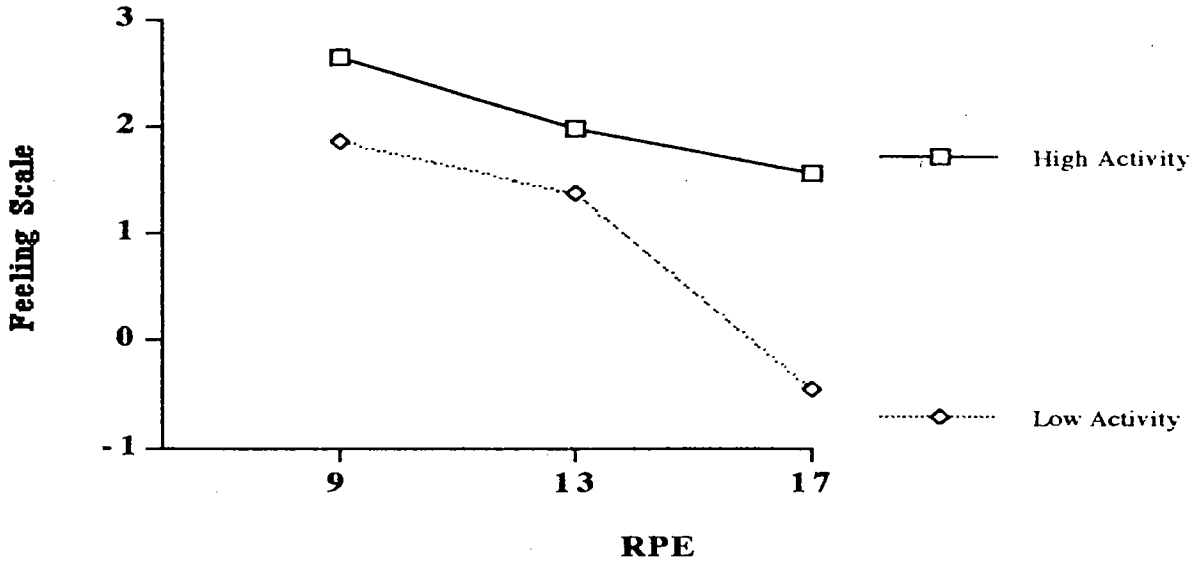

Fig. 1. Showing Activity by RPE Interaction.

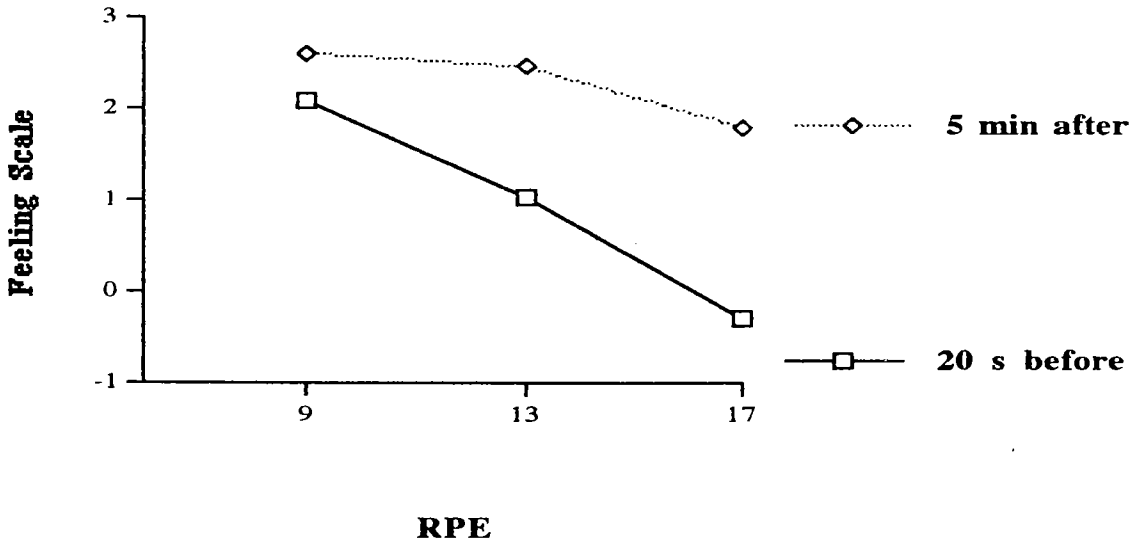

Fig. 2. Showing Time by RPE Interaction

DISCUSSION AND CONCLUSIONS

The two interactions recorded support the hypotheses that low-active individuals should be more negative than the high-active subjects especially at the higher exertion level, and affect would be more negative in the last 20 s of exercise than five min. post exercise, especially at the higher exertion level. These results generally replicate the findings of Parfitt et al. (1994) and suggest that the high-active subjects may have attenuated their distress schema, whereas the low-active have not. Consequently, the low-active subjects report more negative affect, especially at the higher exertion level. Importantly, it was shown that the low-active subjects did not differ statistically at RPEs 9 and 13, and there was no significant difference between their scores and those of the high-active subjects at each of these two levels of RPE . This indicates that exercise leaders and health promoters could recommend that low-active subjects work at RPE 13 without being concerned that the experience will be interpreted very negatively and lead to exercise avoidance. An exercise intensity corresponding to RPE 13 should elicit a greater cardiovascular improvement as the total amount of work done in a given period of time would be greater than at RPE 9. The *total amount of work done* is considered to be the most important factor for the improvement of aerobic fitness (American College of Sports medicine, 1990). Furthermore, the exercise intensity elicited at RPE 13 is greater than the minimal threshold value (50% VO2max) necessary for improving maximum oxygen in normal healthy adults (American College of Sports Medicine, 1990).

The Time by RPE interaction suggests that the negative effects of exercise distress felt during exercise may be precluded by having subjects focus on post-exercise affect. This is crucial at the very high exercise levels (RPEs 13 and 17) when irrespective of activity level, subjects reported more negative affect during exercise, than after it had ceased. Furthermore, if it is necessary for subjects to work at RPE 17 then it is advisable that they do not focus upon how they feel during the exercise bout. Subjects feel significantly more positive 5 minutes after the exercise session has ended.

The findings from this study indicate that the exercise leader and health promoter can use the RPE to regulate exercise work rates in healthy sedentary and active subjects. Provided that the levels of exertion are not set too high (i.e. RPE 17), both sedentary and active subjects will interpret the exercise bout to be equally as positive.

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EVALUATING A PRIMARY CARE EXERCISE PRESCRIPTION SCHEME: DEMOGRAPHICS AND CORONARY RISK FACTORS OF THOSE ENTERING AND THOSE CHOOSING NOT TO PARTICIPATE IN A STUDY

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Key words: Coronary heart disease risk, exercise promotion, primary health care, lifestyle change.

INTRODUCTION

The physical and psychological benefits of exercise have been well documented (Bouchard et al., 1994). Physical activity appears to reduce the risk of coronary heart disease (CHD) directly through improved cardiovascular efficiency, and also indirectly through effects such as reducing body fat and hypertension. Evidence appears to be growing to suggest that the risk associated with a sedentary lifestyle may be at least as great as other primary risk factors such as smoking (Blair, 1993).

Despite this consensus, recent evidence from the Allied Dunbar National Fitness Survey (ADNFS, 1992) in England suggests that over 50% of over 40 year olds do less than 3 moderate or vigorous activity sessions, lasting at least 20 minutes, per week. Trends in population census data also suggest that the proportion of the population classified as overweight or obese is continuing to rise (ADNFS, 1992).

The Health of The Nation report (D.o.H., 1992) recognised CHD in the UK as a major concern and set targets to reduce risk factors among the general population. A Physical Activity Task force was established to set behavioural targets and identify strategies for promoting physical activity. Given that about 95% of the UK population will meet a member of the Primary Health Care team over a three year period it would seem that there is considerable scope for exercise promotion in this setting. In some countries exercise prescription in Primary Health Care (PHC) is nothing new, however, in a British sample of 310 over 40 year olds, only 13% of subjects claimed to have been recommended to exercise more by their GP (Taylor, 1994). These figures reflect the generally low-status of health promotion work among GPs (Calnan & Williams, 1993).

Recent reforms in both Health and Leisure Services in the UK have opened up new opportunities for the promotion of exercise in Primary Health Care. On the one hand fundholding GPs can claim additional funds for health promotion activities, and may be rewarded for lowering drug prescription costs, while on the other hand, Leisure Centres have

been forced to seek less traditional markets to balance running costs. Biddle et al. (1994), in a review of exercise promotion strategies in PHC in England, identified two key approaches, namely the Health Centre-based and the Leisure-Centre based scheme. The classification was founded on where prescribed physical activity took place.

As an example of the Leisure Centre-based scheme, one of the first collaborations between health and leisure personnel became known as the Oasis Scheme in Hailsham, East Sussex, UK. Initiated in 1989, it took 2-3 years before a formal arrangement between the respective local Health and Leisure Services was established; in part due to sceptisism held by Health Service Managers about the cost-effectiveness of a programme of prescribed exercise for the reduction of a variety of chronic health problems. Over 3000 (mostly sedentary) patients, from over 70 doctors within a 20 mile radius, have since been referred to the cardiovascular suite (which houses rowing and cycling ergometers, step machines and treadmills) at the Hailsham Lagoon Leisure Centre.

Such a scheme raises many financial implications which may influence future policy for both Health and Leisure Services Managers at local, regional and national level. For example, exercise may lead to reduced medication costs for the treatment of hypertension and depression, and perhaps fewer visits to the PHC team. Leisure Services may also operate more cost-effectively with many sedentary people becoming users of the centre, particularly during off-peak hours.

There has been an exponential growth in such schemes throughout the UK (Biddle et al., 1994) with many claims about the effectiveness of such schemes (eg. Stockport Leisure Services, 1994). Iliffe et al. (1994), however, warn that no scientific evidence exists about their effectiveness, in terms of both their ability to attract those that would most benefit from such an intervention, and also maintain a patient's physical activity at a level where health benefits would be gained. They state, "Unevaluated initiatives may be of no more value than prescribing coloured water" (p.495). Efficacy must, however, be judged in terms of relative effectiveness to other health promotion strategies, and there has been recent evidence of the limited benefits, in terms of reducing CHD risk (not including exercise), of Practice-based health screening (Family Heart Study Group, 1994).

One of the potential disadvantages of a Leisure Centre-based scheme, despite their apparent popularity, is that it has limited potential to attract those most at risk in numbers that are likely to influence population targets for reducing CHD risk. This is due to the limited availability of referral appointments and suitably qualified leisure centre personnel to work with the at-risk patient. The patients' perceptions of a Leisure Centre and the typical client using such facilities may also serve as a barrier. The inverse care law suggests that those most in

need of health care interventions will least likely access them. Gillam (1992) and Davison et al. (1991) suggest this also extends to health promotion clinics in primary care.

It is therefore important to consider, in evaluating exercise on prescription schemes, the characteristics of those most likely to accept an invitation for referral from the PHC team, and to determine the extent to which external validity has been compromised. As part of a controlled randomised study to determine the efficacy of the Oasis Scheme for reducing modifiable CHD risk factors, the present paper will consider the characteristics of patients who did and did not chose to enter the study. The sampling procedures will be presented, followed by results of analyses to determine any bias.

METHODS

Two Health Centres in Hailsham, from which patients had regularly been referred to the Oasis Scheme, were approached to target patients with CHD risk factors. Approval for the study was granted by the Health Authority's Local Research Ethics Committee, and by 9 GPs practising within the two health centres who allowed access to their patients. From computerised medical records, male and female patients between 40-70 years of age were identified with at least one of the following CHD risk factors; smoker, hypertensive, overweight. This information had been ascertained at the previous visit to the GP or practice nurse, which may have been any time in the previous 2 years. Subjects who had any contra-indications (see American College of Sports Medicine guidelines (p. 6; 1991) were excluded by GPs, following consultation with the patient's medical file. patients who had previous been a part of the exercise referral scheme were also excluded.

Over a period of 10 months, a total of 345 patients were mailed a package which included an invitation letter from their own GP and the researcher; an information sheet describing the nature of the study and the possibility of referral to an exercise programme; a response sheet; and a stamped addressed envelope. In brief, the expectations for subjects were to attend 5, 30-60 minute assessments over a 10 month period, at their respective health centre. Each assessment would involve questions about behavioural and psychological factors, and also physical measures concerned with exercise and health. A low intensity exercise test would be performed on a bicycle ergometer. The information sheet also described how patients could be referred to a twice weekly exercise session (for 10 weeks) at the leisure centre, with each session costing £1.30 (ie., half the normal price). Those not referred were assured that they would have an opportunity to enter the scheme at the end of the study. The response sheet requested patients to tick one of 6 stages of exercise behaviour (Marcus et al., 1992),

and smoking behaviour (Prochaska & DiClemente, 1983). They were also asked to identify interest in becoming a subject or not.

Descriptive statistics were produced for age, gender, risk factor, stage of exercise and smoking behaviour and response status (no response, responded but declined the invitation, and responded and attended an initial assessment). The relationship between response status and the other variables was examined with Chi^2 and analysis of variance, using version 6.04 of SAS (SAS, 1991).

RESULTS

Of the 345 subjects invited into the study, 61% were female, and medical records suggested that 51% smoked, 55% were hypertensive, and 69% were overweight. The proportion of the sample with 1, 2 and 3 risk factors was 32.8%, 60.3% and 7.0%, respectively. The mean age was 54.9 years (SD 8.5). 105 (30.4%) failed to respond to two mailings of the invitation and of the 240 who did respond, 98 (28.4%) declined and 142 (41.2%) accepted the invitation to enter the study. Data from those who completed the stage of exercise and smoking section revealed the proportion in precontemplation, contemplation, planning, action, maintenance, and relapse stages was 33%, 9%, 7%, 7%, 26%, and 18% for exercise, and 19%, 12%, 3% 3%, 55%, and 8% for smoking, respectively. In summary, 33% and 42% described themselves as current exercisers and smokers, respectively. Only 137 and 166 patients completed the stages of exercise and smoking change sections, respectively. Among the 137 patients, 11% classified on medical records as smokers were no longer smoking, and 6% had become smokers. Overall, 8.5% of the subjects were incongruently classified on the two smoking measures.

Chi^2 revealed a significant relationship between smoking status and response category as shown in Table 1. Those who entered the study were under-represented by smokers. Only 35% of all the smokers invited entered the study. No significant relationship was found between response and hypertension or weight status although 45% of those who were classified as overweight did come into the study. One-way analysis of variance revealed a significant relationship between age and response, $F(2, 341) = 3.09$, $p < .05$). Post hoc ttests revealed that non-respondents were significantly older ($M = 56.7$ years) than both declining ($M = 54.3$) and accepting ($M = 54.2$) respondents.

Subjects were also classified by their number of risk factors. Due to the small number who were smokers, hypertensive and overweight, subjects were classified as having one risk

TABLE 1. Chi Squared Analysis of Relationship Between Response Category and CHD Risk Status

		No form returned	Not willing	Entered study	Chi Sq
Smoker	Yes	63 (36%)	51 (29%)	60 (35%)	
	No	42 (25%)	47 (27%)	82 (48%)	7.7*
Overweight	Yes	71 (30%)	61 (25%)	107 (45%)	
	No	34 (32%)	37 (35%)	35 (33%)	4.9 ns
Hypertensive	Yes	56 (30%)	61 (32%)	71 (38%)	
	No	49 (31%)	37 (24%)	71 (45%)	3.6 ns
Risk factors	1	28 (25%)	29 (26%)	56 (49%)	
	more than 1	77 (33%)	69 (30%)	86 (37%)	4.8 ns
Exerciser	Yes		11 (26%)	32 (74%)	
	No		12 (13%)	84 (87%)	3.7*

Notes: * $p < .05$, ns = not significant
Exercise data from 137 subjects who completed stage of exercise section .
Data on smoking, hypertension, and weight based on medical records.

factor or more than one. Chi^2 analysis revealed a significant relationship between response category and number of risk factors as shown in Table 1.

Due to the small number of subjects in some stages of exercise behaviour, respondents were categorised as either exercisers (action or maintenance stage) or non exercisers. The significant relationship between response and exercise category is shown in Table 1, with a greater proportion of non-exercisers entering the study, though this must be interpreted with caution since only 23% of those declining to enter the study completed the stage of exercise survey, compared with 83% who did enter the study.

DISCUSSION

In evaluating health promotion schemes it is important to consider the potential for attracting those with greatest gain to make in terms of CHD risk, as well as what the actual

effects of the intervention may be. The computerisation of medical records by PHC services offers an opportunity to target subgroups of the population who may benefit most from specific health promotion strategies.

In the present study, there was no statistical relationship between the subjects' number of risk factors and response category although there was a greater tendency for those with more than one risk not to enter thestudy. However, smokers were under-represented and there was a tendency for overweight to be over-represented among those entering this study. In other words, smokers were less attracted to the opportunity to engage in a study involving a health assessment and possibly an exercise programme than were non-smokers. If an exercise programme is offered as a smoking cessation strategy (and it has rarely been documented as one to date) it may be difficult to attract more than one third of smokers, perhaps due to the real or perceived cardio-pulmonary difficulties encountered during exertion. On the other hand, overweight patients may be ready to engage in a health check and/or an exercise programme, perhaps because the benefits from exercising are generally acknowledged, in terms of weight loss. The rather crude medical records (with a simple dichotomy of overweight or not) may well be concealing differences between non-overweight, overweight and obese patients. It would seem likely that the latter group would find an exercise programme more aversive than the overweight but non-obese patient.

The low response rate to the stages of change sections among those who declined the invitation to enter the study somewhat devalued the analysis of response bias. At the time subject selection took place there was unfortunately no physical activity information on the computerised medical records data base, upon which to use for sampling and analysis of sampling bias. Future studies may well be able to do this although there appears to be considerable potential for variation in the way data is collected and stored on exercise behaviour.

Consideration of the response bias among smokers revealed in the present study is important for two main reasons. In the first instance, sampling bias should be considered when determining intervention effectiveness at a later stage, and secondly, future studies involving health promotion interventions should consider how to recruit under-represented groups.

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LECTURE

Keynote speaker : ST. BIDDLE

EXERCISE PSYCHOLOGY: FUTURE DIRECTIONS FOR PUBLIC HEALTH PROMOTION

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Key words: exercise psychology, Public Health

ABSTRACT

The expansion of 'sport' psychology into health-related concerns - 'exercise psychology' - has been one of the most pronounced trends in the field in the past decade. Exercise psychology can best be described by reference to the psychological antecedents, psychological consequences and interventions associated with the adoption, maintenance and resumption of health-related exercise and physical activity. This paper, however, will not attempt a research review of the field, but rather highlight current trends that have emerged in recent years in antecedents, consequences and interventions and relate these to practical issues of public health promotion and likely future directions. Contemporary social psychological and motivational theories and 'composite' models of exercise behaviour will be discussed. Reference will be made to physical activity promotion through the Health of the Nation initiative in England.

INTRODUCTION

A clear trend in 'sport psychology' in recent years has been the expansion into issues associated with health-related exercise. For example, Tenenbaum and Bar-Eli (1995) found in a sport psychology computer literature search that publications dealing with 'health, physical fitness and wellness' increased greatly between 1975 and 1991, as shown in Table 1.

TABLE 1. Publication Trends for 'Health, Physical Fitness, Wellness' from 1975-1991 (data from Tenenbaum & Bar-Eli, 1995).

	Advanced papers only	**Percentage**	**Advanced, intermediate, basic papers**	**Percentage**
1975-80	79	21.4	275	16.3
1981-85	125	33.9	586	34.7
1986-91	165	44.7	826	49.0

Part of the reason for this trend stems from the increased awareness in contemporary society of the important role habitual physical activity and exercise can play in disease prevention and health enhancement. This has led to the seeking of answers to such questions as 'how can we motivate people to be physically active?', 'why do some people not exercise?', 'can exercise make you feel better mentally?'. This health-orientation contrasts with the performance-enhancement approach often, though not exclusively, adopted in 'sport psychology'. The health-related approach has become known as 'exercise psychology'.

The purpose of this paper, therefore, is to highlight the important role of exercise psychology by addressing three main areas: *antecedents* of exercise participation - i.e. psychological factors associated with approaching or avoiding exercise; the psychological *consequences* of exercise participation, often referred to as the 'mental health' approach; and the *interventions* that are intended to increase the probability of people adopting and maintaining involvement in exercise. However, rather than review the field, which is not possible given time/space constraints, I will highlight what I see as important trends and applications in exercise psychology and Public Health.

ANTECEDENTS OF EXERCISE PARTICIPATION

Current Trends

The initial efforts in attempting to identify antecedents of exercise participation tended to involve the assessment of static group profiles in supervised exercise settings. Studies have often assessed descriptive motives, used psychological test batteries, or identified descriptive variables of interest but not based on theoretical predictions. Such approaches have their merits in being able to identify possible key variables, but the limitations are also clear to see.

From these early research studies it was recognised that at least three trends had to develop. First, a wider range of physical activity (PA) contexts had to be accounted for, such as habitual PA patterns outside of supervised classes. Second, a move took place towards more theoretically driven research. Third, researchers identified the importance of dealing with exercise participation as a process rather than

a dichotomous variable. It is too simplistic to label people 'exercisers' or 'non-exercisers' given that people may be at different points in an exercise or PA cycle. For example, Sallis and Hovell (1990) identified adoption, maintenance, dropout, and resumption as four important phases in a 'natural history' of exercise.

To counter the weaknesses of some of the earlier studies, contemporary exercise psychologists have adopted a more theoretical approach. Key psychological and social psychological approaches have been enthusiastically 'borrowed' for application in the exercise domain. The two most prominent approaches have been attitude-behaviour theories (e.g. Theory of Planned Behaviour, see Doganis & Theodorakis, 1995), and self-efficacy and related social cognitive theory approaches (see Biddle & Mutrie, 1991; Godin, 1994; Maddux, 1993).

The attitude-behaviour theories have heuristic appeal, although can be limited in approach if only cognitive variables are accounted for. Nevertheless, the attitude component of the Theory of Planned Behaviour and Theory of Reasoned Action has consistently predicted exercise behaviours, accounting for anything up to about 30% of the variance (Godin, 1993). Similarly, self-efficacy has been associated with exercise involvement in a number of studies and may well be the clearest single factor that we can identify in this respect.

A recent area of expansion in exercise psychology has been the inclusion of the 'stages of change' model developed in counselling and health-related contexts such as smoking cessation. This approach confirms the trend discussed earlier whereby greater importance is given to processes and stages of exercise, hence adopting a more dynamic approach. People can be located on a 'continuum of contemplation' whereby some have not really thought about exercise at all, others are trying to start some involvement, whereas others are maintaining the behaviour (see Prochaska & Marcus, 1994). Although this 'transtheoretical model of behaviour change' has some appeal, currently the research base in exercise is rather weak and predictable. For example, researchers have consistently found that higher levels of self-efficacy are more likely for those contemplating exercise in comparison with pre-contemplators. Of more importance (and I predict this to be a major trend in the next few years) is how people move between stages and how we can intervene to move people along the continuum, or prevent relapse. Similarly, the stage approach needs integrating with other approaches, such as marketing and counselling interventions.

Directions for Application to Public Health Promotion

This brief discussion of trends leads to two main applications for public health promotion through exercise: a). recognition of exercise as a complex behavioural process, and b). the importance of theoretically sound principles in antecedents research.

Exercise as a complex behavioural process. A recent governmental initiative in England has been the 'Health of the Nation' (HoN) programme. Addressing the major causes of morbidity and premature mortality, the HoN has established a Physical Activity Task Force' (PATF) to advise on exercise and PA promotion. Targeting has addressed three main issues:

- reducing the number of people who are sedentary
- increasing the number of people who take moderate PA on most days of the week for about 30mins at a time
- increasing the number of people taking vigorous bouts of exercise for more than 20mins per session three times a week.

Such targeting is important as it recognises different populations and concerns. For example, traditionally exercise adherence research has sought largely to increase participation rates in 'fitness' activities as highlighted in the third issue above. However, it is now recognised that a). more moderate levels of PA can have significant health gains, and b). more people are likely to adopt and maintain participation in moderate, rather than vigorous, PA. More work is needed, therefore, in identifying the determinants of participation in these more moderate forms of PA, including personal transport, recreational walking and habitual PA in work settings. We also need to look at differences between people who are regular exercisers and those who are sporadically active.

The importance of theoretically sound principles in exercise antecedents research. Exercise adherence research was initially criticised for being atheoretical. To be fair, this situation has changed greatly in recent years, although the majority of research studies in this field adopt a narrow range of theories (Maddux, 1993). However, it is usually the case that research studies focus only on one theory, or at best contrast two approaches, and that nearly all are small-scale and cross-sectional.

There are also no meta-analytic reviews in exercise determinants research, to my knowledge.

PSYCHOLOGICAL CONSEQUENCES OF EXERCISE PARTICIPATION

Perhaps the oldest topic in what we now call exercise psychology is that of exercise and mental health. From the ancient Greeks to contemporary Western society people have discussed the potential psychological benefits of PA.

Current Trends

Since the publication of our exercise psychology textbook (Biddle & Mutrie, 1991), I detect the following two important trends in this area:

- the publication of meta-analytic reviews
- a diversification of the field.

Meta-analytic reviews. Despite the problems associated with meta-analyses, the quantification of trends can be both important and useful. In terms of psychological consequences of exercise, we now have access to meta-analyses on anxiety, depression, self-esteem, cognitive functioning, personality, mood, and stress reactivity (see Table 2).

The results of the meta-analyses show that small to moderate effects for exercise and fitness are evident. However, such results are plagued by poor and variable measurements, inadequate numbers of studies for robust ESs, and different and imprecise approaches to measurement of the independent variable, such as 'aerobic fitness', 'play', 'exercise' etc. Despite these methodological problems, the evidence does point out the potential beneficial effects of PA on certain mental health parameters.

Diversification of the field. Early research into exercise and mental health tended to focus on a narrow range of outcomes, such as anxiety and depression, and was often dealing with clinical populations. A recent trend has been to diversify the field. This has been achieved in two ways:

- diversification of populations, to include more non-clinical groups
- diversification of outcome measures, and in particular this is reflected in a shift from only studying negative affect to the measurement of well-being (Mutrie & Biddle, 1995).

TABLE 2. Effect Sizes Reported from Meta-Analytic Reviews on Exercise and Psychological Outcomes (all mean ESs have been converted to positive numbers, indicating positive psychological effects for exercise/fitness; the exception is when ranges are reported).

Study	Outcome Variable	Activity/Fitness Measure	Effect Size
Crews & Landers (1987)	Stress reactivity	Aerobic fitness	0.48
McDonald & Hodgdon (1991)	Self-concept	Aerobic fitness training	0.56
Gruber (1986)	Self-esteem	Directed play and PE programmes for children	0.41
North et al. (1990)	Depression	Exercise	0.53
McDonald & Hodgdon (1991)	Depression[1]	Aerobic fitness training	0.97
Petruzzello et al. (1991)	Anxiety: a. state b. trait c. psycho-physiological indicators	Exercise	a. 0.24 b. 0.34 c. 0.56
McDonald & Hodgdon (1991)	Anxiety: a. state b. trait	Aerobic fitness training	a. 0.28 b. 0.25
Thomas et al. (1994)[2]	Cognitive functioning	Exercise	Range= -0.09 to 0.48 [no overall ES reported]
McDonald & Hodgdon (1991)	Personality and adjustment	Aerobic fitness training	0.33
McDonald & Hodgdon (1991)	Mood[3]	Aerobic fitness training	Range= -0.18 to 1.12

Notes: 1. This comprises five standardised measures of depression and differs from the 'depression cluster' reported by McDonald & Hodgdon (1991) and Mutrie & Biddle (1995). The cluster also includes POMS and MMPI measures.
2. Meta-analysis reported in Thomas et al. (1994) is from a larger unpublished study.
3. The mood measures ranged across 6 dimensions of the POMS and 2 dimensions of the MAACL.

One trend contained within the diversification of the field has been the increase in interest in potential negative psychological effects of exercise, and in particular the phenomenon of exercise 'addiction' or 'dependence'. Although from a public health perspective this problem is likely to be so small as to be inconsequential, clearly from a clinical perspective it is something to be addressed.

Directions for Application to Public Health Promotion

The most important direction for applying research findings, as I see it, is to integrate our knowledge on beneficial psychological outcomes of exercise and PA such that we are able to promote PA through such outcomes. However, at present, one of the major barriers to participation is associated with negative feelings towards PA. We need to bridge this gap.

The diversification of research has still left other gaps. For example, we need to know much more about 'basic' or immediate outcomes, such as enjoyment. Only then will we be able to sustain involvement successfully. Strategies are needed, through such approaches as counselling, exercise leadership and mass media. The promotion of more moderate levels of PA should help in this respect. However, progress in the field, such as assessing psychological outcomes from exercise programmes, remains impeded by poor or inappropriate measures of psychological well-being.

INTERVENTIONS IN EXERCISE PSYCHOLOGY

Although intervention issues have already been discussed within the areas of antecedents and consequences, it is possible to identify some further trends and applications. Given the nature of interventions, both trends and directions for application will be discussed jointly.

Current Trends and Directions for Application to Public Health Promotion

Early research in PA interventions tended to address individual behaviour change. More recently, diversification has occurred with a greater recognition of different levels of intervention, such as those identified by King (1991):

- *personal*: face-to-face counselling, advice etc., such as through the family doctor
- *interpersonal*: e.g. exercise classes
- *organisational/environmental*: e.g. schools, workplace
- *institutional/legislative*: policies, laws, regulations.

The effectiveness of many interventions remains unknown, particularly at the community level. Dishman (1994), however, conducted a meta-analysis of behaviour change interventions over a five year period up to 1992 involving 20 studies and 61 ESs. Reporting the ES as a mean correlation coefficient, Dishman found the most positive effect was for behaviour modification (0.23), followed by cognitive behaviour

modification (0.19) and educational counselling (0.18). With reference to these and other results, Dishman concluded:

- increases in frequency through the interventions listed are supported, but the evidence for intensity and duration is less clear
- the ES is inversely related to the 'scientific quality' of the study
- the failure of many intervention studies to be based on broader theoretical models of behaviour change contributes to the "uncompelling nature of the existing evidence" (p. 99).

A trend in exercise promotion in the UK in recent years has been to establish PA and exercise interventions through Primary Health Care (PHC). Our own research has shown that most family doctors ('GPs'), if involved in such work, are more likely to refer patients to a local leisure-centre scheme, although 30% refer to in-house programmes, such as activity counselling or classes (Biddle et al., 1994). Given the potential public health benefit that could accrue from targeting such individuals, further evaluation of such schemes is necessary. Indeed, we found that the evaluation of individual schemes was usually poor or non-existent.

In conclusion, I would like to see interventions based on good theoretical approaches, be targeted across the four levels identified by King (1991) above, involve rigorous evaluation, and continue the trend to target moderate PA rather than just vigorous exercise, as supported by the PATF and HoN initiative.

CONCLUSIONS

Considerable progress has been made in the theory and application of exercise psychology in recent years. However, there is much still to do in understanding antecedents, consequences and interventions, particularly in terms of the development of theoretically sound research and rigorous evaluations of interventions.

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4TH POSTER SESSIONS

P.4.1. Motor learning

P.4.2. Miscellaneous

P.4.1. MOTOR LEARNING

INTERFERENCES BETWEEN PHYSICAL EXERTION AND DIFFERENT STAGES OF INFORMATION PROCESSING[1]

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Key-words: physical exertion, level of expertise, information processing, activation.

INTRODUCTION

One of the main factors of motor performance consisted for subjects in the capacity to process information rapidly and accurately, particularly during physical exercise. Many exemples were known in sports where subjects, submitted to high time-pressure had to perceive, decide and move with efficacy despite a severe physical exertion.

Many experiments have examined the influence of physical exercise on cognitive performance but the results showed mostly inconsistency. In a review of literature, Tomporowski and Ellis (1986) revealed that most conflicting results may be due to a wide variety of methodological approaches. So, the nature of physical protocols was very important, especially when subjects had different physical fitness (Brisswalter, Legros & Delignières 1994).

Likewise, in the aim of controlling cognitive tasks, recent studies used classic mental chronometric procedures (Pass & Adam, 1991). An appropriate reading of experiments in this paradigm showed contrasting effects of physical exertion according to the nature of cognitive processes, particularly when the reaction time task takes place during physical exercise (Delignières, Brisswalter & Legros, 1994 ; Legros, Delignières, Durand & Brisswalter, 1992). Generally, these studies showed an impairement of the performance in simple reaction time paradigm and *a contrario*, only

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[1]. This experiment had been performed at the University Hospital Center, Angers, in the Functional Explorations service. The students came from the Formation Institute of Physical Education and Sports of Angers. We thank these two institutes for their contribution to this experiment.

for specialist of decisional activities, an improvement in choice reaction time paradigm. Nevertheless, more exceptional were experiments which focused on this comparison between one of perceptual or decisional stages and the motor side of information processing.

Most of research which tried to find the locus of effect of an energetical variable in the sequence of information processing used the Additive Factors Method (from Sternberg, 1969). This method suggested that when two variables (energetical vs cognitive) interact they had direct influences on the same processing structures. In addition, in keeping with Sanders (1983) the effect of indirect energetical variable widely fluctuated between individual trials and, hence, affected the end of reaction time distribution.

The aim of the present study was to compare the interferences of physical exercise on two information processing stages, the response choice and the motor adjustement stages (Sanders, 1990). We expected to observe on the two processing stages, a differenciated effect of physical exertion more than a general one. In this case, the effects of exertion would be mainly located at the highest end of the reaction time distribution, specially on the third quartile value.

METHOD

Twelve females and twelves males participated as subjects. They were students in physical education, volunteers and had normal or corrected to normal vision. All were non-experts in sports which required a decisional activity (as team or combat sports). Their mean age was 25.4 years (s.d.=6,95) for the males and 21.58 years (s.d.=1,68) for the females. In a preliminary protocol (adapted from Storer, 1990) subjects were submitted to individually determined maximal oxygen uptake (VO2 max., in $ml.min.^{-1}.kg^{-1}$) and maximal power attained with VO2 max. (Pmax., in watts). Mean VO2 max. and mean Pmax. values were in respective, 59.95 (s.d.=10.48) and 360 (s.d.=28.06) for the males and 47.67 (s.d.=3.70) and 257.50 (s.d.=15.75) for the females.

Both, in preliminary exercises and experimental protocols, a cycloergemeter Miditronic was used. A screen displaying the number of revolutions per minute was positioned in front of subject to provide with feedback regarding pedalling rate. Heart rate was measured in continuous with a Sport tester PE 3000 system (Polar). In the aim of maximal standardization of protocols, the experimental device could be adapted to the morphology of each subject and the luminosity, the heat (Delignières & Brisswalter, this volume) and the moistness were controlled.

The reaction time (RT) tasks were performed by using a computer connected with two joysticks, held in front of the ergometer handlebar. For more conveniences, the forearms of the subject were placed on elbow-rests and the joysticks were pressed only with the thumb. Subjects had to decide as fast as possible on the computer screen, which of the two response signals was the most appropriate by tilting on the appropriate joystick.

Subjects were required to respond to a visual two-choice RT task. In order to sollicite specific cognitive process, two tasks were used with two levels of difficulty. In one task, the variable compatibility was manipulated. In the other task, the foreperiod duration varied (<1150 msec. vs >5500 msec.). The two tasks and the four conditions were randomly presented and each warning signal appeared 1200 msec. after the preceeding response. Errors and response time were recorded continuously by the computer.

For every subject, the experiment was conducted in three separate sessions. In any case, the sessions took place at the same time of the day. During the first session (A) subjects were familiarized with RT tasks (to determine individual standards of performance, Sanders, 1990) and with physical protocol (to determine individual self-paced pedalling rate). The RT tasks were assessed at rest (session B) or concurrently with the pedalling task, whose relative power was corresponding to 60% Pmax., from the third minute of exercise (session C). The order of the sessions B and C varied systematically between subjects.

RESULTS

The validity of the experimental protocol was dependant on the reproductibility of physiological parameters, collected at rest and during each pedalling task. The analysis of heart rate (HR, in batt.min^{-1}) during compatibility and foreperiod tasks (74.86 vs 73.24) showed no significative difference between these two modalities, and likewise between the levels of difficulty. Results were similar for HR collected during pedalling tasks (145.33 vs 146.77). Besides, when these last data were expressed in relative values (% HRmax.) they showed that during pedalling tasks (62,19 vs 61,65) exertion was strictly aerobic and respected criterion of reproductibility determined in same protocol (Becque, Katch, Marcqs & Dayeur, 1993).

The analysis of individual mean RT performance, collected at rest for two levels of difficulty showed a significant decrement for compatibility ($F,1,23=198,10$, $p<.0000$) and foreperiod duration ($F,1,23=75,16$, $p<.0000$) tasks. Similar results were observed on the first and the third quartiles of mean RT in the compatibility task, respectively ($F,1,23=95.94$, $p<.0000$) and ($F,1,23=194.52$, $p<.0000$). In the same way, on the first and the third quartiles of mean RT in the foreperiod task, respectively ($F,1,23=86.66$, $p<.0000$) and ($F,1,23=29.93$, $p<.0000$).

The effect of physical effort on error rate was analysed for each subject and each level of difficulty, by two-way analysis of variance (exertion x levels of difficulty) with repeated measurements on both factors. The analysis indicated no main effect of exertion on error rate for the two cognitive tasks and no interaction between factors. Thus, the assumption of Additive Factors Method should be applied.

Mean RT data are reported in table 1. Data were submitted to a two-way analysis of variance similar to the one performed on error rate. Results indicated a significant main effect of exertion, both for the compatibility variable ($F,1,23=25,48$, $p<.0000$) and for foreperiod duration variable ($F,1,23=22,73$, $p<.0001$). Choice RT was significantly improved. Besides, no interaction effect between exertion and cognitive variables was found.

TABLE 1 : Mean RT Performances (msec.) According to Exertion (Standard Deviation in Bracklets)

	Rest	Exertion
Compatibility	258.07 (16.67)	241.88 *** (15.76)
No Compatibility	309.24 (21.12)	289.73 *** (27.10)
Short Foreperiod	254.43 (17.10)	242.50 *** (25.75)
Long Foreperiod	280.03 (21.66)	261.92 *** (24.21)

Note: The difference between RT performances at rest and during exertion was significant at *p<.05, **p<.025 and ***p<.01.

The first and third quartiles of mean RT data were submitted to a similar analysis.

The analysis of the first quartiles values indicated a significant main effect of exertion, both for the compatibility variable ($F_{1,23}=21,10$, $p<.0001$) and for the foreperiod variable ($F_{1,23}=23,68$, $p<.0001$). These data showed essentially the same results as obtained with the mean RT. Next, no interaction effect between exertion and cognitive variables was found.

Similar results for main effects were obtained when using the third quartiles of mean RT data as dependent variable. They were reported in table 2. The analysis confirmed a significant improvement of RT performance by exertion, both on the compatibility ($F_{1,23}=21,52$, $p<.0001$) and the foreperiod ($F_{1,23}=21,85$, $p<.0001$) variables. Besides, no interaction effect between exertion and compatibility was found.

TABLE 2 : Third Quartiles of Mean RT Performances (msec.) According to Exertion (Standard Deviation in Bracklets)

	Rest	Exertion
Compatibility	277.68 (18.68)	261.44 *** (15.62)
No Compatibility	337.57 (27.15)	317.92 *** (29.15)
Short Foreperiod	272.10 (17.96)	262.65 *** # (26.34)
Long Foreperiod	297.75 (28.06)	276.54 *** # (26.80)

Note: The difference between RT performances at rest and during exertion was significant at *p<.05, **p<.025 and ***p<.01. The interaction (exertion-level of difficulty) was significant at #p<.05.

A contrario of the previous results, the analysis indicated a significant effect of interaction between exertion and foreperiod duration ($F1,23=4.87$, $p<.0375$). Compared with the RT performance at rest, post-hoc analysis (Newmann Keuls test) indicated a significant improvement of RT performance during exercise, for the two levels of difficulty, more especially on long foreperiod duration .

DISCUSSION

The effects of exertion on choice reaction time were quite consistent with those obtained in previous works (Brisswalter, Legros & Delignières, 1994 ; Delignières, Brisswalter et Legros, 1994 ; Delignières & Brisswalter, this volume).

Nevertheless, in these preceeding studies, the improvement in performance by physical exertion concerned only the experts in decisional

tasks. One of the most striking results of this experiment consisted in the possibility to obtain an improvement of RT performance, during physical exercise, even with subjects which did not possess this kind of expertise. This finding make complete the interpretation which explain the differenciated effect of exertion on simple and choice RT paradigms solely for experts in decisional activities (Delignières, Brisswalter & Legros, 1994 ; Durand, Bourrier & Legros, 1991).

According to Additive Factors Method assumption, an interaction obtained between exertion and foreperiod duration suggested that the variables interfere with the same cognitive process : motor adjustment. The hypothesis of differenciated effect of exertion on the sequence of information processing was confirmed because only a significant interaction was revealed on foreperiod duration variable, specially when thirds quartiles values were dependent variable. This result confirmed that the effect of exertion fluctuated widely between individuals trials and that it affected on particular the end of RT distribution (Sanders, 83).

This selective effect of exertion on cognitive processes was in accordance with the Sanders' predictive cognitive-energetical model (1983) which postulated complex influences of specific energetical supplies on each information processing stage.

In accordance with previous works of Pribram and McGuinness (1975) the mutual relations between physical exertion and cognitive processes should be interpreted by a direct influence of activation on the motor side of information processing sequence. Another studies should appear necessary in the aim of validating these results and explorating more widely the locus of influence of physical exertion on cognitive process.

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EFFECTS OF MUSICAL RHYTHM AND SPEED AND DURATION OF PERFORMANCE ON A TAPPING TEST

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Music is often intuitively used by athletes and coaches to enhance and/or reduce arousal level ("psyching up" or relaxation, respectively). Such application is based on the assumption that it may positively contribute to the improvement of athletes' performance (Blumenstein, 1988; Dorney, Goh & Lee, 1992). However, empirical studies on the effect of music on athletes' performance have been quite rare (Zaichkowsky & Takenaka, 1993).

Research in athletic settings indicates that the effect of music on athletes' performance is dependent on factors such as music style and type of task. Researchers in this area often used sedative and stimulative versions of music, rock and roll (Pearce, 1981; Fontaine & Schwalm, 1979; Caoussis & Mekelvic, 1986; Fucci, Harris, Petrosino, Banks, 1993) or classical music (Dorney et al., 1992; Smith & Morris, 1977; Hilliard & Tolin, 1979; Rider & Achterberg, 1989). Among the tasks researched more frequently were muscular endurance (Dorney et al., 1992), grip strength (Pearce, 1981), 60% or 90% of predicted VO_2 max (Johnson & Siegel, 1987; Portiger & Wessels, 1993), visual vigilance performance (Gozhan & Gounaud, 1976), pedometer (Beckett, 1990), and treadmill endurance (Copeland & Franks, 1991).

Few studies have investigated the effect of music on motor performance. For example, Fontaine and Schwalm (1979) found that familiar music had a greater effect than unfamiliar music in increasing heart rate and improving performance on a vigilance task. Corhan and Gounand (1976) and Davenport (1974) found vigilance performance to be better with background rock music than with "easy listening" music. Pearce (1981) found that listening to sedative background music decreased grip strength, whereas grip strength remained unchanged when subjects listened to stimulating music or exercised in silence. However, Vyatkin and Dorfman

(1980), Daloussis and McKelvie (1986) found that in general, music increased arousal and enhanced the static endurance of athletes.

Recently, Copeland and Franks (1991) indicated that soft, slow background music reduced physiological and psychological arousal during submaximal exercise and enhanced endurance performance. The results of this study, however, did not support the hypothesis that fast, loud music increases physiological and psychological arousal.

In an experiment designed to determine the effect of music on heart rate recovery and distance walking, Becket (1990) found that subjects performed better with music than without music. With intermittent background music, heart rate recovery was better and distance walking in 30 minutes was longer than with continuous music.

Dorney et al. (1992) investigated the relationships among music, heart rate and performance in physical tasks. They found that performance did not differ across conditions, but heart rate was significantly lowered after listening to either type of music. In addition, Dorney et al. (1992) examined the relationship between music and imagery and found that the imagery-plus-music group showed a significant increase in heart rate during preparation, but heart rate was not related to task performance. It appears that music may affect arousal, but that at least for these tasks there is no corresponding effect on behavior.

Portgieter and Wessels (1993) found that music is beneficial as a means of dissociation when exercising at low work rates (approximately 50%, 60% and 70% of maximum capacity). As expected, music did not have an effect at higher levels of performance when an associative strategy would be more appropriate. The study did not produce a definite answer regarding the relationship between music and aerobic performance.

It can be concluded that the rationale for using music while performing physical work is that music either lowers or increases arousal, depending on the nature of the music and the desired outcome. In addition, background music, used as a means of distraction, can make unpleasant and monotonous work less aversive (Britton & Karoly, 1989). However, empirical results are contradictory and suggest that further research should be conducted to examine a broader range of music types and motor tasks that may indicate more about the psychological responses to music and its relevance to physical activity and athletic performance.

The investigation of music types may be insufficient, because a further distinction can be made between several musical aspects, such as melody, harmony, rhythm and form (Radocy, 1980). These distinct elements are often organized by the human listener to create a whole which is perceptually different from their separate existence. However, to understand the effects of music on athletic performance, it may be worthwhile to investigate also the distinct influence of each of these elements separately. To our knowledge, this has not been conducted thus far. Accordingly, we attempted to examine the influence of the most basic element of music, namely rhythm, on motor performance.

Rhythm in music is defined as the pattern of organized sounds and silence; to perceive a rhythm means to relate the respective durations in a particular order across time, that is, to perceive an orderly sequence of sound and silence (Bregman & Campbell, 1971; McNally & Kandel, 1977; Radocy, 1980). Thus, rhythm is a temporal rather than a tonal phenomenon. Boyle (1968) demonstrated that rhythmic training utilizing foot tapping and clapping improved the reading of notated rhythms. Practices such as stressing beats with a foot tap or other muscular

movements probably help to provide clues for perceptual organization. However, rhythmic performance seems to be only moderately related to rhythmic perception (Thackray, 1969).

As mentioned above, in sport psychology, the musical parameters of melody, harmony, rhythm and form and their respective influence on performance, have not been studied thus far, except for Copeland and Franks (1991), who included two rhythm versions of music (140 beats/min - fast music and 100 beats/min - slow music) in their study. Few studies indicated that rhythmicity and timing may be imoprtant to the learning of motor tasks and to the performance of skilled activity (Gueze & Kalverboer, 1994; Nagasaki, 1987; Schmidt, Treffner, Shaw, & Turvey, 1992; Southerd & Miracle, 1993; Wrisberg & Klein, 1992). However, these studies had no relation to any music element whatsoever.

Accordingly, the purpose of this investigation was to examine the influence of musical rhythms (being a reflection of actual musical compositions) on tapping performance under comfortable and maximal speed conditions, over time. It should be noted that this particular motor task not only has a close affiliation to the issue of rhythm, but also that tapping tests are commonly used to measure the upper extremity of motor control (Carlier, Dumont, & Beau, 1993), which is highly relevant to sport. Comfortable and maximal speed conditions reflect the realism of sport in that within athletes' training processes, workload is often divided into similar categories.

METHOD

Subjects. Thirty-six college physical-education students (28 female, 8 male) participated in the study. Their ages ranged from 20 to 26 years (M=23.6, SD=1.64).

Experimental Treatments and Tasks: Four rhythms were played from a recorded cassette tape 60 beats/min (slowest); 120 beats/min (average); 180 beats/min (fastest); and a variable rhythm, comprised of which included in random order ten 5-sec parts each of the rhythms. In addition, a control condition (silence) was used. These particular rhythms were chosen because most popular musical compositions (e.g., tango, blues, rock and roll, country music, and lyrical melodies) are within this range of rhythms. Each of the rhythms was previously recorded from a metronome on a cassette. These rhythms and silence were played to each of the subjects in a random order from a Sony cassette tape during motor tasks performance with constant volume 60 db.

Each subject had to perform the tapping task for 60 seconds, under two further conditions: (a) comfortable speed - the subject was instructed to perform the tapping tasks in a speed which was subjectively perceived as comfortable for him or her. (b) Maximal speed - the subject was instructed to perform the tapping task in his or her maximal speed.

Procedure. Motor performance test working panel (A-234, Mödling, Austria) was used for conducting the tapping test. The tapping apparatus consisted of two stylus (each - 150 mm), with which subjects tapped on a square iron plate (50X50mm). The tapping apparatus was connected with an IBM-486-DX2 computer, which showed every 10 sec the amount of beats performed by the subject in the respective period of time (1-10, 11-20, 21-30, 31-40, 41-50, 51-60 seconds). The subject could not control the regularity of performance through visual feedback. Subjects were tested individually. The subjects were seated approximately two meters to the side of the

tape near the table with the tapping apparatus. Each subject was instructed about the motor task and performed the tapping test while attached with a stylus to the dominant hand and iron plate during the entire 60 sec.

Statistical analysis. A repeated measures MANOVA was conducted using the five rhythms (60 beats/min, 120 beats/min; 180 beats/min, variable, silence), the two speed conditions (comfortable vs. maximum), and the six periods of time (1-10, 11-20, 21-30, 31-40, 41-50, 51-60 sec) as within-subject factors. Thus, a 5 x 2 x 6 (rhythms X speed conditions X time periods) RM MANOVA was applied to the data.

RESULTS

Table 1 presents the means and standard deviations of tapping performance for rhythms by speed conditions and periods of time.

The 5 X 2 X 6 RM MANOVA revealed two significant main effects, that of speed conditions, $F(1,34)=155.50$; $p<.001$, and that of periods of time, $F(5,170)=13,65$; $p<.001$. One significant 2-way interactional effect was revealed, namely, speed conditions X periods of time, $F(5,170)=12.45$; $p<.001$; another 2-way interaction approached significance, namely, speed conditions X rhythms, $F(4,136)=2.33$; $p<.059$.

The significant main effect of speed conditions resulted from a substantial difference between the maximum and comfortable conditions (M=62.91, SD=5.61 vs. M=29.83, SD=7.28, respectively). The significant main effect of time periods resulted from a systematic decrease in tapping performance over time, from the first to the sixth period (M=48.27, SD=21.12; M=47.49, SD=20.22; M=46.33, SD=19.55; M=45.93, SD=19.10; M=45.43, SD=18.70; M=44.74, SD=18.56, respectively).

The interaction speed conditions X time periods (Figure 1) revealed that within the maximum condition, a substantial gradual performance decrease was observed from the first to the sixth period of time (M=66.43, SD=5.92; M=64.59, SD=4.92; M=62.64, SD=4.20; M=62.02, SD=4.24; M=61.46, SD=4.05; M=60.33, SD=4.87). However, within the comfortable condition, the gradual performance decrease was much more moderate (M=30.18, SD=7.48; M=30.42, SD=7.64; M=30.01, SD=8.18; M=29.83, SD=7.62; M=29.41, SD=7.63; M=29.18, SD=7.79).

The close to significant interaction speed conditions X rhythms revealed a systematic increase in performance with increasing rhythms within the comfortable condition, from 60, through 120, to 180 beats/min (M=28.71, SD=1.12; M=29.48, SD=3.06; M=32.78, SD=2.91, respectively); silence lay between the two upper values (M=30.28, SD=2.00), and the variable

rhythm lay beneath all other values (M=27.82, SD=1.24) within the comfortable condition. In contrast to these variations, performance remained quite stable for all five rhythms within the maximum condition (M=62.64, SD=3.87; M=63.24, SD=4.08; M=62.49, SD=4.10; M=63.22, SD=5.32; M=62.99, SD=5.28, respectively).

DISCUSSION

In this investigation, an attempt was made to examine the influence of musical rhythms on tapping performance under comfortable and maximal speed conditions, over time. In general, the instructions to perform the tapping task either in a comfortable or in a maximal speed, played a major role in affecting performance. Across all other conditions, the "maximum" instructions produced a substantially higher performance than the "comfortable" instructions, which in itself was not very surprising. However, and even more important, are the interactional effects associated with speed of performance. For example, the more substantial gradual performance decrease over time within the maximum condition, in comparison to the comfortable condition, seems to reflect the effect of fatigue: logically, this effect is much more pronounced over time when more effort is put in one's prolonged performance. Fatigue effects also seem to cause the overall systematic decrease in tapping performance over time, revealed in the main effect of time periods.

The close to significant interaction of speed conditions and rhythm is of particular interest. Rhythms had a negligible influence on performance when subjects tried to exert themselves to their maximum, as reflected by the quite stable performance for all five rhythms under the

maximum condition. In contrast, rhythms played a major role when subjects were performing under comfortable speed conditions. It seems that when exerting themselves to the maximum, the subjects' attention was narrowed and concentrated mainly on tapping. However, under the comfortable speed condition, the subjects' mind seems to be more open to a wider range of cues available in their environment. This phenomenon is closely related to Easterbrook's (1953) cue-utilization hypothesis and Kahneman's (1973) notion of peripheral narrowing (for an extensive review, see Abernethy, 1993).

As to the specific nature of rhythm effects revealed within the comfortable speed condition, it appears at first glance that in order to improve tapping performance, rhythm has to be anything but variable, and preferably, as fast as possible. However, a closer look at the data reveals that in fact, only the rhythm of 180 beats/min had an improving effect on tapping performance. This statement is valid because when silence is taken into account as a control for all other conditions, only the 180 beats/min rhythm actually produced higher performance; 120 and 60 beats/min, not to mention the variable rhythm, gradually decreased tapping performance.

In order to try and explain these findings, it should be noted that when performing comfortably in silence, the subjects' mean tapping performance equalled the value of 30.28 beats *per 10 seconds*, which means a tapping rhythm of 181.68 beats *per minute*. In other words, when instructed to perform the tapping task at a speed which was subjectively perceived as comfortable, subjects "willingly choose" to work in a rhythm, which was very close to 180 beats/min. It is therefore possible that the improving influence of the 180 beats/min rhythm can be attributed not to its being the fastest rhythm, but first and foremost to the fact that when listening to the 180 beats/min rhythm, subjects were actually exposed to a rhythm which was

very similar to their "willingly chosen" tapping rhythm. Thus, when exposed to a rhythm which closely matched their "natural" rhythm, subjects outperformed themselves, in comparison to the "silence" condition.

Interpreted in this way, the gradually decreasing effect of the 120 and 60 beats/min rhythms can be attributed to the increasing distraction produced from being exposed to rhythms, which had a decreasing similarity to the subjects' "natural" rhythm of tapping performance. In other words, these slower rhythms had an inhibiting effect on tapping performance; however, the strongest inhibition was produced when any regularity in rhythm was lost, that is, when rhythm became variable.

In general, rhythmic performance is moderately related to rhythmic perception (Thackray, 1969). However, some research (Kuhn, 1974; Kung & Gates, 1975) indicated that when exposed to alterations in rhythm, people tended to be more sensitive to a decrease than to an increase in rhythm. Since the most obvious way of further researching our above explanations would be to expose subjects to rhythms which will be substantially faster than their "natural" comfortable rhythm of performance, it remains to be seen whether these differences between decelerated and accelerated rhythms will also hold wiht a task such as the present one. At any rate, our results further confirm previous research findings (e.g., Sturges & Martin, 1974), which indicated that any irregularity in rhythm, that is, any loss of predictable cyclicality in the artificially imposed recurring patterns, had a negative effect on rhythmic performance.

The present investigation has gone a step further in understanding the distinct influence of various musical aspects on motor performance. Future research in this area should continue in separately investigating elements such as rhythm, melody, harmony and form (Radocy, 1980),

to follow their effects within athletic contexts contexts. However, since these distinct elements are usually organized by the listening performer to create a "Gestalt" which is perceptually different from their separate existence, it is also worthwhile not to neglect the investigation of music types, e.g., in combination with other mental preparation techniques such as imagery (Dorney et al., 1992).

From an applied perspecitve, the present study suggests that if one wants to improve tapping performance through rhythm, it has any use whatsover only when using 180 beats/min under comfortable speed conditions. Since 180 beats/min was the fastest rhythm in this study under the comfortable condition, future research is needed to indicate whether faster rhythms do indeed produce performance decrements, probably caused by the "mismatch" between people's "natural" tapping rhythm and the externally imposed rhythmic pattern. It is possible, however, that in general, the performance of various motor tasks, each having its own "natural" rhythm, may be improved through an appropriate match between the "internal" and "external" sources of rhythm. To do this, however, one should adopt a transactional point of view, according to which intentional behavior (i.e., performance) is determined by "persons in situations" (Cronbach, 1957; Pervin, 1968). Since in practice athletic tasks are quite often trained time and again in workloads which are conceptually similar to our "comfortable" condition, this "matching" principle - if valid for other rhythms and tasks as well - may substantially contribute to everyday athletic practice. However, further empirical research is needed in this area, to prevent premature application of these findings.

References : Will be sent by the authors at request.

TABLE 1: MEANS AND STANDARD DEVIATIONS OF TAPPING PERFORMANCE FOR RHYTHMS BY SPEED CONDITIONS AND PERIODS OF TIME.

		Comfortable Speed					
rhythm	time period	1-10	11-20	21-30	31-40	41-50	51-60
60 beats/ min	M	28.34	28.57	28.94	28.77	28.97	29.05
	SD	12.20	12.29	12.49	12.18	12.15	12.21
120 beats/ min	M	30.97	31.14	30.48	28.34	27.88	28.05
	SD	16.70	17.62	17.95	14.85	14.91	14.60
180 beats/ min	M	32.11	33.97	33.34	33.80	32.11	31.37
	SD	14.63	17.07	17.57	17.83	15.02	16.64
variable	M	28.14	27.82	27.94	27.88	27.80	27.31
	SD	14.08	14.28	14.29	14.76	14.34	13.91
silence	M	31.02	30.51	29.34	30.34	30.28	30.18
	SD	5.49	14.37	13.64	13.81	13.64	13.71

rhythm	time period	Maximum Speed 1-10	11-20	21-30	31-40	41-50	51-60
60 beats/ min	M	65.42	64.40	61.60	62.08	61.34	61.00
	SD	7.28	7.81	9.85	8.84	9.51	7.90
120 beats/ min	M	66.31	65.48	63.17	62.00	61.25	61.20
	SD	8.55	8.99	7.68	10.03	11.08	8.36
180 beats/ min	M	64.65	64.34	62.25	62.03	61.28	60.34
	SD	11.12	7.97	10.03	9.79	8.91	9.12
Variable	M	68.62	63.31	63.37	62.42	61.09	60.08
	SD	10.68	14.02	11.39	12.31	10.08	11.73
Silence	M	67.11	65.40	63.80	61.62	62.37	59.00
	SD	13.48	10.52	8.32	12.85	8.93	14.51

SPONTANEOUS TEMPORAL ORGANIZATION IN A SEQUENTIAL ARM MOVEMENT.

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KEY WORDS

Timing ; sequential arm movement.

INTRODUCTION

Temporal organization is very important in acquisition of many sports skills. Expert performance when executing a sequential movement can often be characterized by a specific timing or rather by a specific spatio-temporal coordination. When subjects repeat a movement, some of its features are fixed while other aspects are easily changed. For some motor or sports skills, the absolute duration of the movement is fixed, whereas for others the relative durations appear invariant from response to response (Viviani & Terzuolo, 1983 ; Shapiro et al., 1981 ; Wollstein & Abernethy, 1989 ; Schoebel & Hay, 1990 ; Roberton & Halverson, 1988 ; Schmidt, 1988). This specific and invariant timing that characterizes the expert performance has to be acquired during their motor or sports skills acquisition period.

Some experimental studies have been performed regarding the learning of an imposed timing in a sequential arm movement (Carter & Shapiro, 1984 ; Langley & Zelaznik, 1984 ; Williams, 1985 ; Carnahan & Lee, 1989). It has been shown that spontaneous timing can be modified when another timing is imposed but, in absence of both pretest and posttest, authors could not show that the imposed timing has been learned. Moreover, in one experiment (Langley & Zelaznik, 1984), by accident the imposed timing was very close to the spontaneous timing of subjects. In order to avoid this experimental artefact and to better understand the motor control of this kind of movement, it seems that the spontaneous timing has to be analyzed first.

In a previous experimental work (De Jaeger & Boisacq-Schepens, 1992) we could show the existence of a spontaneous temporal organization, consistent across subjects when executing a sequential arm movement on a vertically oriented digitizer table. The first segment duration was the shortest, followed by three segments of nearly equal duration in spite of differences in length and direction. Duration on the last three segments was clearly related to the index of difficulty, calculated for each segment as $\log_2$ (2 A/W) with A = Amplitude or length of segments, and W = Width of the target or tolerance range. (Fitts, 1954). This kind of spontaneous temporal organization probably reflects a basic, economical and unconscious, lower-order control process. The first segment, shorter than the others, seems to be controlled otherwise.

Three experiments were conducted in order to further analyze this spontaneous temporal organization. Experimental conditions were similar to these of our previous work (De Jaeger & Boisacq-Schepens, 1992) except that the start condition was changed in each of the three experiments. Moreover, we could record both the pressing time (pressing and releasing stylus point on the LEDs) and the moving time (moving time between two LEDs). Pointing time as recorded in previous work corresponds to (pressing time + movement time) as recorded in these three experiments. However, for the first segment, pointing time previously recorded corresponds to a moving time due to the fact that movement was initiated with the stylus point already pressed on the LED.

The aims of these experiments can be expressed as follows :

1. to confirm or not the existence and the characteristics of a spontaneous timing consistent accross subjects ;
2. To describe this timing in terms of pressing time and moving time, with pointing time = pressing time + moving time ;
3. To observe the relation between the pointing time and the index of difficulty in the first segment, when start conditions are changed.

METHOD AND PROCEDURE

Subjects

Thirty young adult subjects (15 women and 15 men), all volunteers and right-handed, participated. Ten subjects, five women and five men, were assigned

to each experiment. No statistical difference appeared between men and women when compared in each experiment on a Student t test. So, they were confounded in data analysis.

Apparatus and Task

The apparatus consisted of a vertically oriented digitizer table (Calcomp 640) interfaced with an IBM/PC AT 386. The subjects stood in front of the digitizer, a stylus, which was connected to the table, was held in the right hand. Subjects traced a fixed and invariable spatial sequence consisting of four segments which were different in direction and length (see Fig. 1). The segments measured respectively 20.0, 28.3, 18.6 and 11.5 cm, which represents 25.5, 36.0, 23.7 and 14.7 % of the overall distance to cover. Their extremities were made visible by five LEDs (light emitting diodes) located behind the table.

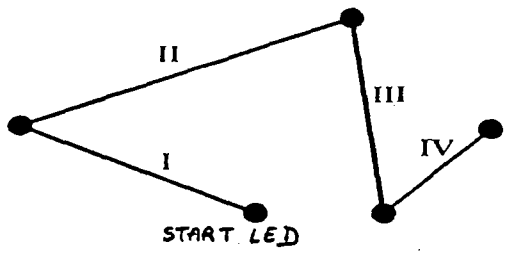

Fig. 1. Spatial pattern in the three experiments. In experiment III, the start point was located 10 cm lower down, under the start LED.

In experiment I, the sequential movement begin with the stylus point pressed on the start LED. On the "go" signal (5 LEDs simultaneously on), the subjects may freely initiate the arm sequence, releasing the stylus point (start of recording), going from one LED to another in a continuous gliding movement and pressing the stylus point on or nearby each LED. In experiment II, the sequential movement begin with the stylus point on the start LED. On the "go" signal, the subjects may freely initiate the arm sequence, pressing the stylus point on the start LED (start of recording), then releasing it, and executing the overall sequence. In experiment III, subjects had the stylus point on a LED located 10 cm lower down, under the start LED. On the "go" signal, the subjects may freely initiate the arm sequence, moving the stylus point up to the start LED, then

pressing (start of recording) and releasing it on this LED, and executing the overall sequence. The five LEDs remain visible for 5 sec., during which the movement had to be performed. The LEDs were then simultaneously switched off.

Procedure and data acquisition

Prior to the experiment proper, each subject was given a period of at least 10 trials without any temporal instruction, just getting accustomed to the spatial pattern. Then, subjects were instructed to execute the sequence 10 times at their own timing (rhythm and speed), but keeping this timing constant from trial to trial. In this way, individual spontaneous temporal organization could be observed and recorded.

Eight counters (nine counters in experiments II and III) were started before the onset of each trial and stopped respectively whenever subject pressed or released the stylus point on the digitizer table. Trials were rejected when pointing time for one segment was longer than 2000 msec. or shorter than 50 msec., or when the distance from the LED was greater than 3 cm. Rejected trials were not analyzed but they were replaced as to have 10 correct trials.

Temporal data analysis

For each subject, durations of the four segments, expressed in absolute (msec.) and relative (%) values, were averaged on the 10 trials. In this way, one mean absolute (msec.) duration value and one mean relative (%) duration value were available per segment for the 10 trials.

To rightly compare, in discussion, the results of the three experiments between themselves and with previously obtained experimental results, we first used a Student t test for intergroup comparisons on segments pointing time.

The existence of a consistent temporal strategy among subjects was tested by means of intersegmental Pearson correlation analyses : pointing time on the four segments have been correlated two by two for the ten subjects. High correlations would be considered as a strong argument towards the existence of a spontaneous temporal organization, consistent accross subjects. Matrix of Bonferroni probabilities were used. Intersubject variability of pointing time

Spontaneous timing expressed in relative value was another feature likely to confirm the existence of such consistent timing.

The characteristics of the spontaneous temporal organization were studied using a Friedman two-way analysis of variance performed on pointing time, pressing time and moving time of the four segments in each experiment. Moreover, in each experiment, a Pearson correlation analysis was performed to study the relationship between pointing time, pressing time and moving time, all segments confounded. Finally, the relation between pointing time and the index of difficulty (Fitts law) was studied with a Pearson correlation analysis.

RESULTS

Between group comparisons performed on pointing time using a Student t test revealed no statistically significant difference between experimental groups results on the one hand, and on the other hand between each group separately and previous experimental results. Only the third segment appeared different when absolute values of pointing time are compared in experiments I and II ($t = 2.425$, $p = 0.03$).

Existence of a Consistent Temporal Strategy Among Subjects.

The existence of a temporal strategy, consistent among subjects, was demonstrated by high significant Pearson correlation values obtained when pointing time on the four segments are correlated two by two for the ten subjects. In experiments II and III, all relationship reach very high significance ($p<0.01$). In experiment I, the first segment (pointing time = moving time) is not significantly correlated with the three other segments (pointing time = pressing time + moving time). See table 1.

TABLE 1. Intersegmental Pearson Correlation Values.

EXP. I

r	seg. II	seg. III	seg. IV
seg. I	0.71	0.74	0.57
seg. II		0.96	0.92
seg. III		0.87	

EXP. II

r	seg. II	seg. III	seg. IV
seg. I	0.98	0.89	0.91
seg. II		0.95	0.93
seg. III			0.89

EXP. III

r	seg. II	seg. III	seg. IV
seg. I	0.93	0.94	0.79
seg. II		0.90	0.72
seg. III			0.82

Intersubject variability of pointing time expressed in relative value is very low, confirming the idea that the spontaneous timing is consistent accross subjects. See table 2.

TABLE 2. Means and Standard Deviations of Pointing Time in Relative Values (%).

	Seg. I		Seg. II		Seg. III		Seg. IV	
	M	SD	M	SD	M	SD	M	SD
EXP. I	22	3	28	1	26	1	24	2
EXP. II	27	2	26	1	25	2	21	1
EXP. III	25	1	27	1	25	1	22	2

Characteristics of the Spontaneous Temporal Organization :

Friedman two-way analysis of variance. In experiment I, II and III, statistically significant differences appear on pointing time ($F_{3,9}$ = 20.16, 21.33 and 16.68 respectively, $p<0.001$) and on moving time ($F_{3,9}$ = 19.56, 18.60 and 20.73 respectively, $p<0.001$). No significant difference appears on pressing time in experience I and II ($F_{3,9}$ = 0.60 and 4.08 respectively, $p>0.05$) while in experience III result is statistically significant ($F_{3,9}$ = 15.75, $p<0.001$).

Pearson correlation analysis between pointing time, moving time and pressing time reveals high correlations between pointing time and moving time (r = 0.86, 0.95, and 0. 96 respectively in experiments I (n=28), II, and III (n=38), $p<0.001$). In experiment I, no significant correlation appears between pressing time and pointing time (r_{28}=0.27, $p>0.05$) or between pressing time and moving time (r_{28}=-0.26, $p>0.05$). In experiments II and III, no significant correlation appears between pressing time and pointing time (r_{38}=-0.13 and - 0.34 respectively, $p>0.05$) while the pressing time-moving time correlation value appears statistically significant (r_{38}=-0.44 and -0.58 respectively, $p<0.05$). Notice

that when performed separately on each segment, this correlation analysis appears no significant in experiment II, but significant for segments I and IV in experiment III.

Relation between index of difficulty and pointing time. In experiment I, a correlation value was calculated on the last 3 segments (r = 0.99 with pointing time = 470.7 + 79.2 X). In experiment II, the correlation value calculated on the 4 segments was 0.82, with pointing time = 505.6 + 128.5 X. In experiment III, the correlation value calculated on the 4 segments was 0.99, with pointing time = 447.3 + 119.7 X.

DISCUSSION AND CONCLUSION.

The existence of a spontaneous timing consistent among subjects is confirmed in the three experiments : pointing times on all segments except the first are nearly equal despite large differences in segments amplitude. In fact, movement duration on the last three segments appears related to the index of difficulty as previously defined. Such an application of the Fitts' law to sequential movements seems not to have been described (Schmidt, 1988, ch. 9).

Notice that the duration of the first segment, which was the shortest in experiment I when no pressing time was recorded, became the longest in experiment II when pressing time was included in pointing time. This is probably due to the fact that a conscious attention process is necessary for initiating the motor sequence. Indeed, when another movement takes place before this first segment, the pointing time on this later appears to be related to the index of difficulty as other segments.

If in experiment I the spontaneous timing is further analyzed in terms of pointing, moving and pressing times, pressing time appears likely to be a constant element : not significant anova, not significant correlation with pointing or moving times, while these two times are significantly correlated. However, this is not so clear in experiments II and III, where significant negative correlation appears between moving time and pressing time. Further investigations are necessary to clarify this point.

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SR COMPATIBILITY AND PROBABILITY ON RT ACCORDING TO HASBROUCQ'S MODEL

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KEY WORDS : SR Compatibility, Probability, Reaction Time

INTRODUCTION

In 1951 Fitts showed that there should be in every individual an optimal relation between a set of stimuli and responses. Fitts defined this notion in terms of "Stimulus-Response Compatibility". Subsequent studies (Fitts & Seeger, 1953 ; Fitts, 1959) showed that the reaction time (RT), i.e. the time between stimulus occurence and setting off of response, is a function of the SR compatibility level : the more complex the relation , the longer RT. Numerous theories attempting to understand the effects of SR compatibility followed Fitts' works (Alluisi et al., 1964 ; Duncan, 1977 ; Dutta & Proctor, 1992) but one of them seems particularly interesting to us : "The List-Rule Model" which was proposed by Hasbroucq, Guiard & Ottomani (1990). The purpose of our study here is to verify the validity of this new model. According to the model, a stimulus-response compatibility (SRC) effect can be defined as the "modification induced in performance by a change in the S-R relationship that is uncorrelated with any change in stimulation or responding". This model predicts that if the subject does reduce the variables S and R to the same concept, the possibility of an algorithmically governed R determination procedure will emerge. In this situation, where stimuli and responses are paired by a rule implementation, one would expect that the probability of stimulus occurence does not affect the response selection stage. However, if the SR mapping prohibits the formulation of a general rule, the R determination procedure will consist in scanning the memorized list of the individual SR pairs that have been defined in the instructions as correct. In this case where stimuli and responses are paired by a memory scanning, it would be expected the probability of stimulus occurence affects the duration of the response selection stage. Thus the hypothesis of this study was, on the one hand, to observe additive effects between probability and SR compatibility when comparing RT performed in simple rule implementation condition with RT performed in a complex rule implementation condition, and on the other hand, to observe the interaction between both factors when comparing RT performed in a rule implementation condition with RT registered in a memory scanning condition.

METHOD AND PROCEDURE

Twenty one subjects were assigned to a choice reaction time task with four eventualities. They were sat at a table on which two moveable handles were fixed, and on which a computer monitor was disposed frontally (*Figure 1*). The handles' angular transfer, produced by a bending or stretching of the wrists, controlled the vertical position of two "X" displayed on screen. In the middle of the monitor was fixed a diode device which constituted the response signal source. The visual response signal was a 1 cm vertical flitch directed towards the bottom or the top and situated either on the right or the left of a vertical line located in the middle of the diode device.

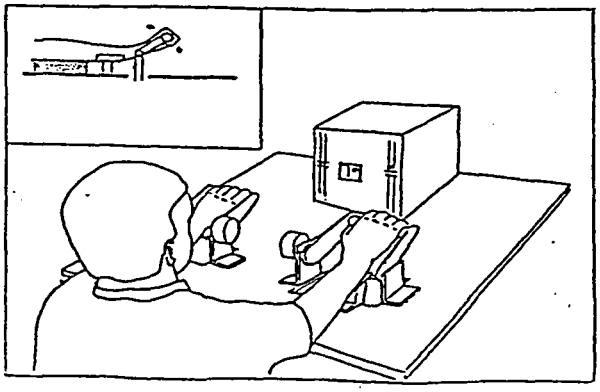

Figure 1 : Apparatus

After each trial, the subjects were informed about the RT performed (time between the flitch occurence and the first moving of one of the handles detected by a potentiometer) or about the nature of the error (too long, anticipation, side error, direction error, double error, or "moved" when both hands move simultaneously). The whole experiment was computerized. A trial progressed as follows : the subject put both handles in starting position (horizontal position), thus setting off the trial probability cue appearance. This preliminary information remained on display for 1 second after which the preparatory signal (100 ms sound) occured. The foreperiod was constant and lasted for 1 sec. It ended with a response signal occurence which is displayed during the whole reaction latency. After responding, the subject read his performance on the screen and put the handle back in its starting place. In our study, we have crossed two variables : Probability and SR compatibility (SRC). The former was composed of three modalities : 0.5 (valid situation), 0.17 (invalid situation), 0.25 (equiprobable situation). The probability cue was a horizontal line situated at each flitch location (so there were 4 such lines). Just one of the 4 lines occurred in the case of valid and invalid situations, and the 4 lines occured simultaneously in the case of the equiprobable situation. The latter was also composed of three modalities. These SRC modalities were similar to those of Hasbroucq's model and all of them had dimensional overlap : simple rule implementation SR compatibility (= simple SRC

: response in the direction and in the side of the flitch) ; complex rule implementation SR compatibility (= complex SRC : response in the opposite direction and opposite side to those indicated by the flitch) ; memory list scanning SR compatibility (= scanning SRC : response according to instructions learned : the 4 SR pairs could not be represented in terms of a general concept). The subjects were assigned to just one SR compatibility condition. In other respects, they were confronted with the three probability conditions (randomized over blocks of trials). They were submitted to a learning session beforehand. This session was composed of blocks of 40 trials in the course of which subjects had to try to reach two learning criteria : a percentage error rate of 5% or less and a standard deviation of RT distribution of no more than 15% of mean RT of this distribution. When these two criteria were reached in a same series, the subjects were able to go on to the experimental session. This session was composed of 10 blocks (of 36 trials) and divided up into two "sub-sessions" carried out on two different days in the same week. Finally, subjects had to give their opinion about the experiment in a post-experimental introspective questionnaire.

RESULTS

The statistical analysis consisted of an analysis of variance of average RT and number of errors : an univariate analysis (ANOVA) for the study of the effect of the SRC factor and a multivariate analysis (MANOVA) for the study of the effect of the probability, with SR compatibility as between-subjects factor and probability as within-subjects factor.

Experimental session :

An ANOVA performed on the RT data revealed non-significant effect of SR compatibility : [F (2,16) = 3.5 ; p = .053]. By contrast, planned comparison showed a significant effect of SR compatibility between RT registered in both rule implementation conditions and RT performed in the memory scanning condition : [F (1,16) = 5.9 ; $p < .027$]. This specific analysis also showed a non-significant effect of SR compatibility when comparing RT performed in simple SRC and RT registered in complex SRC : [F (1,17) = 0.87 ; p = .36]. In other respects, the MANOVA on average RT revealed a non-significant effect of probability : [F (2,16) = 1.72 ; p = .21], whatever the SRC conditions (including memory scanning condition). Similarly, MANOVA did not show significant interaction between both factors : [F (4,32) = 0.37 ; p = .82]. (see *Figure 2*)

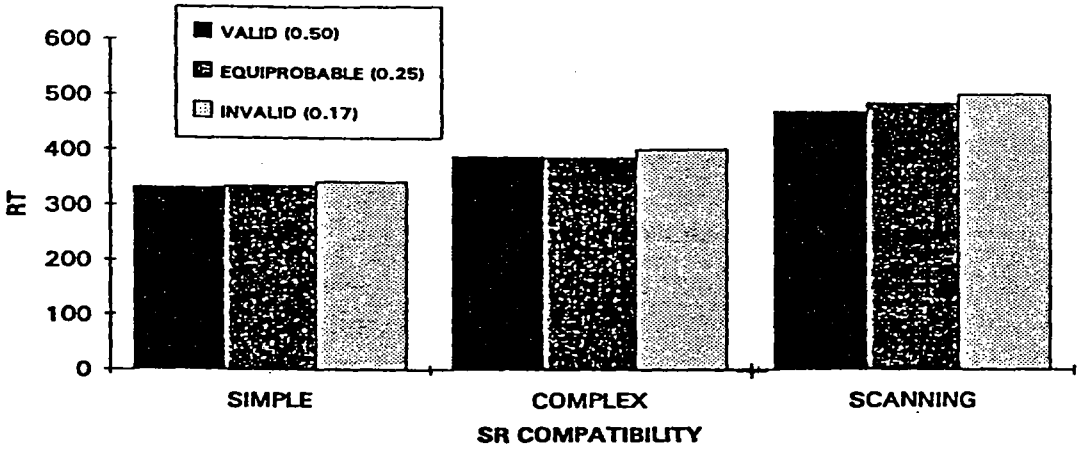

Figure 2 : SR compatibility and probability effects on RT in experimental session

Finally, there was no significant effect of SR compatibility and probability with regards to average number of errors (see *Figure 3*).

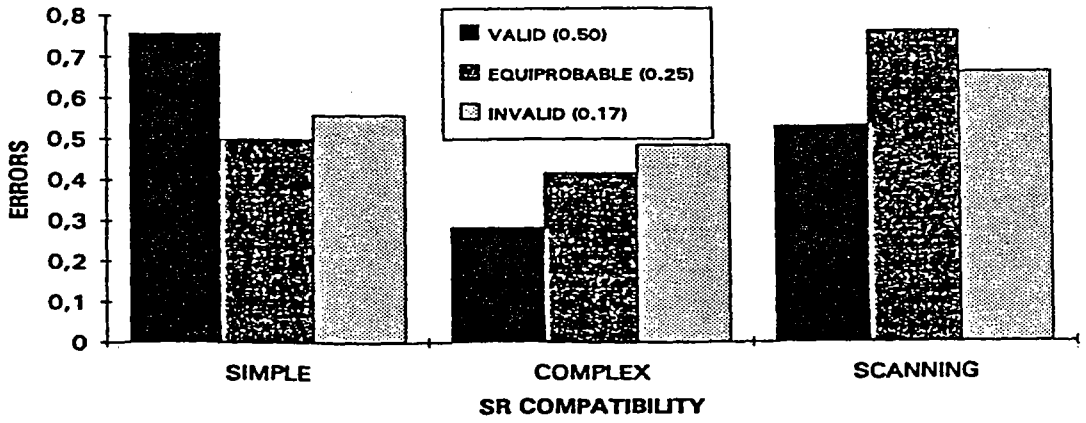

Figure 3 : SR compatibility and probability effects on number of errors in experimental session

Given the rather unexpected results observed in the experimental session, we thought it was necessary to analyse the learning session as well. This analysis could allow us to understand (more accurately) the curious nature of our results.

Learning session :

We had made a comparison between data registered in the first learning block and data recorded in the last learning block. A univariate variance analysis (ANOVA) on the RT data showed a significant effect of SR compatibility : [$\underline{F}$ (2,16) = 22.9 ; $\underline{p}$ < .000025] (see *Figure 4*).

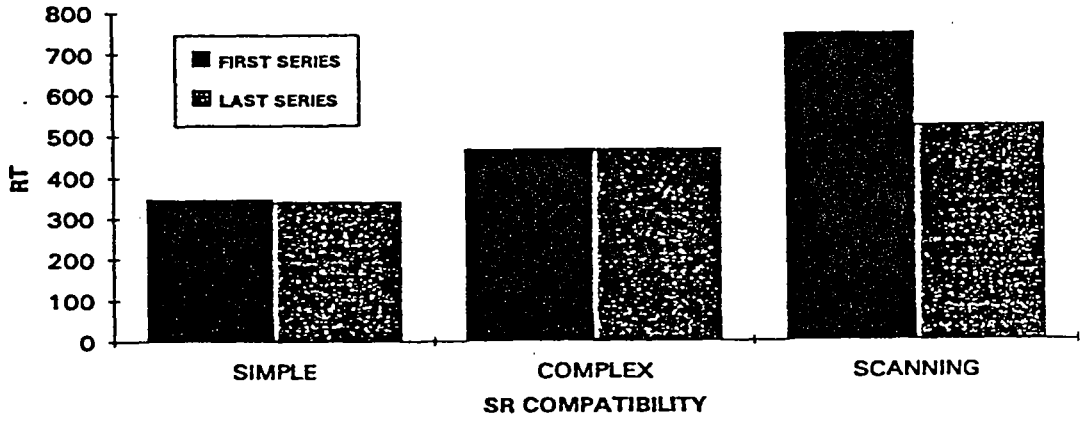

Figure 4 : SR compatibility effect on RT in learning session

Planned comparison of variance confirmed this result : RT observed in simple SRC were significantly shorter than those observed in complex SRC [$\underline{F}$ (1,16) = 7.5 ; $\underline{p}$ < .015] and RT recorded in SRC with rule implementation (simple and complex) were significantly shorter than RT performed in scanning SRC : [$\underline{F}$ (1,16) = 38.3 ; $\underline{p}$ < .000015]. MANOVA is known to be more pertinent than univariate analysis in studying effects of repeated measure factors which have more than 2 modalities (Rogan et al). Thus we have used MANOVA to test the probability effect. This analysis revealed a non-significant effect of this factor on mean RT : [$\underline{F}$ (2,15) = 3 ; $\underline{p}$ = .08]. (see *Figure 5*) :

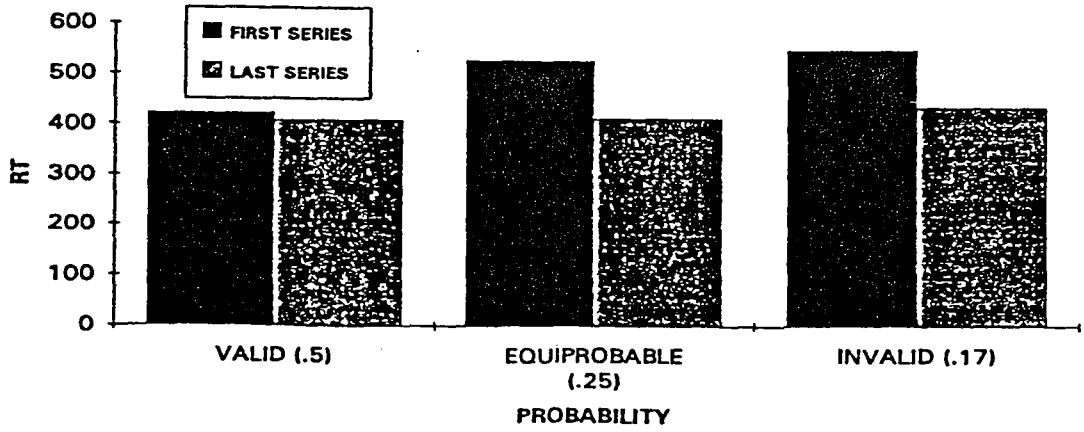

Figure 5 : Probability effect on RT in learning session

ANOVA performed on average number of errors showed a significant effect of SR compatibility : [$F(2,17) = 4.15$; $p < .035$] (see *Figure 6*). Planned comparison of variance enabled us to explain that this effect was only significant between the memory list scanning condition and both rule implementation conditions.

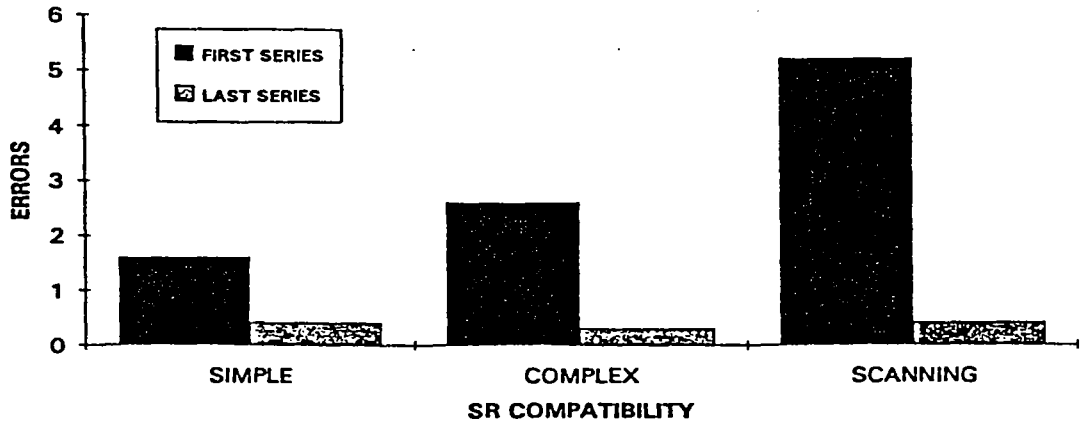

Figure 6 : SR compatibility effect on number of errors in learning session

Furthermore, a specific analysis on the last learning blocks showed that SR compatibility effect was not significant on the number of errors. This result showed that the subjects reached the accuracy criterion aimed at the learning session. Similar results were found about the probability effect (see *Figure 7*).

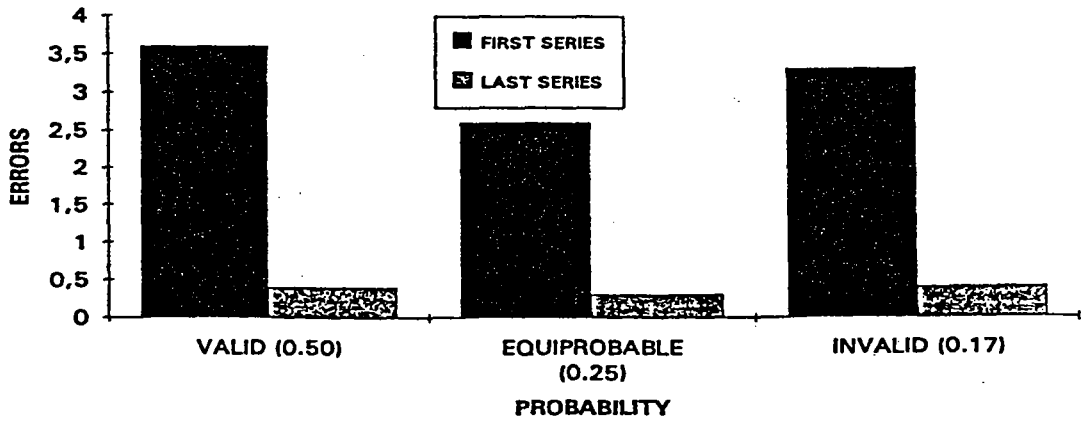

Figure 7 : Probability effect on number of errors in learning session

DISCUSSION

As far as SR compatibility effect in learning session is concerned, results lead us to suppose that there is a rise of reaction latency caused by a complexification of rule pairing stimuli with responses. However this difference disappears progressively with learning : the subjects assigned to the complex condition became, in the last learning block, as fast as the individuals assigned to the simple one. This acquisition seems to be durable, since reaction times of the experimental session are not significantly different when one compares the two rule implementation conditions. This hypothesis was confirmed by findings about the average number of errors which showed exactly the same evolution of effects during both sessions (significant effect of SR compatibility in the first learning block, non-significant effect of this factor in the last learning block and in the experimental session). As a conclusion, we may suppose that subjects confronted with rule implementation conditions are able to become just as fast in their reaction time, no matter what the level of complexity of rules. In other respects, if they must perform a task in which SR compatibility puts them to scan a memory list, they cannot, even with learning, become as fast as subjects confronted to an implementation rule condition. As for the probability factor, we were very surprised to observe no significant effect. Results of a post experimental introspective questionnaire informed us that most of the subjects had noticed that it was better to deny preliminary information about trial in order to reach learning criteria (accuracy and regularity). This behaviour is explained by Alain & Proteau (1979) who believe that in order to eliminate response error, the subject may opt for a more cautious strategy in moderating the selectivity of its preparation. This hypothesis is confirmed by Harm & Lappin's study (1973). These authors observed that probability effect on RT was closely linked to speed accuracy trade-off : as probability was more important, errors became numerous in the least probable situation. For this reason, we think that the absence of significance of this factor effect may have been caused by the subjects' eagerness to reach learning criteria. Otherwise, the absence of probability effect can also be explained by methodological causes. Studies (Alain & Proteau, 1979 ; Proteau & Alain, 1979 ; Proteau, Teasdale & Laurencelle, 1983) have shown that below a certain probability threshold, there is not a probability effect any more : this threshold would stand at about 0.9/0.1 (for a two-eventuality reaction task). Thus, it is possible that the contrast between the highest and the lowest probability was not high enough. Since we have not found any significant effect of probability, nor any significant interaction between this variable and SR compatibility, we may not draw any conclusions as to the validity of the Hasbroucq's list-rule model (1990). Nevertheless, it would be interesting to suppose a similar experiment with higher modalities of probability and with less stringent learning criteria .

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THE ROLE OF BACKGROUND TEXTURE IN A LOCOMOTOR COINCIDENCE ANTICIPATION TASK: APPARATUS AND METHODOLOGY.

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INTRODUCTION

Coincidence-anticipation timing (CAT) can be defined as 'the ability to predict the arrival of a moving object to a particular point in space and co-ordinate a movement response with that arrival' (Payne, 1987). CAT-research has mainly dealt with situations in which either the subject or the object are moving, for example catching a ball (Savelsbergh, 1990) or running towards a fixed point (Bardy & Laurent, 1989). Little work has been done on intercepting or avoiding a moving object during egomotion, while these abilities are crucial in ball games and even more important in traffic situations (see Berthelon, 1993). Different factors have been studied extensively, such as angle of approach (Payne, 1987), viewing time (Whiting & Sharp, 1974) and stimulus speed (Haywood, 1983). A factor that has only sparcely been studied until now is the influence of background texture (Ridenour, 1981; Savelsbergh, 1990).

METHODS OF PROVIDING A MOVING STIMULUS

2-D Stimulus Presentation.

The experimental research concerning the interception of small objects requires an apparatus that enables the experimenter to control different variables (such as ball speed, trajectory, accelerations/decelerations) as much as possible. Computer or video simulations are frequently used (Schiff & Detwiler, 1979; Berthelon, 1993) and they do of course reach a very high degree of reliability and controllability. However, their compatibility

with real-life situations can be questioned. First, all methods of providing a stimulus in a 2D-way bring on a limitation of the possible sources of information used by the observer. Distance cues can be impoverished by the lack of ocular disparity, and speed information is limited by the small visual angle in most studies with 2D-projection (Laurent, 1991). Second, the emphasis clearly lies on the perceptual aspect of the task, since it can only lead to verbal responses or to very simple motor responses such as pressing a button. By contrast, most real-life interceptions involve activity of both the perceptual and motor system.

Similar objections can be put forward regarding the use of the Bassin Anticipation Timer (BAT), consisting of a consecution of Light Emitting Diodes which light up one after the other, creating the impression of a moving stimulus (Haywood, 1983).

3-D Stimulus Presentation.

Several authors have designed some kind of apparatus to project or move an object (mostly a ball) in three dimensional space. Whiting & Sharp (1974) used a trampette type sprung bed to give a ball the necessary speed and direction after falling down from a height of 3m. More frequently, ball projection machines are used in research involving interceptive actions (e.g. Savelsbergh, 1990). The main advantage of these projection methods is their compatibility with real-life aspects of the flight phase of the ball such as 3-dimensionality and decelerations due to air resistance and gravitation. Compared to the above mentioned 2-D projection methods, their main disadvantage lies in the relatively poor consistency concerning temporal and spatial aspects of the trajectory of the projectile.

Dunham & Glad (1976) constructed a chute with a length of 3.60m in which a little car was propelled by gravitation. The bottom of the chute was left open in order to permit a ball, which was attached to the car, to move freely and to be clearly seen. Two microswitches connected to a clock made it possible to calculate travelling time and speed. Reliability of average ball

speed was found to be very high (table 1). Picado (1978) used a similar apparatus: a 6.096m long plastic tube of which the first and the last 1½m were cut open. This made a little bal visible while rolling through the tube. Travelling time and speed were obtained by two photocells at the beginning and the end of the trajectory.

Ridenour (1974; 1981) constructed two electrically engined vertical shafts connected by a belt on which objects could be hang up. Velocities up to 1.5m/sec could be presented. The same principle was used by Alderson & Whiting (1974) for stimulus presentation at velocities between 0.30 and 12.19m/sec and for a distance of 7.60m. This kind of stimulus presentation tries to combine the advantages of computer simulation (consistency and controllability) and real-life projections (threedimensionality). Some characteristics of the abovementioned apparatus are presented in table 1.

Table 1. Characteristics of Apparatus for Presenting a Moving Stimulus.

author(s) type of task	reliability	presentation time (X ± SD)	lenght of trajectory
Dunham & Glad (1976) CAT press- button	reliability coefficient 0.972 (fast) 0.968 (slow)	0.888 ± 0.028s (fast) 1.073 ± 0.019s (slow)	± 3.5m "
Ridenour (1974) CAT inter- ception	accuracy of 0.03m/sec	3.2s and more	± 4.8m
Picado (1978) gross-motor CAT without interception		2.452 ± 0.041s (slow ball) 2.156 ± 0.034s (fast ball)	± 6.0m "

In most of the studies referred to, the motor output was limited to pressing a button or catching a ball, without moving the rest of the body. Only Picado (1978) designed an experimental set-up in which both ball and subject were moving, although no physical interception took place.

APPARATUS

Experimental Room.

Construction. By means of a solid wooden construction, a training room was transformed into a triangular room with a length of approximately 25m and a height of 2.30m. The angle between the two legs of the triangle was 14.84°. Entrance and exit of the room were connected to the neighbouring rooms, providing sufficient distance for run-up and braking. Floor, ceiling, and walls of the room were covered with black plastic. Figure 1 shows the experimental room from the starting position of the subject. On the left side of the triangle, a rail with a length of 23.77m was attached to the ceiling.

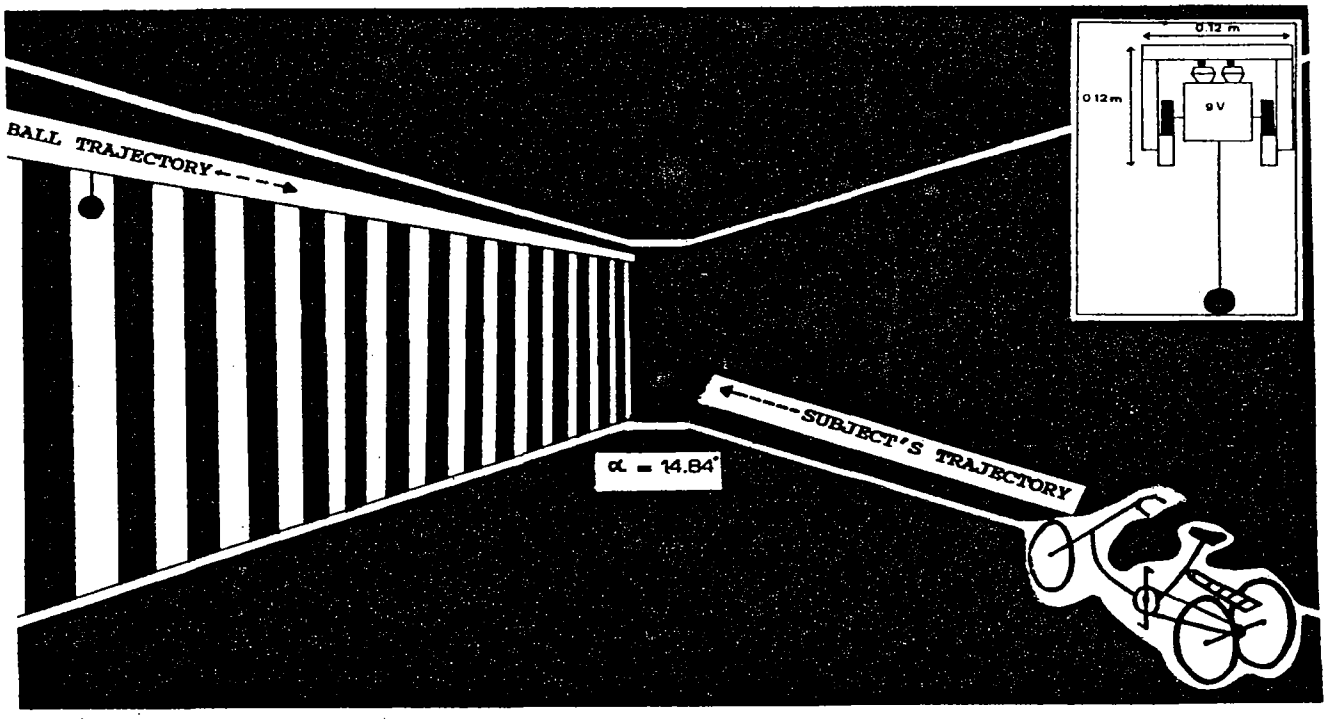

Fig. 1. Experimental Room Seen from the Starting Point. Inset: Cross-section of the Rail and the Car.

The rail. A straight wooden chute was constructed in which an electrically propelled car transported a bal at velocities varying between 0.0 and 3.0m/sec. Only constant velocities could be presented in a controlled way. The track was built of an upper

side of 0.12m broad and 0.015m thick and two sides of the same dimensions, and was suspended from above. At the inner side, two laths were attached supporting the weels of the car and serving as a pathway (see inset on fig. 1). Two copper wires were stuck 0.02m from each other in the ceiling of the chute to provide the car with electricity.
At a distance of 18.36m from each other, two microswitches were attached to the left side of the rail. At every transit the switches were pushed in by a plastic pin horizontally glued to the top of the car. Pulses were transmitted to PC in order to calculate the average velocity of the ball.

The car. The car consisted of the engine and the wheels of a toy train (9 Volts) provided with rubber tyres in order to prevent the wheels from slipping over the wooden supports. Two pantographe conductors on the upper side of the car made contact with the electric wires in the ceiling of the rail. Velocity of the car was regulated by a transformator connected with the main current. At the bottom of the car a mousse ball was attached about 0.20m underneath the rail by a stiff copper wire. Total weight of the car-ball system was 0.215kg (see inset on fig. 1).

Illumination of the room. At the backside of the chute a series of 19 TL-lights of 1.20m (36 Watt each) was hang up. All light tubes were painted partially black so that only the trajectory of the ball was illuminated. No additional illumation in the room was provided.

The Tricycle.

Subjects moved on a tricycle in order to be able to fully concentrate on the interception task instead of on stearing and keeping balance. At the rear axle a metal disc was attached with in the periphery 180 indentations of 0.005m deep and 0.001m wide. These indentations interrupted an IR-ray 180 times during one rotation of the wheels. The IR-ray was produced by a transmitter-receiver system (type 304-560). The pulses generated by this system were converted in a continuous current directly proportional to the velocity of the tricycle. This current was

registrated on PC at a frequency of 250Hz. On the handlebar a white plate (0.08 x 0.08m) was attached at a height corresponding to the height of the ball.

Reliability.

Reliability of average ball speed. Consistency of ball speed was tested on 400 random trials during the experiment. Intra-class reliability was computed on 200 'fast' and 200 'slow' trials. The characteristics of the apparatus are presented in table 2.

Table 2. Characteristics of the apparatus.

Number of trials	Stimulus presentation time ± SD*	Average Speed and SD*	reliability coefficient
200	10.00 ± 0.13s (slow)	1.84 ± 0.04 m/s	.61
200	9.04 ± 0.14s (fast)	2.03 ± 0.04 m/s	.65

(*) Values obtained over a distance of 18.36m. Highspeed video-analysis showed an extrapolation of the data to the entire trajectory to be justified.

The reliability of the average ball presentation time seems to be quite moderate as compared to the data of Dunham and Glad (1976 - table 1). However, variation coefficients (standard deviations expressed in percent) of movement times are very similar (and even somewhat lower) as shown in table 3:

Table 3. Variation Coefficient of the presentation time.

Dunham & Glad (1976)	3.15% (slow) 1.82% (fast)
Picado (1978)	1.69% (slow) 1.59% (fast)
Lenoir & Musch	1.30% (slow) 1.55% (fast)

TASK & PROCEDURE

After a short run-up of 2m, subjects entered the room and saw the ball move on their left side. They were asked to adjust their speed in order to intercept the ball at the end of the room, at the point where both trajectories crossed. They tried to arrive not too early neither too late so they could touch the ball with the plate on the handlebar. The interception phase was filmed laterally at a frequency of 50Hz.

RELEVANCY OF THE APPARATUS

The advantage of this apparatus lies in the possibility to provide a stimulus over a long distance (more than 20m as compared to 3-7m in the litterature referred to) with a satisfactory level of consistency. This enables us to study the 'product' (by means of video-analysis) as wel as the 'process' preceding the interception. At any moment, the position of the subject relative to the ball can be calculated, which can yield information on the strategies used during the approach phase of an interceptive action.

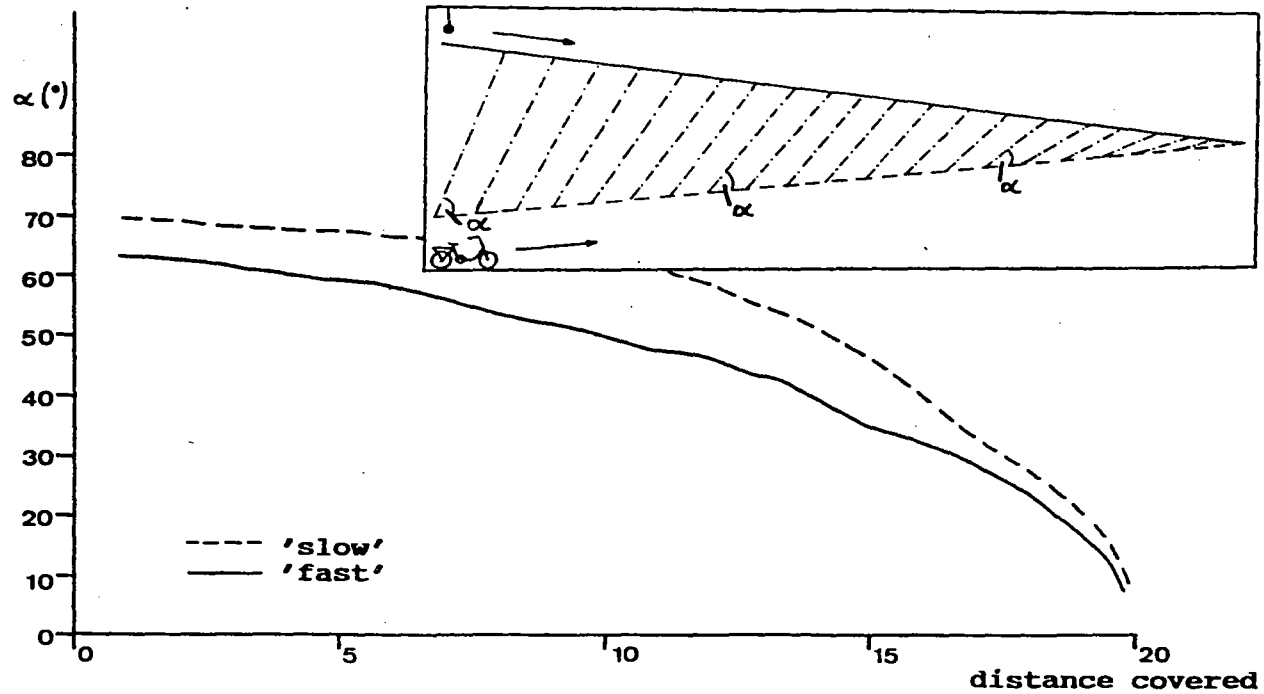

Fig. 2. Evolution of angle α with distance covered.

For example, fig. 2 exhibits the evolution of the angle α (angle between the trajectory of the subject and the position of the ball - see inset on figure 2). By clothing the left wall with different patterns, the influence of background texture on product and process of the task can be studied (see figure 1). In a preliminary investigation the utility of the apparatus was demonstrated (Lenoir, Musch & Uyttenhove, 1993).

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THE EFFECT OF EXERCISE ON SIMPLE REACTION TIME

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Key words: exercise, arousal, reaction time.

INTRODUCTION

The purpose of this study was to examine the effect of exercise on simple visual reaction time. The physiological and biochemical changes induced by exercise - increased heart and respiratory rates, perspiration, and increased plasma levels of adrenaline, noradrenaline and dopamine, which may mirror changes in the central nervous system (Cooper, 1973) - are similar to those observed when an individual's somatic arousal level is raised by emotions such as anxiety. As a result, several authors have examined the effect of exercise on cognitive functioning. Davey (1973) suggested that exercise would affect cognitive functioning in an inverted-U fashion, based on Yerkes and Dodson's (1908) theory. Other authors (Fleury, Bard and Carriere, 1981; Allard, Brawley, Deakin and Elliott, 1989; Isaacs and Pohlman, 1991) have, also, suggested an inverted-U effect but these authors drew on Easterbrook's (1959) cue utilisation theory for their theoretical underpinning. According to Easterbrook (1959), in low states of arousal attention is too broad and irrelevant cues are attended to, at the expense of task relevant cues. When arousal rises to moderate levels, attention narrows onto task relevant cues and performance is optimal. While with high levels of arousal, narrowing is too great and task relevant cues are missed.

The relationship between somatic arousal induced by emotions and that induced by exercise has, however, been questioned (McMorris and Keen, 1994). McMorris and Keen (1994) argued that it may be erroneous to equate the two because the physiological and biochemical reactions to exercise are induced and mediated by the activated musculature and are attempting to maintain homeostasis. Whereas, somatic arousal rising from emotions is induced by the brain and destroys homeostasis. As a result the organism will not be in an identical state in both situations. While it may be fair to claim that the two states are not synonomous, it cannot be denied that exercise is a stressor and the organism does react to it in a way which may affect its efficiency. Therefore, there is sufficient theoretical evidence to suggest that exercise will affect cognitive functioning. Research findings, however, do not provide unequivocal support for such an hypothesis.

Improved performance with moderate exercise has been demonstrated by Davey (1973), Allard et al (1989) and Fleury and Bard (1990) but not by Isaacs and Pohlman (1991) and McMorris and Keen (1994). Similarly, an inhibiting effect of fatiguing exercise on cognitive functioning was found by Davey (1973), Hancock and McNaughton (1986), Isaacs and Pohlman (1991) and McMorris and Keen (1994) but other authors (Bard and Fleury, 1978; Fleury, Bard and Carriere, 1981; Fleury, Bard, Jobin and Carriere, 1981) failed to show any effect of fatiguing exercise on the performance of cognitive tasks. It is, however, difficult to compare studies. Different criteria for determining moderate and fatiguing exercise have been used. Prior to a critical review by Tomporowski and Ellis (1986), the criteria were mostly arbitrary and made no attempt to take account of differences in subjects' fitness levels (Tomporowski and Ellis, 1986). Since then most studies have used some form of physiological testing to establish fitness level. Even so, there is still some disparity.

Moderate exercise has been defined as 60% of the subject's physical work capacity (Allard et al, 1989) as determined by the PWC 170 test (see Astrand and Rodahl, 1977, pp. 353-358 for a description of this test); 40% and 75% of the person's maximum volume of oxygen uptake (Isaacs and Pohlman, 1991); 60% of maximum volume of oxygen uptake (Fleury and Bard, 1990); and 70% of maximum power output (McMorris and Keen, 1994). Similarly, fatiguing exercise has been described as work to exhaustion (Bard and Fleury, 1978; Fleury and Bard, 1990), intermittent work on a cycle ergometer at 66% of maximum power output for a total of 45 minutes (Fleury, Bard and Carriere, 1981); 100% of maximum volume of oxygen uptake (Isaacs and Pohlman, 1991); "anaerobic threshold" (Hancock and McNaughton, 1986); 20 secs running on a treadmill with a grade of 10% and speed increasing from 7-10 mph; 5 bouts of 1.5 min on a treadmill at a workload with an energy demand estimated to require 150% of maximum volume of oxygen uptake (Fleury and Bard, 1990); and cycling at 100% of maximum power output (McMorris and Keen, 1994).

According to McMorris and Keen (1994), fatigue cannot be said to have been achieved unless a force or power failure has been observed. This argument is based on Edward's (1983) definition of fatigue, which states that fatigue is the failure to maintain a required power output. Studies where the PWC 170 test (Allard et al, 1989), maximum volume of oxygen uptake (Isaacs and Pohlman, 1991) and "anaerobic threshold" (Hancock and McNaughton, 1986) have been used as the criteria for fatigue, may not in fact have achieved fatigue as work can continue at the same power output after these physiological states have been reached. The fatiguing effect of the high intensity treadmill running protocol used by Fleury and Bard (1990) is more difficult to assess. This exercise mode appears to be extremely demanding but, as no performance failure was described, one cannot assume that fatigue was achieved.

The situation is further exacerbated by the fact that in some studies cognitive testing took place during exercise (Fleury, Bard and Carriere, 1981; Hancock and McNaughton, 1986; Allard et al, 1989; Isaacs and Pohlman, 1991; McMorris and Keen, 1994), while in others it took place after completion of the exercise bout (Davey, 1973; Bard and Fleury, 1978; Fleury and Bard, 1990). As recovery from exercise can be rapid, particularly for trained subjects (Fox and Mathews, 1981, pp. 33-51), there is no guarantee that the subject's physiological status and somatic arousal level is the same during cognitive testing as it was during exercise.

While the differing criteria for exercise intensity may account for the unequivocal results, so far obtained, it has, also, been suggested that the problem may be more the fact that different cognitive tasks have been used (Tomporowski and Ellis, 1986). Tasks that differ in complexity, attentional and computational demands have been used e.g. visual detection (Davey, 1973; Allard et al, 1989); short term memory (Davey, 1973; Hancock and McNaughton, 1986), coincident anticipation (Fleury and Bard, 1990; Isaacs and Pohlman, 1991); and simple visual reaction time (McMorris and Keen, 1994). Several authors (Landers, 1980; Sanders, 1983; Jones, 1990) have claimed that different tasks may be affected in different ways by the same stressor. Oxendine (1984, p. 238) argued that task complexity was the key issue. He stated that simple tasks would require high levels of arousal before optimal performance would be exhibited, while complex tasks would be inhibited by high levels of arousal. On similar lines, Fleury, Bard and Carriere (1981) asserted that fatigue would only adversely affect complex tasks that required a great deal of central processing. McMorris and Keen (1994), however, found that while moderate exercise had no effect on simple visual reaction time, fatiguing exercise resulted in poorer performance.

Although these results question the claims of Oxendine (1984, p. 238) and Fleury, Bard and Carriere (1981), McMorris and Keen (1994) felt that their results may not have been due directly to somatic arousal, i.e. the physiological and biochenical changes may not have been directly responsible for the detriment in performnce. McMorris and Keen (1994) used recreational athletes as their subjects and they claimed that the deterioration in performance during fatiguing exercise was probably due to subjects focussing on their physical discomfort at the expense of attention to the task. According to McMorris and Keen (1994) this was the most likely explanation for their results as the subjects were not used to heavy exercise and would have presumably been disturbed by the experience. The present study used trained subjects who were used to physical discomfort and therefore less likely to be affected in the way proposed by McMorris and Keen (1994). As a result, the present study was more likely to examine the effect of exercise induced somatic arousal on reaction time than the McMorris and Keen (1994) study, which may have inadvertently measured the effect of pain rather than somatic arousal.

METHOD and PROCEDURE

The subjects were nine male and six female undergraduates majoring in sports science. All had previous experience of working to exhaustion and trained regularly, at least three times per week. Maximum power output was measured by an incremental test to exhaustion (McMorris and Keen, 1994). Subjects began pedalling a Monark 814E cycle ergometer at 70 rpm with a resistance of 0.5 kg. After every 2 min., 0.3 kg for women and 0.4 kg for men were added to the resistance until the subject failed to maintain the required pedal rate. Maximum power output and 75% of maximum power output were calculated.

The simple visual reaction time test was on a BBC microcomputer. The stimulus was a red square, which appeared in the centre of the screen. Subjects placed the index finger of their preferred hand on the spacebar of the computer keyboard, which was mounted on the handlebars of the cycle ergometer. When the stimulus appeared the subject pressed the spacebar. Foreperiods were randomised between 0.5 secs. and 2 secs. The test consisted of 15 trials and subjects took the test under four different conditions. The first test was taken at rest, while seated on the cycle ergometer. Following this test the subject began pedalling at 70 rpm with a ressitance of 0.5 kg. and the same protocol as for the maximum power output test was followed. When subjects reached 75% of maximum power output they cycled for one minute at that intensity before being tested for the second time. The same procedure took place when the subjects reached 100% of maximum power output. Heart rate was recorded on a Sports Tester PE-3000 monitor and rate of perceived exertion (RPE) was measured using the Borg (1973) scale. Heart rate and RPE were noted at each incremental stage.

RESULTS

The mean reaction times at rest, while exercising at 75% and 100% of maximum power output can be seen in Table 1. A one-way ANOVA (with repeated measure) found a significant effect ($p<0.02$) for exercise but Tukey post hoc tests showed that the only significant difference was between the 75% and 100% maximum power output conditions. A one-way ANOVA (with repeated measure), also, demonstrated a significant ($p<0.001$) difference in heart rate across the testing conditions. Tukey tests found that the heart rate was significantly faster in each of the conditions.A one-way ANOVA (with repeated measure) demonstrated a significant effect ($p<0.001$) of exercise on RPE. Tukey tests showed that RPE increased significantly for each condition.

TABLE 1. Mean and Standard Deviations for Reaction Times (Msecs.), Heart Rates (Beats Per Minute), and Rates of Perceived Exertion (Borg Scale) at Rest, During Exercise at 75% and 100% of Maximum Power Output.

	Rest	75% Max power output	100% Max power output
Reaction time	241.00 (30.52)	226.53 (23.77)	257.86 (39.40)
Heart rate	67.00 (11.09)	155.07 (14.11)	181.4 (10.06)
RPE	6.00 (0.00)	15.45 (1.55)	19.4 (0.83)

DISCUSSION and CONCLUSIONS

The failure of the present study to show a significant improvement in performance between the rest and moderate intensity of exercise condition is in agreement with Isaacs and Pohlman (1991) and McMorris and Keen (1994). Other authors (Davey, 1973; Allard et al, 1989; Fleury and Bard, 1990), however, found that performance improved with moderate exercise. The findings for performance during maximum power output are similar to those of Hancock and McNaughton (1989), Isaacs and Pohlman (1991), and McMorris and Keen (1994), who all showed a decrement in performance. Fleury, Bard and Carriere (1981), however, did not demonstrate an effect of fatigue on performance of cognitive tasks. As stated earlier, however, it is difficult to compare studies as they differ in the nature of the cognitive task and the criteria used for determining exercise intensity. The present study, however, is very similar to that of McMorris and Keen (1994).

McMorris and Keen (1994) found that simple visual reaction time during fatiguing exercise was significantly slower than at rest and during exercise at 70% of maximum power output. The present study showed that performance during fatiguing exercise was significantly slower than at 75% of maximum power output but not at rest. The fact that no significant difference was found between the at rest and moderate intensity condition is in agreement with McMorris and Keen (1994). This would support Oxendine's (1984, p. 238) claim that simple tasks require high levels of arousal before any improvement in performance will be observed. It does not, however, explain why physiological and biochemical changes accompanying moderate

exercise did not induce a decrease in reaction time. Moderate exercise results in increased speed of nerve transmission (Astrand and Rodahl, 1977, p. 562), which should, theoretically, lead to faster reaction time. Similarly increased central nervous system levels of catecholamines induced by exercise would be expected to result in better attention (Cooper, 1973). As McMorris and Keen (1994) pointed out, however, it is not known how long and how intense a period of exercise has to be for these changes to be sufficient to induce an observable change in performance (Astrand and Rodahl, 1977, p. 562-563).

Although, the fact that reaction time at 75% maximum power output was not significantly faster than at rest might be explained by Oxendine's (1984, p. 238) theory, the results comparing performance at 75% and 100% of maximum power output do not support Oxendine (1984, p. 238). According to Oxendine (1984, p. 238) performance should have improved between the moderate and fatiguing conditions. In fact the opposite occurred, as was, also, found by McMorris and Keen (1994). These results, also, fail to support Fleury, Bard and Carriere (1981) who claimed that exercise would have no effect on such a simple task.

McMorris and Keen (1994) argued that their results were probably not due directly to high levels of somatic arousal but because the subjects were probably focussing on feelings of discomfort at the expense of task relevant information. This would appear to be a logical explanation for the recreational athletes used in that study but may not account for performance in the present study. All the subjects in the present study had experienced work to exhaustion on several occasions and were not unaccustomed to the feelings of discomfort that are associated with fatiguing exercise. Therefore, one must consider the possibility that high levels of somatic arousal may have had a causal effect on the deterioration in simple reaction time. This would be in disagreement with the claims of Oxendine (1984, p. 238) and Fleury, Bard and Carriere (1981). It is possible that the key issue is not task complexity but task familiarity. Landers (1980) claimed that familiar tasks can withstand a great deal of stress. While simple visual reaction time may be a simple task requiring little channel space, it is not a familiar task and may, therefore, be susceptible to disruption when arousal level is high.

This, however, does not explain why reaction time during fatiguing exercise was not significantly different from that at rest. According to Landers (1980) the similar results found at low and high arousal levels can be explained by high levels of neural noise at both extremes of arousal. The result being that irrelevant cues are attended to at the expense of task relevant ones. This is a slightly different explanation for an inverted-U effect than that proposed by Easterbrook (1959). Both theories may explain the lack of any significant difference in reaction time at rest and fatigue but they both hypothesise an inverted-U effect. This was not

demonstrated in the present study as performance at rest and during 75% maximum power output did not differ significantly. It should be noted, however, that the trend was for an inverted-U effect.

As such the results of this study show that exercise can affect even a simple task like simple visual reaction time. They do not, however, fully support any arousal theories. That reaction time during exercise at 75% of maximum power output was significantly better than during fatiguing exercise supports Easterbrook's (1959) perceptual narrowing theory but the failure to show a significant difference between the at rest and 75% maximum power output condition fails to support the theory. Similarly, Oxendine's (1984, p. 238) claim, that simple tasks require high levels of arousal before optimal performance is demonstrated, is not supported by these results, because the poorest performance was during fatiguing exercise.

McMorris and Keen's (1994) argument that somatic arousal induced by exercise may be different from that resulting from emotional change, may explain why the results do not support any of the arousal theories. This is supported by Sanders (1983), who claimed that while different stressors may induce the same physiological responses they may affect tasks in different ways. It may, therefore, be necessary to break with the assumption that the effect of somatic arousal, induced by exercise, on cognitive functioning can be accounted for by theories of arousal that have their origins in emotionally induced arousal.

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COMPARATIVE EFFECTS OF PREPARATION ON PROGRAMMING A BALL INTERCEPTION IN CHILDREN AND ADULTS

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KEY WORDS

Motor programming, children, interception

INTRODUCTION

Research about the development of motor skills in children has focused mainly execution (Hay, 1987) and less on cognitive processing. It seems that the lower level of motor performance achieved by young children could be due to lesser efficiency of the information processing system (Thomas, 1980 ; Hay, 1979). Also, it is possible that operation involved in motor programming mechanisms may be immature. However, previous research (Clark, 1982 1987 ; Durand & Barna, 1987 ; Reilly & Spirduso, 1991 ; Olivier, Ripoll & Audiffren, 1994) show that the weakness may be located at the response selection stage and, to a lesser degree, at the programming stage. These studies presented some limits. For instance, the movement was simple (such as aiming) ; program selection resulted from binary choice and finally, no specifications were given concerning the programmation of the different parameters of the movement (side, direction, extent, ...).

Our research attempted to exceed these limits. Our aim is to validate early maturation of the programming stage hypothesis during complex behavior, such as intercepting a ball.

METHOD AND PROCEDURE

Methodology

A priming procedure (derived from Rosenbaum & Kornblum, 1982) was used to identify how a movement was programmed. This procedure consists in displaying to the subjects, prior to initiation of the response, information or prime on the most probable response. Results show that RT is related to the validity of this prime. When the prime is valid, movement preparation is correct, but when it is invalid, preparation is incorrect. In the valid situation, the time to program the movement is reduced by preparation of the movement. In the invalid situation, RT is considered as the time required to modify, completely or partially, the programming of the movement. For instance, it is well known that in valid condition, RT is shorter than in invalid condition.

In our experiment, the prime was given prior to each trial by one of four red lights. The stimulus was the appearance of a ball. Four movements of ball interception were possible. Balls were projected on the subject's right or left side with two possible directions in each side. The prime was valid 50% and invalid 50% of the time. In valid situation, the prime indicated the correct information on side and direction (50%). In invalid situation, the prime was partially incorrect : either the side (16%) or the direction (16%) was wrong, or the prime was completely incorrect : both side and direction were wrong (16%).

Subjects

Five groups of eight subjects each, between age 6 and 22 years old, have participated in the experiment :

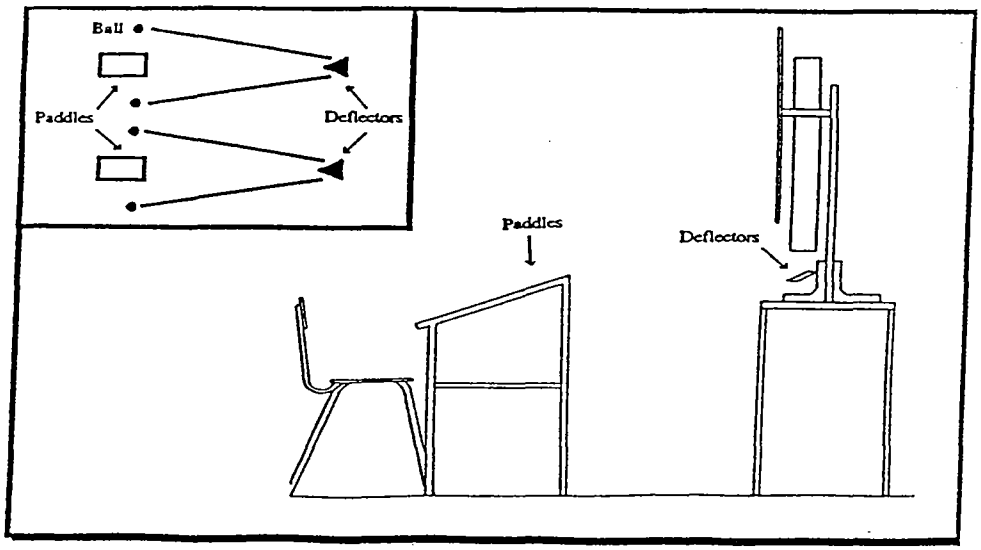
- 6 year olds (with a mean age 6-3)
- 8 year olds (with a mean age 8-2)
- 10 year olds (with a mean age 10-2)
- Adults (with a mean age 22-6)

Apparatus

The experimental apparatus consisted of three main components :

1- Ball channeling and directing system : A two inch diameter rubber ball was dropped vertically in one of two tubes directing it to a deflector which deviated it. Appearance of the ball occured only at the moment of contact with the deviation deflector. There were four possible trajectories for the ball. The tubes determined towards which hand (right or left) the ball bounced. The deflector determined two directions for each side (Fig. 1.). The subject had to intercept the ball with a paddle.

Fig. 1. Experimental Apparatus : Ball Channeling and Directing System



2- Light system for priming procedure : Before a ball was dropped, the subject viewed a ten cm (4 in.) square pannel with four red lights (one in each corner) which conveyed the prime.

3- Chronometer devices and computer connections : The chronometer device consisted of four pressure sensitive switches and two laser switches. Both paddles and deflectors were equipped with pressure sensitive switches which were activated by impact with the ball. The two laser switches determined when each hand and paddle were to the lifted off the table.

Dependant Variables

Three dependant variables were analysed :

- Reaction Time (RT) corresponding to the time between ball impact on the deflector and lifting of the paddle
- Response Error (RE) corresponding to error in selecting the side for ball projection
- Interception Error (IE) corresponding to error in intercepting the ball

Independant Variables

Two factors were manipulated :

- Age with 4 levels (6, 8, 10 and 22 year-olds)
- Nature of the prime (valid (50%), invalid side (16%), invalid direction (16%) and invalid side and direction (16%))

Procedure

Subjects learned the task in a training session composed of blocks of 24 trials. The aim of this session was to execute the task with fewer than 5% errors.
The experimental session consisted in 4 blocks of 24 successful trials.

RESULTS

TrainingSession Results

Response Error : An average of three blocks was necessary for adults to attain a level of performance fewer than 5% errors. By contrast, 10 blocks were necessary for the 6, 8 and 10 year-olds to reach an error rate of 7%.
An ANOVA with Age of children as a between-subject factor revealed :
- no significant effect of Age. After 240 trials, all age groups of children executed the task with an average of 7% errors.

Experimental Session Results

Reaction Time (Fig. 2) : An ANOVA with Age as a between-subject factor and Nature of the prime as a within-subject factor revealed :

- an Age effect [F(3, 28) = 6.02 ; p<.05] : the younger the children the higher the RT.
- an effect of Nature of the prime [F(3, 84)) = 26.39 ; p<.001]. A Newman Keuls analysis showed : (i) no significant difference between RT in valid prime and in invalid direction ; (ii) no significant difference between RT in invalid side and invalid side and direction and (iii) a significant difference between RT in valid prime or invalid direction and RT in invalid side or invalid side and direction
- There was no interaction between Age and Nature of the prime.

Fig. 2. Age and Nature of the Prime Effects on RT

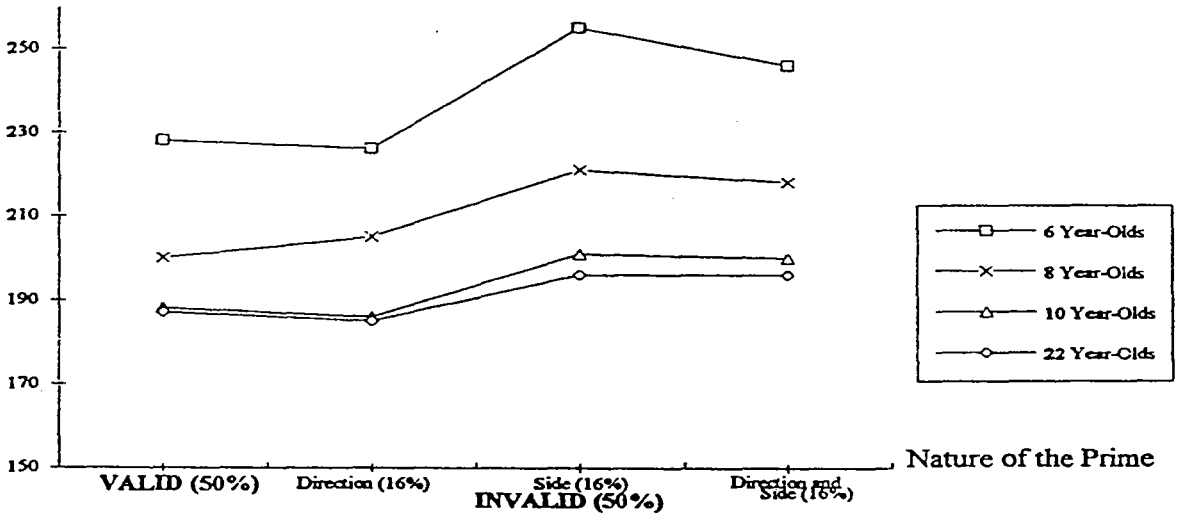
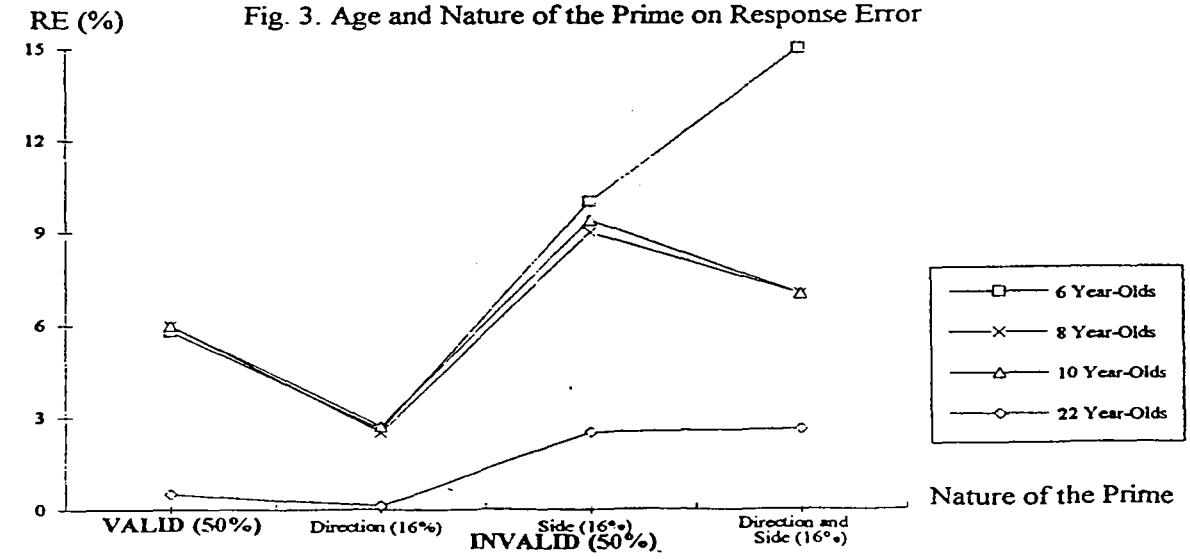


Fig. 3. Age and Nature of the Prime on Response Error



Response Error (Fig. 3.) : - an Age effect [F(3, 28) = 7.45 ; p>.001] : 1,5% errors for adults with 9% for 6, 8 and 10 year-olds.

- an effect of Nature of the prime [F(3, 84) = 12.88 ; p>.001]. This effect was similar to the one obtained for RT.

- no significant effect of Age by Nature of the prime interaction.

Interception Error : - an effect of Age [F(3, 28) = 31.39 ; p<.001] : the younger the children the higher the IE.

- no significant effect of Nature of the Prime.

DISCUSSION

Our results show an increasing RT when side information is incorrect. This suggests that the side is programmed before the initiation of the movement. The initiation of the movement in valid situation is as rapid and accurate as in the relevant side parameter situation. This means that the programming time is similar both in complete programming of the movement and in only programming the side. Consequently, it seems that the direction is programmed in the course of execution. Children to 6 do many erros in invalid side and direction situation. They appear to have major problems correcting programmation of two parameters. Particularly interesting is the fact that there is no interaction between age and nature of the prime. This finding confirms that the programming stage for left or right side and direction of the arm extension is similar in adults and children. Early maturation of the programming stage hypothesized by previous research is also confirmed for complex motor skills in that side and direction movement parameter programmation is similarly specified by age. The only difference is that a child's behavior gradually becomes faster. This result may be attributed to the existence of a specific RT plateau level in each age that could be considered as one a consequence of the maturation level of the subject's nerve structure. The time required for a subject to respond is determined by ball speed and distance between deflectors and paddles. However, increasing RT by playing on the nature of the prime, compels subjects to decrease their Movement Time (MT). Rapidity of the movement varies with nature of the prime. On the other hand, it appears that rate of IE does not vary with the nature of the prime. However, speed of movement did not affect accuracy. Consequently, the lower level of ball interception achieved by young children related to adults does not appear to be due to a slower speed of movement, but more to the maturation of movement execution. Such as interpretation of results confirms that proposed by Hay (1987).

To conclude, this work shows that the effects of movement preparation is the same with side and direction parameters along childhood development. So, in complex ball interception situations, children's motor programming mechanisms operate like adult ones. The hypothesis of an early maturation of the programming stage, already proposed in previous litterature, is also confirmed for complex behavior, such as intercepting a ball.

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TOWARDS A FURTHER UNDERSTANDING OF ADHERENCE TO PSYCHOLOGICAL SKILLS TRAINING.

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Key Words: Adherence, individualisation.

INTRODUCTION.

Utilising psychological interventions to enhance sporting performance is commonly advocated by sport psychologists. Despite the apparent widespread use, research has begun to examine the effectiveness of psychological skills training (PST) (Daw & Burton, 1994; Gould et al., 1990). Such programme evaluation has evolved from the recognition of the accountability of the sport psychologist (Smith, 1989). A key factor in ensuring both programme effectiveness and research validity is that of adherence to PST. It is generally accepted that for PST to be effective, systematic training is required. If convincing evidence of the validity of PST is to be provided then adherence must be demonstrated. Furthermore, if athletes are to maximise the likelihood of intervention effectiveness then PST should facilitate easy implementation, and therefore, adherence.

Despite the importance of adherence to PST only one published article has appeared specifically investigating this area (Bull, 1991). Researchers have noted that there is often a problem with the post-education use of PST by athletes. Gould et al. (1990) stated that:

"*Too often sport psychologists have blindly assumed that the education or clinical services offered are successful.*" (p.250)

Bull (1991) found that adherence to PST was very low after initial education. The main reasons attributed to this low usage was, lack of time and programme individualisation. The self-motivation of the subjects correlated positively with adherence. Bull (in press) has developed a preliminary model of adherence to PST. Based upon the work of Kristeller and Rodin (1984), this model outlines three phases of adherence (entry, adherence, and maintenance) and proposes influential personal, situational and programmes characteristics.

From this initial base it is evident that more research is needed. The present paper reports recent efforts to achieve this. In both phases of research reported there has been a conscious

effort to study adherence from an applied perspective in order that sport psychologists may be able to use the information gained in their applied work.

Phase 1.

Eighteen student athletes participated in phase one (Mean age = 20.6 ± 2.43). All subjects were regularly training and competing in their chosen sports.

Subjects were exposed to an imagery training workshop. Subsequent adherence to imagery training was assessed over the next six weeks. Adherence was measured via a self-report diary (frequency and duration). Each subject was interviewed at the end of the six week period.

Hypotheses.

1) A positive relationship between the self-motivation of the subjects and level of adherence to the imagery training would exist i.e., high self-motivation would correlate with high adherence.
2) Adherence levels would be significantly lower than suggested levels of training (7 x 5mins per week).
3) There would be a decrease in the amount of imagery training engaged in over the six weeks.

General Findings and Discussion.

Adherence levels for both frequency and duration of imagery training were very low, but variable (12.5% ± 10.6, 20.1% ± 21.7). A repeated measures analysis of variance showed that there was a significant change in percentage frequency and duration scores over the six week period ($F = 3.74$, $p < 0.01$; $F = 2.64$, $p < 0.05$). The change in mean frequency and duration is shown in figure 1. This concurs with the finding of Gould et al. (1990) who showed that perceived use of PST decreased over a three-month period. When considering adherence to exercise Sallis and Hovell (1990) have suggested that there is a *natural history* to this process, with exercisers going through stages of adoption, adherence, drop-out, resumption and maintenance. From the present findings it would appear that this type of process may occur with PST. This notion is further supported by aspects of the qualitative data.

In contrast to Bull's (1991) findings, correlations demonstrated no relationship between self-motivation and adherence.

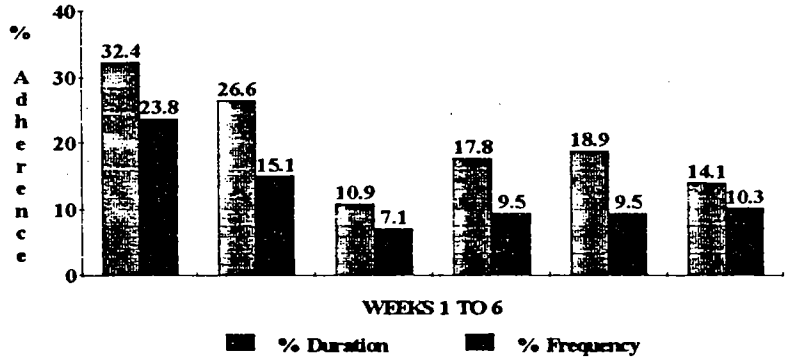

Figure 1: Graph Showing Mean Percentage Adherence of Imagery Training for Both Duration and Frequency of Imagery Training.

Results from the interviews demonstrated the imagery training had not been used in a systematic fashion. It was felt that the training would be of use to co-athletes and the educational inputs had been very effective. Time constraints and not competing during the time of the study emerged as detrimental to adherence. Experiencing positive returns emerged as the strongest positive influence. Scheduling exact times for training was suggested to improve adherence. A diversity of adherence influencing factors were used to explain the poor adherence. This finding support the need to personalise PST. Butler & Hardy (1992) have forwarded Performance Profiling as potential approach to achieve this individualisation. This process may also help limit the drop-off in adherence evident in this study.

Due to the apparent importance of individual influences upon adherence, a more idiographic approach was adopted for phase two. This type of research has been recommended in recent times within sport psychology (Bryan, 1987).

Phase Two.

Seven student athletes utilising the University of Brighton Sport Psychology Service were randomly selected to act as subjects in phase two. Each athlete was assigned to one of two design alternatives. These were either: (a) Assessing the role of meetings with a sport psychologist upon adherence to PST, or (b) Assessing the impact of programme structuring, during consultant withdrawal, upon adherence levels. Both designs assessed adherence levels to a personalised PST programme.

Within each design the athletes were assigned to a randomly pre-determined baseline period. In each case a nonconcurrent multiple-baseline design across individuals was used. Four subjects

formed design 'a', and the remaining three formed design 'b'. One athlete in design 'a' dropped out of the programme, however, this athlete's results are still shown as drop-out is relevant to adherence. Nonconcurrent designs (Barlow & Hersen, 1984) do not provide a rigorous research framework, but in this case it was not possible to start gathering data simultaneously as with a conventional multiple-baseline design. Furthermore, this study was carried out in a 'natural' setting to add to the 'practical significance' of the research.

Each athlete was met twice prior to implementation of any programme. Meeting one consisted of general discussions of the athletes' participation in sport. In order to individualise the PST a Performance Profile was constructed. Each athlete also completed a Sports related Psychological Skills Questionnaire (SPSQ) (Nelson & Hardy, 1990). Information from the discussion was combined with that from the Performance Profile and SPSQ to form the PST programme. During the second meeting the athletes received a booklet containing details of visualisation training, goal-setting, anxiety management and concentration training. SPSQ and Performance Profile results also appeared in the booklet. These results were discussed with the sport psychologist. Using the individual results the sport psychologist suggested a direction for the programme. The athletes received education relevant to the direction of the programme, and if in agreement with the suggested PST, the sport psychologist discussed availability of time for PST with the athletes. This discussion led to a mutually agreeable PST prescription. Each athlete received a PST diary in which to record date, time, duration, location, quality and reactions to each training session. Diaries were reviewed by the sport psychologist and athlete at every meeting.

A regular schedule of meetings was then outlined (typically one per week) to ensure the athletes received as much individual attention as required. After the pre-determined baseline period the sport psychologist became unavailable for several meetings in design 'a' (i.e. withdrawal of contact). In design 'b' this same approach was taken and the athletes provided with a structured programme for this period of non-contact. During the last meeting before consultant withdrawal, a date was arranged for when meetings would recommence. All athletes were interviewed after data collection had finished to further examine the adherence issue.

Hypotheses.

1) Cessation of meetings with the sport psychologist would produce a decrease in adherence. Re-starting meetings would produce a concomitant increase in adherence.

2) Structuring of PST at the point of consultant withdrawal would help maintain adherence.

3) Individualising of the PST programmes would produce good levels of adherence.

General Findings and Discussion.

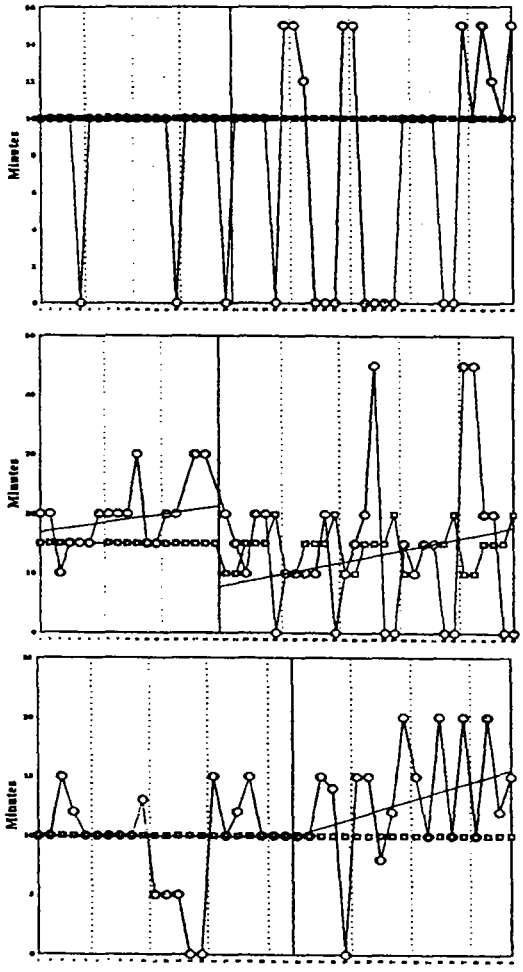

Figure 2: Single-Case Research Design to Show Efficacy of Structuring of PST on Adherence During Non-Contact Time.

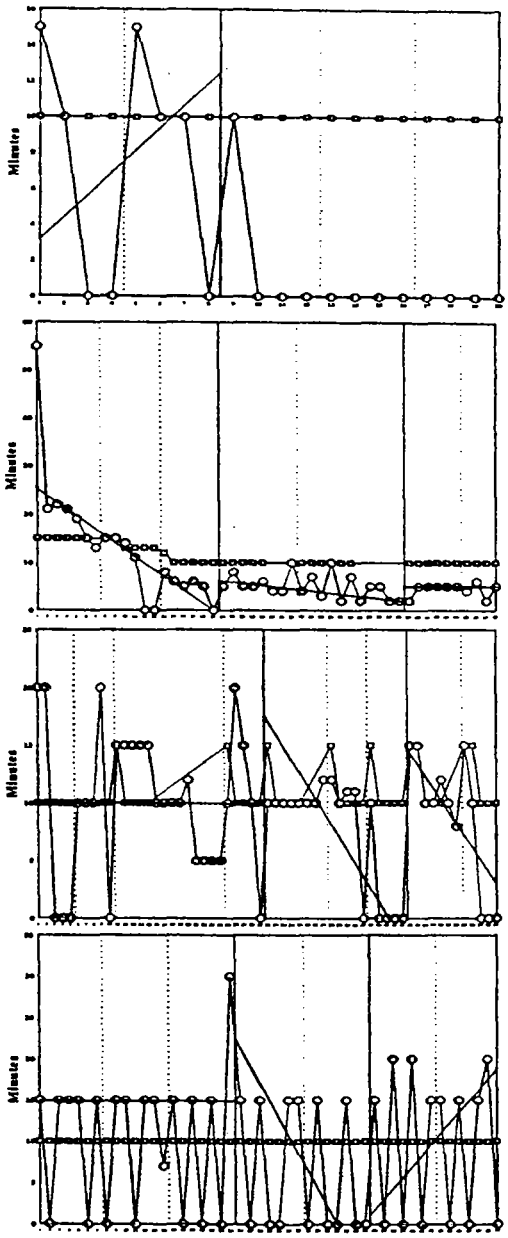

Figure 3: Single-Case Research Design to Show Impact of Cessation of Meetings with Sport Psychologist Upon Adherence.

Circle data points = actual training Square data points = prescribed training.
Bold vertical lines = change in experimental phase. Dashed vertical lines = weekly intervals.
y-axis shows minutes of training. x-axis shows sequential PST sessions.

Graphical representations of the data are shown in figures 2 (design b) and 3 (design a). In design 'b' there was no return to baseline condition as each athlete continued to train without recommencing meetings. The presentation style of the data allows appraisal of percentage adherence in terms of both duration and frequency of training for each week. Using Split-Middle Analysis (White, 1974) trend lines have been added for each period of data collection.

From figures 2 and 3 good levels of adherence to the PST are evident. For the six subjects with complete data sets, regular training was engaged in and sustained for several weeks. Support is given for using Performance Profiling to foster adherence to PST. Further support is apparent in the qualitative data. This claim needs further verification. Cessation of meetings with the consultant appears to have had an influence upon adherence, and programme structuring appears to have helped maintain adherence during the period of non-contact. The qualitative data from the interviews provided valuable information regarding the athletes' experiences during the data collection period. The athletes perceived that PST had been used more when a competition was approaching. This concurs with the findings of Rodgers et al. (1991). Further individual differences were evident in the reactions to the interventions, once more highlighting the need to constantly tailor programmes to meet changing preferences and experiences.

CONCLUSIONS.

The results reported here further support the notion that high adherence should not be expected when delivering PST. However, it would also appear that steps can be taken to increase adherence. From the two phases of research reported, additions have been made to Bull's (in press) preliminary model of adherence to PST (see figure 4.). It is evident that athletes use PST sporadically, and this has been accounted for in the model by introducing core elements of *non-use*, *drop-out*, and *resumption*. Some initial suggestions have been made for situational characteristics which may influence drop-out and resumption of PST.

Several recommendations can be made as a result of this process.

- When delivering PST in a workshop setting, sessions should be included which allow athletes to individualise the training being taught. This may be achieved via a Performance Profiling session plus provision of examples of training programmes available for athletes.

- Programmes should be structured in such a way as to promote maintenance during periods when athletes are not competing. This may be achieved by making PST an integral part of physical practice sessions (Sinclair & Sinclair, 1994).
- Workshops should include sessions which teach athletes how to implement the PST into their overall preparation routines, rather than just educating athletes about PST.
- If possible, support networks should be established to help athletes maintain training if they do not maintain regular contact with a sport psychologist. Coaches, team-mates or family members could be recruited as part of this network.
- Athletes should be encouraged to update their programmes regularly to help maintain interest in the PST, and allow for individual changes over time. Promoting the use of setting regular goals for the PST would facilitate this process.

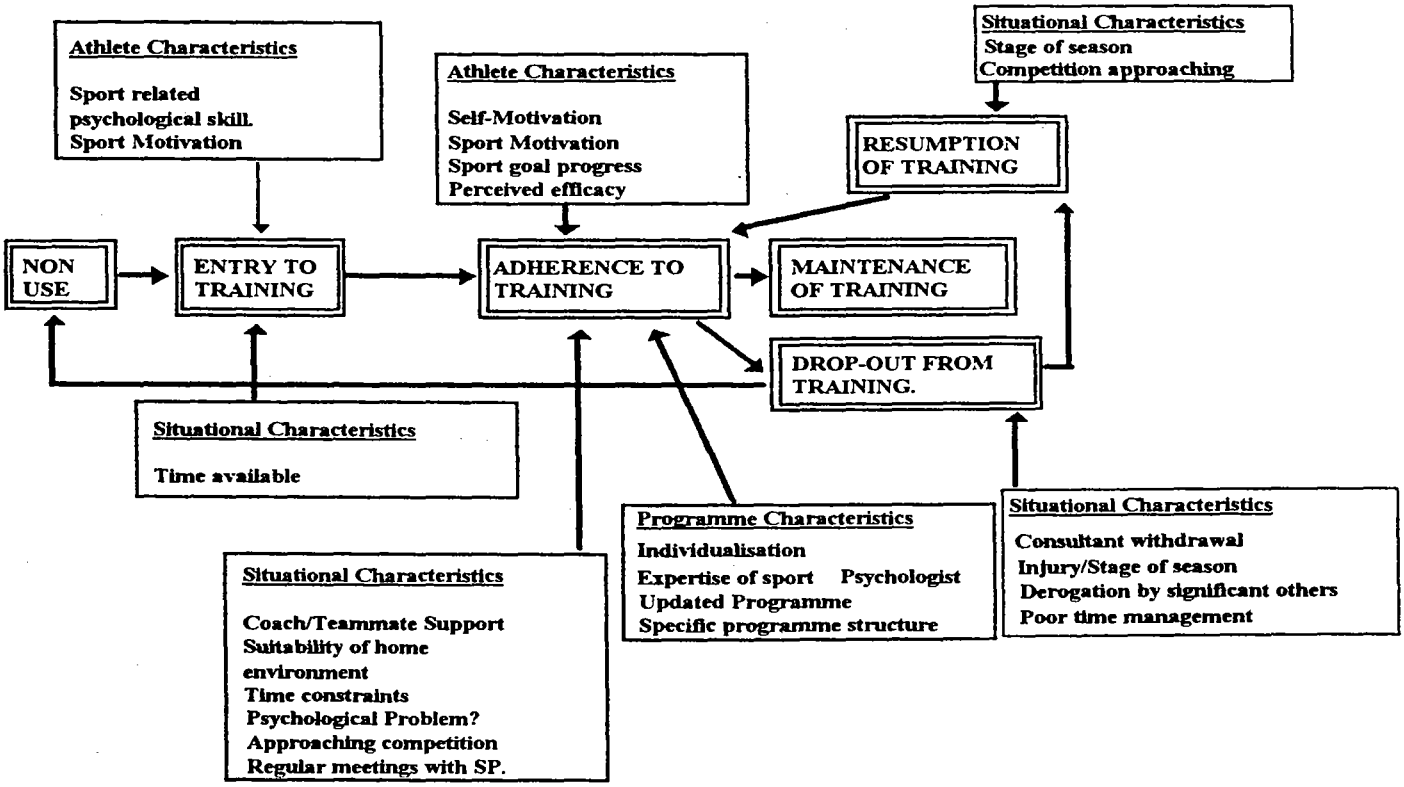

Figure 4: Revised Model of Adherence to Psychological Skills Training. Adapted from Bull (in press).

The adapted model of adherence to PST requires validation and research attention should be given to the maintenance phase of the model. It is hoped that the model provides a useful framework for identifying potential problems in getting athletes to adhere to PST, as well as providing some potential solutions to these problems.

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P.4.2. MISCELLANEOUS

PHYSICAL AND SPORT ACTIVITY AS TREATMENT AND REHABILITATION MEANS FOR DRUG ADDICTS IN PRISONS

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Key Words: rehabilitation in prisons, drug addicts, physical activity

The recent Italian regulations, dated 1990, concern prevention, treatment, and rehabilitation of drug addicts; it ensures collaboration between Social and Health Services, and Institutions for prevention and detention. This collaboration has been carried out for some time by social and health service staff giving assistance to inmates. They are mainly involved in pharmacological therapies with methadone, legal assistance, and psychological support. The regulation also establishes that suitably equipped prison departments and rehabilitative programs must be provided; the aim is to guarantee treatment and rehabilitation of convicted drug addicts.

Following Tims and Leukefeld (1992) considerations, there are several reasons for offering treatment to incarcerated drug addicts: (a) administrative problems seem to reduce when inmates receive treatments, (b) inmates' drug-seeking behavior decreases, and (c) an opportunity to engage the drug-dependent individual in a rehabilitation process is offered.

Also in Italy the number of incarcerated addicts is now relevant. These subjects are often in compromised psychophysical condition and need a therapeutic and rehabilitative intervention. Alternative prison structures are therefore expected where therapeutic interventions, aimed at recovering addict subjects, would efficaciously be applied. Larger space and many opportunities for therapeutic, formative, occupational, expressive, and playful activities must be considered; meeting rooms must be furnished without dividors to create a positive environment when relatives visit. Also the inmates personal area must be enhanced for the therapeutic program, for example using, where possible, single cells and a common self-managed kitchen.

Rehabilitative interventions are aimed at motivating the subject toward a change process, and help him/her choose a life style alternative to drug addiction. The Social and Health Services of Padova, Italy, in collaboration with the Institute of Physical Education are carrying out a project for therapy and rehabilitation in one of the departments. Physical and sport activities are emphasized in this project.

A project for motor activity applied to drug addicts aims mainly at recovering a positive relationship with one's body, through improved physical condition as well as awareness of bodily expressive potentials. Body of a drug addict is elective ground for destructive behavior: it is an unhealthy and shattered body kept in life by drug. Drug becomes the only source of energy replacing any somatic, psychological, and spiritual activity. As Valenti and Gainotti (1991) argue, a drug addict has conceived a body without soul and psyche, a narcotized body paradoxically extraneous even to itself. In the relationship with the addict, body is the means of communication, with its organic lesions, holes, and tattoos. Pasini (1991) highlights how physical activity and muscle tone lack on addicts. He believes in therapeutic project aimed at bodily functions recovery, also through physical and sport activity.

Psychosomatic medicine has widely demonstrated how mental aspects of experience could act deeply on bodily dimension. However, a further perspective should be taken into account: the possibility to act on mental aspects through body changes deriving from physical activity (Van Andel & Austin, 1984). In the psychiatric domain, physical exercise, sports, games, and leisure motor activities, have been experimentally verified in recent years as treatment strategy along with classical psychotherapy and pharmacological therapy. Reviews about this topic (cf. Leith & Taylor, 1990) have shown how physical activity produces positive effects at both physical and psychological levels, reducing anxiety and depression in particular. Positive changes are attributed to:

a) biochemical variations produced by exercise, when activity is intense enough. Even a single session of aerobic exercise, as it has been shown, can determine reduction in state anxiety and physiological arousal, with much longer lasting effects than relaxation techniques (Raglin, 1990);

b) greater control over body and environment, improvement in physical appearance and fitness, increase in well-being, all associated to physical exercise. For example, Tucker (1983a, 1983b) considers weight training in males an excellent way to develop positive body appraisal, because of the morphological changes associated with this practice. This tends to enhance competence, efficiency, and satisfaction.

On the basis of these considerations, in the therapeutic and rehabilitative intervention project for drug addict inmates, a broad physical activity program was proposed. Motor experience can take educational meanings to perceive the body as something to feel, respect and love. The program pursues the following main goals:

1. recover a balanced relationship with own body by increasing somatic awareness of main functions and motor potentials. Drug addict must regain respect over own body aggressed and neglected for long time. This is a main goal, because the body conveys the experience of life. To be healthy it mainly means to feel satisfied with own bodily dimension;

2. learn to relax to control muscle tone and emotions. Progressive relaxation and rhythmical deep breathing have a neutralizing effect on autonomic nervous system response to stressors. The subject can learn rather quickly how to cope with physiological response to stress and disturbing emotions. Furthermore, learning to tense and relax muscle groups lead to better self-awareness and to a renewed attention from own bodily cues;

3. reactivate physiological functions connected with motor activity. Inmates, drug addicts in particular, often spend their time in a sedentary way, watching television or staying in bed. An adequate physical activity, with strength and stamina increase associated with it, act against the progressive psychophysical deterioration derived from inactivity;

4. develop and improve interaction and cooperation with others. Games, plays, and sports stimulate socialization and communication. This is an important goal in a prison environment, where forced cohabitation can destructively act on interpersonal relationships;

5. favor learning sport and motor skills. Motor skills acquisition and greater feeling of control over body and environment contribute to self-efficacy enhancement. This can also indirectly improve self-concept, because its multidimensional structure includes physical appearance and motor competence (Marsh & Shavelson, 1985);

6. give the opportunity to live experience that generally belongs to the "normal" world. Many people practice physical activity to increase well-being and enjoy themselves. Even those going through a tragic situation of drug addiction and imprisonment can regain an increased positive dimension of existence through sport and physical activity.

Within the general project, which comprises various rehabilitative, formative and occupational activities (cinema, workshops, etc.), two hours per day are dedicated to sport and motor activities: physical fitness programs, muscular strength exercises, sport games, relaxation techniques. Also behaviors inherent to hygienic and body care are connected to physical activity. Particular emphasis is given to functional assessment to regularly record modifications in physiological parameters and in motor capacities. In subjects with low fitness level, progress is rather evident and this constitutes an important motivational factor acting as a stimulus to increase commitment and improve self-image.

In conclusion, for many drug abusers incarceration may be an opportunity to receive some treatment and become involved in programs for rehabilitation and social recover. Sport and motor activities represent a helpful and valid instrument of intervention within a wider, articulated project.

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FAMILY DETERMINANTS OF HEALTH RELATED BEHAVIOR : THE ROLE OF THE FAMILY IN PHYSICAL ACTIVITY

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KEY WORDS

Health Behavior, Health Promotion, Families and Social Variables, Exercise Promotion, Physical Activity

INTRODUCTION

Despite the health benefits of regular physical activity, a large proportion of individuals maintain a sedentary lifestyle (Stephens, et.al., 1985 ; Dishman, et.al., 1985 ; Powell, et.al., 1986 ; Crombie, et.al., 1990 ; Sallis, et.al., 1992). In the past decades many researchers studied determinants of physical activity with a view to give directions for physical activity interventions. Successes of these interventions are mixed, maintenance of change over the long term has not been easy to effect. Zimmerman (1989) shows several reasons for this problem. First individuals frequently drop out of exercise programs without completing them. Second, though individuals' attitudes and beliefs about health and health-related behavior may change over the long term, this may not necessarily lead to a long-term change in behavior. Third, even after "successfully" completing the programs, individuals frequently fall back to their old habits when confronted with situations conducive to those habits. Hollis (1984) mentioned that the benefits of the intervention have generally been shown to fade rather quickly. An increasing number of researchers and practitioners in the health behavior field however are convinced that long-term change requires more than education, persuasion and behavior modification, it requires an environment that is "actively" supportive of change. Sallis & Nader (1988) state that because of the long-term impact, and because the family is a dynamic system, it is hypothesised that health habit changes made in the entire family will be relatively stable and well maintained. One important benefit of increased understanding of family determinants of physical activity is to influence the design of family-based exercise promotion programs.

The purpose of our study is to investigate the role of the family in physical activity. Special focus is given to family variables others that those already frequently

studied based on cognitive-social learning and operant learning principles. Congruent with Sallis & Nader (1988) who state that more conceptual work is required to identify dimensions of family functioning that should be relevant to the development and alteration of health behaviors, some aspects of the complex intrafamily patterns of influence are studied : family rules and habits, family cohesion and adaptability, and family communication about physical activity. The question we ask is whether there are certain rules or habits a family might possess, or certain ways of structuring its interactions, or dealing with its issues of cohesion and intimacy that will make its members be more physically active.

METHOD AND PROCEDURE

This article focuses on part of a larger study, investigating family determinants of health related behaviors. The study was conducted between November 1994 and February 1995. 329 adolescents between 13 and 20 years of age filled in a questionnaire while waiting for a school medical examination.

Four items are used to obtain information on physical activity. The following question was asked : "How often do you usually participate in the following sports or activities : (1) bicycling , (2) gymnastics, dance, jazz, aerobics, callisthenics, ... (3) team sports (soccer, volleyball, tennis, basketball, ...) (4) individual sports (swimming, jogging, running, ...). The frequency was coded on a 5-point-scale with the poles *every day* (5) and *(almost) never* (1).

The variable "family rules and habits" was operationalized using seven items. The questions asked were as follows : (1) are your parents willing to bring you by car to your sports ? (2) do you parents think it is important for you to exercise ? (3) do your parents encourage you to exercise ? (4) do your parents value the physical courses at school as much as the other courses ? (5) are you sometimes exercising together with your parents ? (6) do your parents complain because you spend to much time in exercising ? (7) do your parents sometimes forbid you to exercise because you did something wrong ? Respondents answered the questions by "yes" or "no".

Scores for family cohesion and family adaptability were obtained from the Dutch translation (Gezinsdimensieschalen, Buurmeyer & Hermans, 1985, 1988) of the *Family Adaptability and Cohesion Scales* (Olson, et.al., 1982, 1983, 1985). An example of a cohesion item is : "Family members feel closer to each other that to people outside the family". An example of an adaptability item is : "We shift jobs at home from person to person".

Family communication about physical activity was measured by one item asking : "How often do members of your family talk about the necessity to exercise ?", answering on a 7-points-scale from (7) every day to (1) never.

RESULTS

Percentages of the items measuring family habits and rules are shown in Table 1. Almost all the parents (87% to 88%) are willing to bring there adolescents to their sport events, rarely complain about exercising, and seldom use physical activity as a punishment. Three fourth of the adolescents think their parents consider exercise as something important to them. Only half of the respondents feel really encourage by their parents to exercise, less then 30% sometimes exercises together with his/her parents. More than 60% think their parents value the physical courses at school less than the other courses.

TABLE 1. Percentages of Family Habits and Rules

Family habits and rules	**no**	**yes**
- are your parents willing to bring you by car to your sports ?	13%	87%
- do your parents think it is important for you to exercise ?	28%	72%
- do your parents encourage you to exercise ?	45%	55%
- do your parents value the physical courses at school as much as the other courses ?	63%	37%
- are you sometimes exercising together with your parents ?	71%	29%
- do your parents complain because you spend to much time in exercising ?	87%	13%
- do your parents sometimes forbid you to exercise because you did something wrong ?	88%	12%

T-tests measuring differences in physical activity for family habits and rules, can be found in Table 2. The results show that adolescents are more participating in physical activity if their parents think it is important to exercise, if their parents encourage them, exercise together with them, and value the physical courses at school as as important as the other courses. Adolescents who mention that their parents sometimes complain about exercising or use physical activity as a punishment, are more physically active than the others.

TABLE 2. Differences in Physical Activity for Family Habits and Rules

	Physical Activity			
Family habits and rules	**no**	**yes**	**T-value**	**p**
- are your parents willing to bring you by car to your sports ?	8.7	9.0	-0.9	ns
- do your parents think it is important for you to exercise ?	8.0	9.5	-3.9	<0.001
- do your parents encourage you to exercise ?	8.4	9.5	-3.0	<0.005
- do your parents value the physical courses at school as much as the other courses ?	8.7	9.6	-2.3	<0.05
- are you sometimes exercising together with your parents ?	8.7	9.8	-2.7	<0.01
- do your parents complain because you spend to much time in exercising ?	8.7	10.6	-3.6	<0.001
- do your parents sometimes forbid you to exercise because you did something wrong ?	8.9	10.0	-2.0	<0.05

The correlation matrix (Table 3) shows a significant correlation between level of physical activity and communication about physical activity in the family (r=0.30).

TABLE 3. Pearson correlations

	Cohesion	Adaptability	Communication
Cohesion	-		
Adaptability	-0.61**	-	
Communication	0.31**	-0.17**	-
Physical Activity	0.01	0.07	0.30**

* p<0.05 ** p<0.01

Correlations between family cohesion and adaptability and physical activity are not significant. It could be hypothesised that these more general constructs, measuring family dynamics, influence physical activity indirectly, through the setting of family habits and rules. Table 4 shows differences in family cohesion, adaptability and communication for the seven family habits and rules. More positive habits and rules about physical activity are clearly associated with a higher score on family cohesion and a systematic lower score on family adaptability. Communication about physical activity goes in the same direction, with the exception of a higher communication score for the parents complaining about exercise and those using exercise as a punishment.