Abstract: The aim of this paper is to give a brief overview of recent research on perceived difficulty and perceived exertion, and to bridge a gap between this domain and some central topics in sport psychology. In the first section, we present the methodologies and results of a psychophysical approach of the perception of difficulty and exertion. The main conclusion of this approach is that perceived difficulty reflects mainly the amount of resources, or effort, that subjects have invested in the task, to reach a given level of performance. In a second section, we try to establish a link between this psychophysical approach and goal setting studies. The third section is concerned with interindividual differences in the perception of difficulty. Finally, we adopt in the fourth section a more qualitative point of view, linking perceived difficulty with motivational orientation.

Abstract (French translation): L'objectif de cet article est de proposer un bref aperçu de travaux récents sur la perception de la difficulté et de l'effort, et de jeter un pont entre ce domaine et d'autres sujets centraux en psychologie du sport. Dans la première partie, nous présentons les méthodologies et résultats d'une approche psychophysique de la perception de la difficulté et de l'effort. Le résultat principal de cette approche est que la difficulté perçue reflète essentiellement la quantité de ressources, ou d'effort, que les sujets ont investi dans la tâche, pour atteindre un niveau donné de performance. Dans la seconde partie, nous tentons d'établir un lien entre cette approche psychophysique et les recherches sur la fixation de buts. La troisième partie est consacrée aux différences interindividuelles dans la perception de la difficulté. Enfin nous adoptons dans une quatrième partie un point de vue plus qualitatif, liant difficulté perçue et orientation motivationnelle.

Key-words: Perceived difficulty, perceived exertion, intended effort, goal setting, motivational orientation.
PE teachers often try to adjust the difficulty of the learning tasks to the resources that students have at their disposal. Nevertheless, a rational or "scientific" management of the requirements of the tasks does not necessarily guaranty the success of learning: students still have to agree to work, and to invest effort in the search for the solution to the problems which have been proposed to them. Then the teacher could have a lot of surprises: some students lose heart although the task is largely at their hand, and some others succeed in a priori too difficult tasks. The behaviour of a given student can be very variable from one lesson to another, even when confronted with identical tasks.

In fact, the objective requirements of the learning tasks seem less important than the representation that students have of these requirements, and the performance is less related to objective difficulty rather than to subjective difficulty, which constitutes a genuine interface between subject and the task he is faced with.

A number of theories, in the domain of motor performance, have identified perceived difficulty as an important variable in the regulation of emotions and motivation. Nevertheless, little research has focused specifically on the understanding of the true nature of perceived difficulty.

Perceived difficulty can be defined as the subjective assessment of the requirements of a task. According to the nature of this task, it is useful to distinguish between perceived exertion, in the case of tasks mainly determined by energetical factors, and perceived difficulty, when the task is characterised by informational constraints. Delignières, Famose, Thépaut-Mathieiu and Fleurance (1993) have shown that in a complex task subjects were capable to assess these two dimensions separately. Even if in the present text perceived difficulty is often used as a generic term, it will frequently be precised as to whether it is the perception of exertion that is being referred to, or the perception of informational difficulty. Another distinction must be realised between an a priori assessment, i.e. before any trial on the task, and an assessment during or just after performance. In the first case we will speak of estimated difficulty, and in the second, properly spoken, of perceived difficulty.

This paper constitutes an attempt to synthesise the results of recent research on perceived difficulty and perceived exertion, and to put forward some lines of possible theoretical development and practical application. In the first section, we present the methodologies and results of a psychophysical approach of the perception of difficulty and exertion. In a second section, we try to establish a link between this psychophysical approach and goal setting studies. The third section is concerned with interindividual differences in the perception of difficulty. Finally we adopt in the fourth section a more qualitative point of view, linking perceived difficulty with motivational orientation.

**THE PSYCHOPHYSICAL APPROACH OF PERCEIVED DIFFICULTY.**

The perception of difficulty or exertion was primarily studied from an intensive point of view. The focus was on the following question: how difficult is the task? This line of research has used the methods of psychophysics, a psychological discipline which studies the relationships between stimuli and the corresponding sensations.
The Psychophysical Methodology.

Two main methodologies have been used in the psychophysical approach to perceived difficulty. The first was the magnitude estimation method. In this kind of approach, subjects have to estimate the difficulty of series of tasks. An arbitrary rating is assigned to one of these tasks (for example 10), and subjects have to rate the other tasks in reference to this standard: for example a task perceived twice as difficult would be rated 20.

This method allows the study of the relationship between objective difficulty (measured for example by the intensity of the task, or by the amount of information to be processed), and perceived exertion or difficulty. These relationships can be characterised by mathematical functions: in our domain of interest, perceived exertion appeared as a power function of objective effort, with an average exponent of 1.6 (Borg, 1962), and the relationship between objective and subjective difficulty, in simple perceptual-motor tasks, has been accurately described according to an exponential function, with an exponent of 0.4 (Delignières & Famose, 1992; Figure 1).

![Figure 1: Relationship between the index of objective difficulty and perceived difficulty, in the reciprocal tapping task of Fitts (1954). Exponential fitting: PD= (5.65) * e(.402)0D, r=.999 (from Delignières & Famose, 1992).](image)

These results yielded some interesting preliminary conclusions: the first one was that subjects are absolutely capable to assess, with accuracy and consistency, the difficulty of a series of tasks. The fitting functions were extremely accurate, at the group level as well as at the individual level. This suggested that perceived difficulty was a reliable index, which could be used in experimental protocols as well as in teaching or training situations.

Secondly, these results indicated that the relationship between objective and perceived difficulty was positively accelerated. In other words the sensitivity to difficulty increased as tasks became more difficult: a given increase in objective difficulty corresponded to an important increase in perceived difficulty when the task was difficult, but to a lower increase when the task was easy. So teachers and trainers must be cautious when they manage the difficulty of tasks that have already been assessed as difficult by students.
The exponent of the function objective difficulty-subjective difficulty could be considered as a measure of global sensitivity to difficulty. Some studies have suggested large interindividual differences at this level: for some subjects a given increase in objective difficulty corresponded, on average, to low alterations of perceived difficulty, when for other subjects the modifications in perceived difficulty were much more important (Borg & Karlsson, 1976; Delignières & Famose, 1994). This problem will be discussed later.

The magnitude estimation method does not allow the comparison of *levels* of perceived difficulty, between individuals: the fact that one subject gives a rating of 20 for a task and another subject gives a rating of 30 does not signify that the second finds the task more difficult, as the response of subjects is closely related to their numerical behaviour, i.e. the manner with which each individual uses numbers and arithmetical operations (Gescheider, 1988). A second approach was developed with the aim to allow such interindividual comparisons. Borg (1970) has proposed the well-known RPE scale, for the assessment of perceived exertion. This scale is composed of 15 points, numbered from 6 to 21, and is anchored at two points with verbal labels, from "very, very light" to "very, very heavy". This scale was constructed to produce a linear relationship between objective effort and perceived exertion in submaximal cycloergometer exercise.

More recently, Delignières, Famose and Genty (1994) have constructed and validated a category scale for the perception of difficulty, called DP-15 (figure 2). This scale produced a linear relationship, in simple perceptual-motor tasks, between objective difficulty and perceived difficulty.

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*Figure 2: The DP-15 rating scale for perceived difficulty (from Delignières, Famose & Genty, 1994).*

Clearly these category scales can not give any information on the form of the objective difficulty-subjective difficulty relationship, as they were constructed to produce a given form of relationship. However they allow interindividual comparisons on levels of perceived exertion or perceived difficulty: it is possible to affirm that a subject which rates an effort at 9
on Borg's RPE scale has perceived a lower level of exertion than another subject who gives a rating of 13. Finally, these scales allow the assessment of a unique task, without any systematic comparison with a standard.

From a practical point of view, these category scales appear largely more interesting than the former methodologies. For example some experiments have demonstrated the practical usefulness of the Borg's RPE scale, in order to prescribe a given level of exertion (Birk & Birk, 1987; Ceci & Hassmén, 1991; Dunbar, Goris, Michielli & Kalinski, 1994). These experiments have shown that subjects are able to produce, in running or pedalling tasks, exertion levels prescribed according to RPE ratings. This method of effort regulation, while essentially subjective, gave more accurate results than more classical methods such as heart-rate monitoring (Dunbar et al., 1994). Mainly developed in the domain of cardiac rehabilitation settings, this approach has not been tested in the domain of PE teaching. Nevertheless, it seems an interesting and practical way to regulate the intensity of the exertion requested from students.

**Perceived Difficulty and Resource Allocation.**

The main objective of this psychophysical approach was to determine the nature of the stimulus at the origin of the feeling of difficulty or exertion. For example, diverse physiological variables have been studied in relation with perceived exertion: perceived exertion has been proved to correlate, besides heart rate, with lactate concentration, oxygen intake, or ventilatory rate (see, for example, Borg, Van den Burg, Hassmén, Kaijser & Tanaka, 1987; Gamberale, 1972; Ljunggren & Hassmén, 1991). As all these variables increase monotonically with the intensity of exercise, high linear correlations between perceived exertion and physiological variables constitute expected results. Nevertheless the correlational nature of these studies does not allow causal relationships between physiological variables and perceived exertion to be concluded. Yet some recent experiments have put forward strong arguments supporting the determinant role of lactate concentration (Hetzler, Seip, Boutcher, Pierce, Snead & Weltman, 1991; Seip, Snead, Pierce, Stein & Weltman, 1991): These studies indicated a close relationship between lactate concentration and perceived exertion, despite controlled variations of the nature of the task and of the other physiological variables (heart rate, oxygen intake,...).

Nevertheless, according to the nature of the task, the antecedents of perceived exertion seem clearly differentiated. Ekblom and Goldbarg (1971) have showed the possibility to independently assess a central effort, related to aerobic processes and objectively revealed through indexes such as heart rate or oxygen intake, and a local effort, mainly anaerobic, which could be measured from blood lactate concentration. Robertson (1982) has suggested that the relative contribution of these central and local factors depends on the intensity and duration of the exercise. During the first thirty seconds, the local factor should be predominant. The central factor could be the most important under high intensities, and beyond the first thirty seconds.

These approaches of perceived exertion remained in a traditional psychophysical point of view: task constraints (distal stimulus) led to a solicitation of the energetical system (proximal stimulus), which constituted the base of the feeling of effort. The study of perceived difficulty has suggested new considerations about this problem.
As a first step, these studies have shown the relative independence between perceived difficulty and reached outcomes (Delignières & Famose, 1992). In other words, a subject could assess a task as easy, even if he or she did not obtain satisfactory outcomes, or conversely assess the task as difficult, despite a good performance.

A work by Delignières, Brisswalter and Legros (1994) suggests that perceived difficulty reflects mainly the amount of resources, or effort, that subjects have invested in the task, to reach a given level of performance. This experiment has shown that when subjects had to perform a reaction time task in stressful conditions, those who presented the better resistance to stress (those who obtained the best performances), gave higher perceived difficulty ratings than those who obtained poor performances. Inversely, some studies have shown that with learning, subjects obtained progressively better performances in a given task, and found the task easier and easier (Bratfisch, Dornic & Borg, 1970). These results suggest that perceived difficulty is not directly related to objective task difficulty, nor to subjective performance, but reflects the amount of resources which have been invested in the task.

These "dissociations" between performance and perceived difficulty have been frequently observed: for example Vidulich (1988) reported, in industrial settings, that a long-term improvement of performance was accompanied by a decrease of subjective workload, and conversely a short-term improvement led to an increase of subjective workload. This result was explained by the fact that in the first case, the improvement in performance was related to learning, so subjects could solve the task with a lesser investment of mental effort. In the second case, the improvement of performance is directly due to the investment of extra resources.

It could be interesting here to refer to a useful distinction between task difficulty and goal difficulty (Famose, 1993). Task difficulty is related to the objective characteristics of the situation, a set of constraints which limits the possibilities of action. Goal difficulty defines, for a given level of task difficulty, an outcome standard. Some experiments have tried to independently vary these two dimensions (e.g. Campbell & Ilgen, 1976). The results indicated that both goal difficulty and task difficulty affected performance, but in opposite directions: for a given task difficulty, difficult goals led to a better performance than easy goals. Conversely, for a given goal difficulty, the performance was poorer in difficult tasks rather than in easy tasks.

Adopting this conceptual framework, perceived difficulty appears more as an assessment of goal difficulty rather than as an assessment of task difficulty. This suggests that perceived difficulty is less determined by the direct experience of task constraints, rather than by an a priori decision concerning a performance standard to reach. From this point of view, the distinction we have proposed in our introduction, between perceived difficulty and estimated difficulty, seems purely formal, and an experiment by Delignières (1993) has shown that perceived difficulty presents a higher correlation with estimated difficulty, rather than with effective performance.

Could these hypotheses concerning perceived difficulty also be relevant for perceived exertion? Some experiments have demonstrated that the a priori representation of the required amount of effort had a strong influence on perceived exertion (Rejeski & Ribisl, 1980; Rejeski & Sanford, 1984). The conclusions of the authors were limited to the idea of a secondary modulation of the perception of exertion. Another hypothesis could be proposed,
according to which intended or expected effort could constitute the main antecedent of perceived exertion.

These hypotheses lead to new considerations on the relationships between perceived difficulty, motivation, effort, and performance, and allow a link to be established between the themes of perceived difficulty and goal-setting.

**PERCEIVED DIFFICULTY AND MOTOR PERFORMANCE.**

Much research in the area of goal-setting, in particular in industrial or organisational settings, has shown a positive influence of goal difficulty on performance: the more difficult the goals, the higher the performances. According to the authors, the assignment of difficult goals leads to a greater investment of effort (Locke, 1966), and a better persistence, as effort is provided until the goal or the sub-goal is reached (LaPort & Nath, 1976; Latham & Locke, 1975).

The cognitive theories of motivation offer an interesting frame to analyse the relationships between goals, effort and persistence (see, for example, Nuttin, 1980): the subject persists in his or her effort as long as he or she perceives a discrepancy between the goal and the actual outcome. Goal-setting allows this discrepancy to be created and structured. The motivational theory of Kukla (1972) gives an understanding of the role of the estimation of difficulty in the determination of the amount of effort which will be invested in the task. According to this author, the subject in a given task chooses the minimal level of effort which allows the required outcome to be reached. If the subject was to estimate the task as easy, then he or she would think that little effort was necessary to reach the goal. The increase of the level of estimated difficulty leads to a monotonous increase of intended effort. The theory suggests, at least within certain limits which have to be determined, that invested effort, and hence performance, are proportional to subjective difficulty.

Nevertheless, Locke and Latham (1985) suggested that this monotonous relationship between goal difficulty and performance was valid only if the assigned goal was realistic: if subject was to assess the task as too difficult, he or she stopped investing effort. As well, Kukla (1972) has postulated that the amount of effort was limited by a subjective maximum. When the level of estimated difficulty was such that the necessary amount of effort seems superior to the conceivable maximum, in other words, when subjects had the feeling that whatever their investment, their attempts are doomed to failure, then they turned away from the task and their investment returned to zero (Figure 3).

This hypothesis of the realism of goals was frequently evoked in the domain of sport psychology (Boterill, 1979; Gould, 1986). It implies that it is necessary to individualise goal difficulty, according to the resources that each subject has at his disposal. Nevertheless, some experimental works have shown that unrealistic goals, clearly overtaking the capabilities of subjects, did not necessarily lead to a decrease of motivation or of effort investment (Garland, 1983). In the domain of physical activity, such results were evidenced in a series of experiments using tasks such as sit-and-reach, handgrip dynamometer, or basket-ball shooting (Weinberg, Bruya, Jackson & Garland, 1987; Weinberg, Fowler, Jackson, Bagnall & Bruya, 1991; Figure 4). These studies suggested that even if subjects considered "irrealistic" goals as effectively extremely difficult to reach, this had no influence on the effort they intended to invest.
Diverse hypotheses have been proposed to explain these results. A possible specificity of physical activities have been evoked: these activities could be more intrinsically motivating, and this could explain the difficulties to replicate with sport tasks results classically obtained in industrial settings. Moreover, nothing proves that assigned goals were really taken into account by subjects. According to Locke (1991), subjects are moved by their own goals, which can be only influenced by the goals which have been assigned. So it was possible that subjects in the "irrealistic goal" condition chose more acceptable goals, and in so doing protected their motivation and their level of performance. The same reasoning was conceivable for subjects which could be assigned too easy a goal.
INTERINDIVIDUAL DIFFERENCES IN PERCEIVED DIFFICULTY.

We have previously evoked the important interindividual differences which have been observed at the level of the exponent of the function objective difficulty-subjective difficulty. It is also clear that different subjects facing a given task perceive different levels of difficulty.

Exponent Invariance.

Some experiments have shown high similarities in the assessment of difficulty, across tasks and within subjects. More specifically, the individual exponent of the psychophysical function objective difficulty-perceived difficulty, appears invariant from one task to another, whatever the nature of the required resources: Delignières and Famose (1994) have shown that the nature of the task (visual research, reaction time, tapping, or fine motor control) had no influence on individual exponents, and Gopher and Braune (1984) showed that the relation objective difficulty-perceived difficulty could be described in twenty three different tasks by the same function. A recent experiment (Delignières & Brisswalter, 1996) suggested that this invariance does not only concern perceptual-motor tasks, but more broadly reasoning tasks, and energetical tasks. This experiment showed finally that this invariance in exponent was not related to subjects' numerical behaviour. Then, the exponent of the psychophysical function seems to be a characteristics of the subject, independent of the nature of the assessed tasks. It constitutes a measure of the acceleration of the function, and could represent an index of the individual sensitivity to difficulty and exertion.

This does not imply that subjects with high exponents will overestimate difficulty, and conversely for subjects with low exponents. The exponent seems to be more a measure of the sensitivity to the variations of difficulty: a given increase in objective difficulty will be perceived as more important by subjects with high exponents. Nevertheless if as postulated by Borg (1970) the subjective range of the sensation continuum is identical for all subjects, one could suppose that facing a given task, sensitive subjects will perceive higher levels of difficulty than less sensitive subjects.

Individual Variables and Perceived Difficulty.

A systematic study of interindividual differences would allow a better understanding of the processes underlying the perception of difficulty. Nevertheless few attempts have been made with the aim to compare individual exponents. Dornic and Birbaumer (1974) studied perceived difficulty in a task under temporal pressure, with normal and neurotic subjects. This experiment showed that perceived difficulty was a linear function of available time with normal subjects, but an accelerated transformation of available time in neurotics. Delignières (1993) has compared the exponents of a group of expert rock-climbers and a group of sedentary subjects in the assessment of the difficulty of Fitts' tapping tasks: the mean exponent of climbers was significantly lower than the exponent for the other group (.30 vs .38, Figure 5), and this result was not related to differences in tapping performances. These results suggested that certain variables of personality or expertise could be an important antecedent of the individual sensitivity to difficulty. Nevertheless, little empirical data are available to support a definitive conclusion.
More attempts have been made to compare, between groups, the levels of perceived difficulty or perceived exertion. A question frequently tackled was the influence of sex on perceived exertion. A hypothesis commonly proposed was that as effort corresponded to "male values", females would perceive higher levels of exertion than males, at an equivalent level of objective effort. For example Dill, Rejeski & Ribisl (1981, cited by Rejeski, 1981) have shown that in a running task of equivalent relative intensity (80% VO2max), perceived exertion was significantly lower for males.

In many cases the results were divergent. For example Wrisberg, Franks, Birdwell and High (1988), have studied the assessment of exertion in a running task on a treadmill, with a group of expert runners, and have obtained higher ratings for males than for females. From a slightly different point of view, Delignières and Famose (1991) have realised an experiment on the estimation of the requirements of verbally described walking tasks, with two groups of children aged respectively 12 and 16, and also with a group of PE teachers. There were no differences between boys and girls in the 12 years old group. In the 16 years old group, girls gave significantly higher estimations than boys. Conversely, within the teachers group, females gave lower estimations than males.

Some studies have emphasised the influence of sports expertise on the "objectivity" of perceived exertion (Rejeski, 1981; Winborn, Meyers & Mulling, 1988; Wrisberg & Pein, 1990). Sylva, Byrd and Mangun (1990) showed no differences between male and female top-level athletes, for perceived exertion in tasks of equivalent relative intensity. Famose, Delignières and Court (1991) have evidenced, with young high level athletes, significant differences between boys and girls in perceived exertion or perceived difficulty, but only when the nature of the task advantaged one sex or the other. When the level of performance was equivalent between sex, boys and girls gave identical subjective ratings. So, if with sedentary subjects systematic differences seemed to appear between sex in the perception of exertion, these differences tended to disappear with sports experts.
Beyond biological sex, some experiments on the influence of sex roles have yielded more consistent results. Hochstetler, Rejeski and Best (1985) studied perceived exertion in a group of women. The subjects were classified, according to a specific inventory, as feminine, androgynous or masculine. Results showed that feminine subjects gave higher ratings of perceived exertion than androgynous or masculine subjects. These results have been replicated with male subjects by Rejeski, Best, Griffith and Kenney (1987). One could note that in the previously cited experiment by Delignières and Famoise (1991), differences between sexes appeared only during adolescence, an important period for the structuring of sex roles.

Moreover, sport expertise and sex roles seemed intimately related. Some works have clearly shown that sportswomen presented more masculine traits than sedentary women (Salisbury & Passer, 1982; Williams, 1978). This could suggest a possible explanation for the results obtained in some previously cited experiments, on the perception of exertion with sports experts (Delignières and Famoise, 1991; Delignières et al., 1991; Wrisberg et al. 1988).

A Qualitative Perspective: What is the Nature of the Task?

Previous parts have mainly focused on an intensive approach of perceived difficulty. Some other points of view, more qualitative, could be adopted, related to the perceived nature of the task, and the kind of goals really followed by subjects.

The Perceived Nature of the Required Resources: Aptitude vs Effort.

Some experiments have shown that the conceptions about task difficulty induced by the researcher or spontaneously used by subjects, have an important influence on motor performance and motor learning. Namely, when subjects believed that performance was mainly determined by skill and learning, they invested more effort and reached significantly higher outcome levels than when they believed the performance to be mainly related to aptitudes or innate capabilities. Jourden, Bandura and Banfield (1991) have specifically studied the influence of these conceptions. Subjects had to perform a rotary pursuit task. The first group was told that this task was designed to assess a stable and untrainable ability. Conversely the instructions given to the second group emphasised the role of learning and effort on performance. In the second group results showed a greater interest for the task, a better level of performance, more positive reactions to outcomes and a reinforcing of the feeling of competence.

It is important for subjects to have the conviction that the factors susceptible to affect performance are under their control. If subjects estimated current failure to be related to a skill deficit or a lack of effort, controllable and improvable factors, they would persist in their attempts to reach the goal. Conversely, if they had the impression that their failure was related to stable factors (e.g. aptitudes or morphological characteristics), or to external and out-of-control factors (chance, referee's decisions, opponent's strength), they would tend to withdraw themselves from the task (Roberts, 1984; Rudisill, 1990).
Mastery Goals vs Competitive Goals.

The theory of motivational orientation offers an interesting frame in which to integrate the previous propositions. Recent approaches explain achievement motivation through an individual need to demonstrate one's competence. A subject who acts in an achievement situation tries to demonstrate his or her competence, or to avoid showing his or her lack of competence.

Two conceptions of competence have to be distinguished. According to the first one, competence is referred to the performance of others: one estimates oneself as competent if one has realised a better performance than others. Competence is exo-referenced, determined by a process of social comparison. According to the second conception, competence is determined by individual standards of mastery and performance improvements. The subject seeks to reach a performance standard, independent of the performances of others. These conceptions determine two fundamental motivational orientations: the competitive and mastery orientations (Roberts, 1991).

These motivational goals are related to differentiated conceptions relative to skill, or effort, and their contribution to performance. Some authors have shown that in the sport domain, mastery-oriented subjects perceived success as being dependent on effort and persistence (Duda, Fox, Biddle & Armstrong, 1992; Lochbaum & Roberts, 1993). In this case, skill and effort were considered as two necessary means to improve performance. Conversely, competition-oriented subjects thought success to mainly reflect a superior ability, and also frequently referred to chance. Moreover, for these subjects, effort constituted a suspect investment, as a success obtained with an important effort could be minored, and a failure suffered despite a significant effort would be difficult to justify.
According to Roberts (1984), subjects who opt for competitive goals do not persist in case of failure. Failure affects the feeling of competence, and the expectation level, persistence and performance will decrease. Conversely mastery-oriented subjects tend to consider errors and failures as natural components of the acquisition of skills: they learn from failures, which do not affect then their persistence in effort. Rudisill (1990) has effectively shown, in three motor tasks (dart throwing, long jump and a flexibility task), that mastery orientation leads to higher expectation levels, a better persistence, and higher levels of performance (Figure 7).

![Figure 7: Influence of motivational orientation on performance expectations and persistence in a flexibility task (data from Rudisill, 1990).](image)

In conclusion, mastery orientation seems more favourable in order to induce effort investment and learning. Even if motivational goals are in part determined by individual variables, the teacher could play a decisive role at this level. Some authors have demonstrated that it was possible to incite students to opt for mastery goals, by the motivational climate instituted in the classroom (Ames & Ames, 1984; Famose, Sarrazin & Cury, 1995). The motivational climate is related to the nature of the goals assigned to students, the evaluation and reward process, and the type of relationships between students induced in the classroom. Teachers should try to avoid, in the organisation of their courses, any interindividual comparison and to give to each student individualized goals and performance standards.

Conclusion

We have presented in the first section an overview of an ensemble of studies focusing on perceived difficulty and perceived exertion, from a psychophysical point of view. The most salient conclusion of this psychophysical approach is that perceived difficulty is not a judgement on task difficulty, but rather an assessment of the amount of resources, or effort, that subjects have invested in the task, to reach a given level of performance. We have shown in the second section that this conclusion was consistent with the experimental results obtained in most goal-setting studies focusing on the effect of goal difficulty on performance. Further research remains necessary to verify if such closed relationships between perceived difficulty and effort are always obtained in more ecological settings, especially with social comparison and public audience. Nevertheless, it seems that psychophysical techniques could
offer useful tools in future studies, for assessing intended and/or provided effort in motor tasks.

The third section was concerned with interindividual differences in the perception of difficulty: available studies suggest that each individual is characterized by a sensitivity to difficulty, determining the manner by which he or she subjectively reacts to increases in objective difficulty. This sensitivity to difficulty seems related to personality traits and/or individual characteristics, such as expertise. Nevertheless, further research is necessary to analyze the antecedents of this sensitivity, which could constitute an important factor in the resistance to stressful situations.

A more qualitative point of view was adopted in the last section, focusing on subjects' beliefs about the nature of the resources they have to invest in a given task. It was argued that motivational orientation, and motivational climate, could induce diverse kind of beliefs, more or less favorable to performance improvement and learning. Mastery orientation appears particularly favorable to effort investment and persistence.

The main conclusion of this paper is that motor performance is not mechanically determined by the confrontation of a resources system to objective task constraints. The subjective assessment of the level and the nature of the difficulty of the task constitutes an important mediator of subject's emotions, motivation and effort. We would like now to propose some practical implications of these results, especially for PE teachers.

- Perceived difficulty could be considered as an index of the amount of effort that subject intends to invest and/or has invested on the task. Consequently, subjective goal difficulty could have a positive effect on performance. Often, teachers do not dare to assign ambitious goals, with the aim to avoid discouraging students. We think, conversely, that the assignment of significant challenges is necessary to induce a true investment of effort, and a real learning process during PE courses.

- Each individual seems characterised by a sensitivity to difficulty, which determines the manner with which he or she perceives the level and the variations of the level of requirement of tasks. There are great interindividual differences in this sensitivity to difficulty. Some personality dimensions, such as sex roles, appear to have a great importance at this level. Teachers must keep in mind the gap which could exist between their own sensitivity and the sensitivity of their students.

- The perception of difficulty refers, from a more qualitative point of view, to the subject's conceptions relative to the nature of the goal and of the required resources. The teacher could incite students to adopt optimal conceptions, on the one hand by a clear explicitation of the goals, and on the other hand by the institution of a mastery climate in the classroom.
References


Extended abstract: L'objectif de cet article est de proposer un bref aperçu de travaux récents sur la perception de la difficulté et de l'effort, et de jeter un pont entre ce domaine et d'autres problématiques importantes développées dans le cadre de la psychologie du sport. Dans la première partie, nous présentons les méthodologies et résultats d'une approche psychophysique de la perception de la difficulté et de l'effort. Le résultat principal de cette approche suggère que la difficulté perçue constitue moins un jugement sur la difficulté objective de la tâche, qu'une évaluation de la quantité de ressources, ou d'effort, que les sujets ont investi dans la tâche, pour atteindre un niveau donné de performance. Ces relations étroites entre difficulté perçue et investissement d'effort nous permettent, dans une seconde partie, de proposer une nouvelle lecture de la problématique au travers des travaux portant sur la fixation de buts (goal-setting), suggérant notamment que le niveau de performance est étroitement lié à la difficulté des buts qui ont été assignés au sujet. La troisième partie est consacrée aux différences interindividuelles dans la perception de la difficulté: il est montré que les relations difficulté objective-difficulté perçue possèdent pour un même sujet des caractéristiques invariantes, quel que soit le type de tâche auquel ce sujet est confronté. Chaque individu semble caractérisé par une sensibilité à la difficulté, reflétant la manière dont il réagit subjectivement aux accroissements de difficulté objective. Nous étudions dans ce cadre l'influence potentielle de certaines caractéristiques individuelles (expertise, sexe, rôles sexués) sur cette sensibilité à la difficulté. Enfin nous adoptons dans une quatrième partie un point de vue plus qualitatif, renvoyant aux représentations que les sujets ont de la nature des ressources requises dans la tâche. Cette approche nous permet de lier difficulté perçue et orientation motivationnelle: il est notamment suggéré que l'orientation de maîtrise induit une conception liant le niveau de performance à l'apprentissage, et à l'effort, et permet une meilleure persistence des sujets.