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FEATURE ARTICLE / ARTICLE DE FOND

THE RELATIVE AGE EFFECT IN PROFESSIONAL BASEBALL: A LOOK AT THE HISTORY OF MAJOR LEAGUE BASEBALL AND AT CURRENT STATUS IN JAPAN

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Recent reports show that success in sports is related to birthdate. This relationship is due to the fact that, in many sports, children are classified on the basis of chronological age with a fixed cut-off date. In sports like soccer or ice hockey, players born just after this date are more likely to access professional levels than players born just before this date. Access to Major League Baseball since its inception was studied so as to evaluate this relative age effect. As well, the current situation in professional baseball in Japan was investigated. It is shown that participation in Major League baseball and birthdate are related, but the magnitude of this link varies over decades and, to some extent, also varies as a function of players' position and handedness. The effect of the moment of birth on participation to professional baseball is of greater importance in Japan than in the U.S.A.

De nombreuses études récentes font état de ce que le succès dans le sport est lié à la date de naissance. Cette relation est attribuable au fait que, dans de nombreux sports, la classification des enfants est fondée sur l'âge chronologique et sur l'utilisation d'une date fixe servant à délimiter des catégories. Les participants nés tout juste après cette date, étant plus vieux, ont de meilleures chances de se rendre au niveau professionnel que ceux qui sont nés juste avant cette date. La présente étude retrace les conséquences de cet effet d'âge relatif au cours de l'histoire du baseball majeur. De même, la situation actuelle dans le baseball professionnel au Japon a été étudiée. La participation au baseball majeur et le moment de naissance sont liés mais l'ampleur de ce lien varie en fonction des décennies et aussi, jusqu'à un certain point, en fonction de la position des joueurs et de leur dominance manuelle. Enfin, l'effet du moment de naissance sur la participation au baseball professionnel est beaucoup plus important au Japon qu'aux Etats-Unis.

An age-based classification of children is known to have some influence on school success (Grondin, Proulx, & Zhou, 1993; for a review of relevant articles, see Thompson

& Barnsley, 1996), and recent research indicates that younger children have a higher probability of completing suicide than their older classmates (Thompson, Barnsley, & Dyck, 1999). In sport, there is an extensive body of recent literature showing that children born earlier in an age-based category are more likely than children born more lately to access higher levels of competition or professional ranks (for a review, see Musch & Grondin, 2000). The age difference of individuals of the same category is referred to as the relative age, and the consequence of such a classification is the relative-age effect (RAE).

The relationship between the moment of birth and sport success was recently reported for soccer in several countries (Barnsley, Thompson, & Legault, 1992; Dudink, 1994; Helsen, Starkes, & van Winckel, 1998; Musch & Hay, 1998) and for tennis and swimming (Baxter-Jones, 1995). The moment of birth was also reported to influence results in Physical Education, and this applied not only to the ratings of sport performance, but also to written components of the examination (Bell, Massey, & Dexter, 1997).

Ice hockey has been extensively studied with regard to this relationship. Essentially, it was shown that there is a large overrepresentation in elite and professional teams of players born in the earliest part of the selection year, and an underrepresentation of players born in the latest part (Barnsley & Thompson, 1988; Barnsley, Thompson, & Barnsley, 1985; Boucher & Halliwell, 1991; Boucher & Mutimer, 1994; Grondin, 1982; Grondin, Deshaies, & Nault, 1984; Grondin & Trudeau, 1991).

Baseball received less attention than ice hockey (Thompson, Barnsley, & Stebelsky, 1991; 1992). Daniel and Janssen (1987) reported virtually no relative-age effect (RAE) for players in Major League Baseball (MLB) in 1985. However, Thompson et al. (1991) argued that, in the Daniel and Janssen (1987) study, an inappropriate cut-off date (September 1) was employed in analysing the distribution of players in the selection year. Thompson et al. (1991) reported that August 1st is the appropriate date since it is the one used in Little League, the main minor baseball organisation for children. Consequently, players born in August, September or October should have the relative age advantage. In their analysis, restricted to players of the 1985 and of the 1990 seasons of MLB, Thompson et al. (1991) showed that there is a relationship between moment of birth and participation to MLB.

Although Thompson et al. (1991) provided evidence that there is a RAE in MLB, some important empirical questions regarding the RAE and baseball remain open. Firstly, one question is related to the fact that the phenomenon may be changing with time. For instance, Daniel and Janssen (1987) reported that, in the National Hockey League, the RAE is quite a recent phenomenon. It is therefore important to verify the possibility that the RAE grew over the years, as it did in professional ice hockey. Regarding this issue, we will use a large sample, with all players from MLB's inception in 1871 until 1992 included in the analysis. This will allow to examine the development of the RAE from its beginning to the present time.

Secondly, for periods showing a systematic RAE, it is important to identify if this effect applies to all players, regardless of their position. The magnitude of the RAE was reported to vary according to players' position in ice hockey (Grondin & Trudeau, 1991) and in cricket (Edwards, 1994). Along the same line, it is important to note that it is the competition in obtaining a position on a team that causes the RAE (Grondin et al., 1984). There are different levels of competition that might be inherent to some positions in baseball. Baseball is a game involving an important lateral component. One consequence of asymmetry in baseball is that left-handed pitchers, given the low proportion of people throwing with the left hand throughout the population (Gilbert & Wysocki, 1992), may have greater opportunity to participate in baseball. As well, players batting left have better batting and slugging averages than players batting right (Grondin, Guiard, Ivry, & Koren, 1999), which might provoke different RAEs. Thus, in the players' position analysis, handedness will also be taken into account.

Finally, we will compare the RAE in MLB with the RAE in professional baseball in another country, Japan. In Japan, baseball is very popular. A specific interest in doing this analysis comes from the fact that most Japanese baseball leagues for children base age categories on a cut-off date[1], April 1st, that is different from the one used in America (August 1st). In comparison with ice hockey, the RAE in baseball was reported to be weak (Stanaway & Hines, 1995; Thompson et al., 1991). One potential explanation for this difference might be the nature of the sport itself. If such is the case, the RAE for baseball in Japan should compare to what is observed in the U.S.A. for the same sport.

Method

Participants and Material

The birth date of all players in the history of Major League Baseball, from its inception in 1871 to the end of the 1992 season, was considered in the present analysis. All players' birth dates were extracted from the CD ROM version of Total Baseball (Thorn & Palmer, 1993), independently of their birth place.

Also, because most players in MLB are Americans, the distribution of birth rates in the different months in the U.S.A. was examined. This information was extracted from the documents available at Université Laval: Grove and Hetzel (1968), and the Vital Statistics of the United States for 1966 (Table 1). As Table 1 indicates, there have been only weak changes over the years of the distribution of births in the U.S. A..

Table 1
Distribution (in %) of Players born in each Trimester (T) in the U.S. Population from 1940 to 1949, from 1950 to 1959, and in 1966; and in the Japanese Population in 1975

	T_1	T_2	T_3	T_4
U.S. 1940-1949	26.38	24.87	24.26	24.51
U.S. 1950-1959	26.31	24.56	24.05	24.68
U.S. 1966	26.44	24.75	23.97	24.87
Japan 1975	24.93	25.85	23.93	25.29

Note: T_1 in the U.S. is August-October, and is April-June in Japan.

In a second part of the study, data from the 12 teams of the two main professional baseball leagues in Japan, Central and Pacific, were collected on the basis of the 1998 rosters available on the World Wide Web (www2.inter.co.jp/baseball/1999/99season.html). Only Japanese players were kept in the analysis.

Procedure

As in many studies on the RAE in sports, the birth date records of players were grouped per trimester (T), not per month. Since the cut-off date in the main youth baseball development in the U.S.A. is August 1st (Thompson et al., 1991, 1992), trimesters in the analysis of MLB were divided as follows: T1: August-October, T2: November-January, T3: February-April, T4: May-July.

Birth dates of players born in the 19th Century were grouped together. Birth dates of players born in the 20th Century, that is, for the period corresponding the MLB in its actual form (National League and American League), were presented for each decades. The few players born in the 1970s were grouped with players born in the 1960s.

Furthermore, for decades showing a RAE, players were also grouped according to their playing position. Firstly, they were classified as pitchers and non-pitchers. Secondly, pitchers were classified according to their handedness (left-handers vs right-handers) and non-pitchers according to their batting side (bat left, bat right or switch-hitter, i.e., bat from either side of the plate).

Because of the small sample, the analysis of the present situation of baseball in Japan was made on the basis of trimesters, and was limited to a classification of players according to their position without consideration for handedness. Trimesters of interest are as follows: T1: April-June; T2: July-September; T3: October- December; T4: January-March.

Table 2
Distribution of Players Over the History of Major League Baseball According to their Birthdate Trimester and Birthdate Period

	August-October	November-January	February-April	May-July	Total
Before 1900	1373	1253	1186	1221	5033
1900-1909	319	297	253	254	1123
1910-1919	351	325	285	299	1260
1920-1929	273	264	234	261	1032
1930-1939	255	256	230	259	1000
1940-1949	366	328	307	302	1303
1950-1959	440	398	342	334	1514
1960-	407	377	346	275	1405

Statistical Analyses

All statistical analyses reported were chi square tests. This non-parametric test was used to analyse frequency distributions. More specifically, the distribution in each trimester of players' birth and the distribution of population's births for the corresponding decade were compared. Note that in the MLB analysis, regarding players born since 1960, the theoretical distribution used for comparison was the one of 1966 (available at Laval). For Japanese players, the comparison is made with the distribution of birth rates in the different months in Japan for 1975 (these data are reported in Musch and Hay, 1999).

Results

Major League Baseball

A RAE predicts an overrepresentation of players born in the earliest portion, and an underrepresentation of players born in the latest portion, of the selection year. Table 2 shows that, as early as in the 19th Century, there were more players born in the August-October period. As well, a similar pattern of results emerge for the first two decades of the 20th Century. These data reveal that the RAE is not a new phenomenon. However, there was no apparent RAE effect among players born in the 1920 and 1930 decades. It is

not until the 1940s that there were not only more players born in the first trimester of the selection year, but also less players born in the trimester (May-July) expected to be the most disadvantageous.

The statistical analyses revealed that there is no significant deviation of players' distribution from the population's distribution for the 1940s [$\chi^2(3)=2.82$, n.s.]. However, this deviation is significant for players born in the 1950s [$\chi^2(3)=11.75$, $p < .01$] and for the players born in 1960 and later [$\chi^2(3)=21.80$, $p<.01$].

On each of these two periods showing significant deviations, another analysis was performed in order to test if the effect applies to both pitchers and non-pitchers (see Figure 1). For the 1950s, the deviation of players' distribution from population's distribution is not significant for the 719 pitchers [$\chi^2(3)=4.30$, n.s.], but is significant for the 795 non-pitchers [$\chi^2(3)=8.62$, $p<.05$]. For players born in 1960 and later, the deviation is significant for the 669 pitchers [$\chi^2(3)=15.54$, $p<.01$], but not significant for the 736 non-pitchers [$\chi^2(3)=7.43$, $p<.10$].

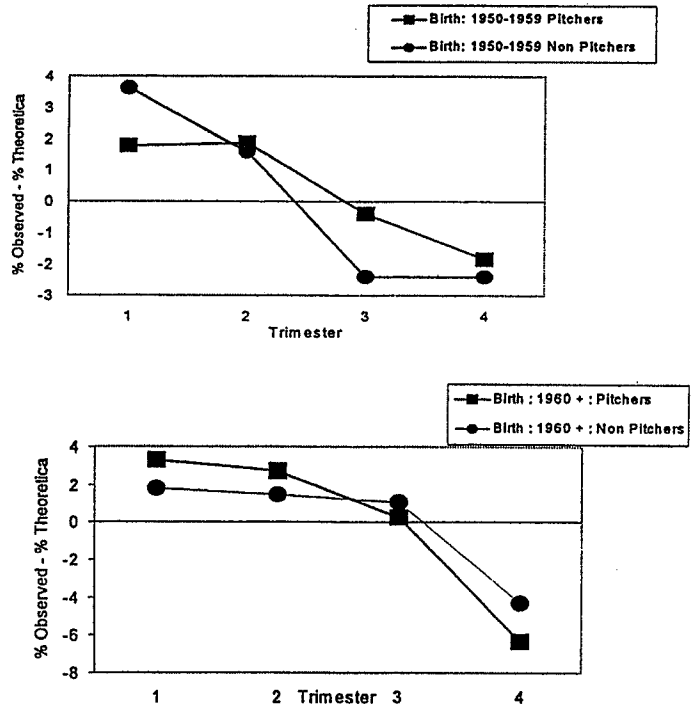

Figure 1. RAE for pitchers and non-pitchers

Finally, the data for pitchers born in the 1950s and 1960s were pooled together, and so were the data for non-pitchers. For pitchers, an analysis was conducted according to handedness. As shown in Figure 2, the distribution was monotonic only for right-handers. The statistical test revealed a significant RAE for the 894 right-handers [$\chi^2(3)=13.97$, $p<.01$], but not for 404 left-handers [$\chi^2(3)=6.24$, n.s.]. For non-pitchers (Figure 2), there is a RAE for 894 players batting right [$\chi^2(3)=8.24$, $p<.05$], but not for 421 players batting left [$\chi^2(3)=4.86$, n.s.] and not for the 216 switch-hitters [$\chi^2(3)=3.73$, n.s.].

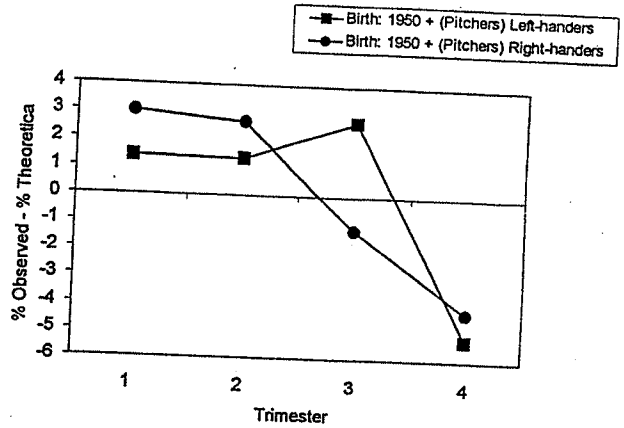

Figure 2. RAE for Right and Left handed pitchers

Japanese Baseball

As noted earlier, the first trimester in Japan is April-June. Therefore, it is not during the August to October trimester, as for MLB, that we find a peak in the distribution of players' births. It is actually during this April to June period that players' births are the most frequent. This cannot be explained by an abnormal distribution of births in the Japanese population (Table 1). Figure 3 shows a huge overrepresentation of players born in T1, and a large underrepresentation of players born during T4. Indeed, while 35.70% of players are born during T1, only 14.94% are born during T4, which reveal a much larger RAE than the one observed in MLB. The statistical analysis revealed that this frequency distribution is not consistent with the one in the population [$\chi^2(3)=77.89$, $p<.01$].

Another analysis was performed in order to test if the effect applies to pitchers and to non-pitchers (Figure 3). The deviation of players' distribution from population's distribution is significant, both for the 347 pitchers [$\chi^2(3)=44.79$, $p<.01$], and for the 395 non-pitchers [$\chi^2(3)=36.41$, $p<.01$].

Discussion

In many recent articles, a link is established between the moment of birth and success in sports. The present article contributes to the understanding of the phenomenon in professional baseball as it establishes distinctions related to the RAE over the history of MLB, and as it reveals an important RAE in Japanese baseball.

Major League Baseball

The results of the present analysis indicate that only recently does the moment of birth systematically influence participation to MLB. Nevertheless, in the 19th Century and until 1920, there was a large overrepresentation of players born in the first two trimesters of the selection year. However, there were more players born in the last trimester than in the third trimester, which is not consistent with the RAE. One partial explanation for not observing a systematic RAE for that period of time is that August 1 might not be the appropriate cut-off date for this period since Little League was founded in 1939 (Thorn, 1994). Because the developmental organisation of baseball players in the 19th Century

and early in the 20th Century is unknown to the authors, it is difficult to comment on the distribution observed in the course of these periods. However, interestingly, beginning in the 1940s, the distribution of players' births is consistent with the RAE given that there is a gradual decrease of the number of births from T1 to T4. This coincides with the inception of the Little League organisation in 1939. Moreover, another important baseball organisation in the U.S.A. is the American Legion Baseball, founded in 1926. This main baseball organisation for teenagers (mostly 16- to 19-years old), also has August 1st as a cut-off date. It is reasonable to believe that the institution of August 1st as a general cut-off date in amateur baseball provoked the eventual RAE. This explanation is reinforced by the growth in popularity of baseball in the late 1940s (Thorn & Palmer, 1993). The Little League organisation also gradually grew in popularity. It is important to remind that the magnitude of the RAE is related to the popularity of a sport, i.e., to the fact that competition does or not exist for obtaining positions on a team (Grondin et al., 1984).

For pitchers born in the 1950s and for non-pitchers born in the 1960s, the statistical tests do not show significant results. However, observation of Figure 1 reveals quite a similar pattern of birth distribution in different trimesters for pitchers and non-pitchers. In the National Hockey League for example, while 55% of forwards were born in the first two trimesters of the selection year, more than two thirds of goal keepers and more than two thirds of defencemen were born during the same period (Grondin & Trudeau, 1991). In the present study, among players born in 1950 and later, there is virtually no difference related to position given that, for both pitchers and non-pitchers, the same proportion of players (slightly more than 55%) were born in the first two trimesters of the selection year.

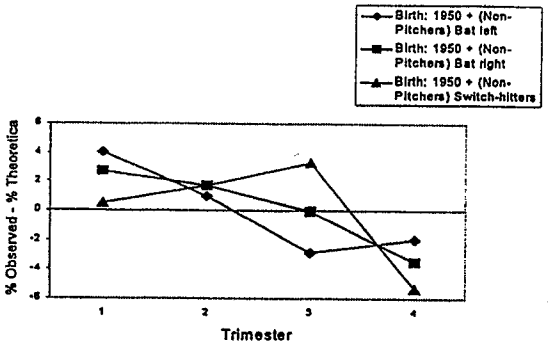

Figure 3. RAE for non-pitchers

As regard to handedness, the RAE is more systematic with right-handed than with left-handed pitchers. In both cases, there is an underrepresentation of players born in T4. However, for left-handers, in comparison with the population percentage, there is only 1.35% and 1.33% more players born in T1 and T2, respectively. The fact that the RAE does not apply much to left-handed pitchers might be due to the fact that there are less left-handers than right-handers in the population (about 10 to 15% left-handers: Gilbert & Wysocki, 1992). This is consistent with the idea that the magnitude of the RAE is proportional to the number of players available for filling positions (Grondin & al., 1984).

For batters, once again, the most systematic RAE applies to players batting right, which is a group almost exclusively formed of players throwing right. It is also with right-handers, and not left-handers, that there is a RAE with players batting left. A larger sample might contribute to produce a RAE.

What Japanese Baseball Reveals

Data from MLB indicate a much weaker RAE in baseball than the one reported for ice hockey. One hypothesis to explain this difference concerns the requirements of the game itself. Because ice hockey, more than baseball, would require from participants great physical qualities such as strength or speed, the RAE would be more likely to apply to ice hockey. Consistent with this point is the fact that, in soccer, which also requires speed and strength, there are important RAEs all over the world (Musch & Hay, 1999).

The results obtained with professional Japanese players are not consistent with this hypothesis. Although our sample is smaller for Japanese than for American baseball, a systematic and large RAE was observed for baseball in Japan, an effect applying both to pitchers and to non-pitchers. The RAE is as important for baseball in Japan is as it is for ice hockey or soccer elsewhere. In other words, lower physical requirements do not explain why the RAE is less important in baseball than in ice hockey in North America. Indeed, advanced physiological maturity was observed for many children participating to Little League World Series in 1955 by Hale (1956) who used pubic hair ratings, and in 1957 by Krogman (1959) who estimated skeletal age.

The fact that the RAE is now shown to be so important in Japanese baseball, as it is for many other sports, is a strong invitation to readdress this old question of youth classification and competition: what can be done to avoid or reduce the RAE? The present results also open the door to a new issue susceptible to provide partial response to the first question: why would the RAE in baseball be stronger for Japan than for the U.S.A.?

The most logical and most frequently reported interpretation to the unbalanced distribution of births in trimesters in professional sports is that it is caused by a chronological age classification of children in sports (Grondin & Trudeau, 1991; Musch & Grondin, 2000). Specifically, the problem comes from the fact that being older, even by only a few months, is very important as regards to growth and development processes of children (Malina, 1994). One alternative to chronological age is to use one of several ways to express the biological age: anthropometric measurements such as height, weight or a height-weight ratio, or physiological measurements such as dental age, sexual maturity revealed by secondary traits like pubic hairs, or skeletal age. However, it is unlikely that it would be possible to find all material and human resources required by such systems for evaluating age of all young sport participants.

There might be a solution to the RAE, within a system based on chronological age. The problem with the chronological age comes from the fact that when it is adopted in one given sport, the cut-off date is the same for all categories. In a 12- or 24-month category system, the same children remain with the age advantage. The principle that should be applied is to break this structure based on a multiple of 12. For instance, within a 7-year cycle (4 categories), a 21-month category system would allow the children born in any trimester to gain benefit of age advantages once, and to suffer once from age disadvantages. Such a proposition is described in detail in Grondin et al. (1984; see also Boucher & Halliwell, 1991).

Viewed from a wider scope, a partial solution to the RAE in sports would be to distribute the potential chronological age advantage among the several sports where such a classification system is adopted. This would be a mean for all children to have some avenues where the moment of birth would not prevent development. It is within this scope that the Japan versus U.S. difference regarding the RAE magnitude in baseball takes all its relevance. One hypothesis to explain the fact that the effect is much more important in Japan, relies on the omnipresence of a cut-off date, April 1st, in many spheres of activity in this country. This date applies to school entrance, and to popular

sports such as soccer and baseball. In the U.S.A., August 1st is typical to baseball, but does not apply, for instance, to soccer or ice hockey. Moreover, school entrance (cut-off date) in this country varies in different States (e.g., December 1: DeMeis & Stearns, 1992; October 1: Erion, 1987).

This explanation remains an hypothesis, but it is our impression that it is reasonable enough to be careful with recommendations such as using a uniform cut-off date in all sports in a given country, and to match this date with the one determining school entry. Such a proposition has potential to aggravate the discrimination occurring within a given sport. On the other hand, it goes without saying that solutions such as those proposed above would produce a dispersion of some of the social links of children. It would not be possible for kids to remain together in all activities.

Concluding Remark

In order to attenuate the RAE, there are solutions and some are very simple, at least from a logical point of view. But until change occurs, it is important that parents and coaches involved in sport competitions be aware that two kids born the same year do not necessarily have the same age, although they might be considered, according to some organisational rule, to be at the same level in their curriculum. If the goal of sport during childhood is to give children chances to develop skills, then the least we should hope for is that parents and coaches know that a child being a few months younger than teammates might be less effective but might have as much potential as other children in this activity. Skills in sports constitute a very important basis of personal competence, which is critical in the development of self-esteem. For these reasons, we must remind parents and coaches of the potential influence of the RAE.

Endnote

1. There are many youth leagues in Japan, and they are mainly classified into two types, "hard-ball leagues" and "rubber-ball leagues". Their names describe them. The hard-ball leagues use hard balls like the ones used in MLB and Japan Professional Baseball.

There are seven different leagues using hard balls, and two of them are most popular: the Little League and the Boy's League. The Little League started in Japan in 1964. Because it follows the Little League in the United States, children of age 9 to 13 play together, and the cut-off date is August 1. On the other hand, the Boy's league includes children of elementary schools (age 6-12) and junior high school (age 13-15). Following the Japanese education system, the cut-off date is April 1. Even those who played in the Little League go to high school to play baseball. Moreover, high-school baseball is very popular in Japan.

There are two different rubber-ball leagues; Student Baseball League (Gakudo Yakyu) and Sports Youth Group (Sports Shounen Dan). The Student Baseball League is the most popular among the youth leagues, including the Little League and the Boy's League. The League consists of many local leagues, and their cut-off dates is April 1, following the education system. The eligible age may vary from league to league, depending on the characteristics of the region.

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FEATURE ARTICLE / ARTICLE DE FOND

No Evidence for a Termination Stage in Exercise Behaviour Change

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Prochaska (1995) has discussed a sixth stage of behaviour change labeled termination which is defined as a 0% temptation of returning to the old behaviour and 100% self-efficacy in all previously tempting situations. Although no definitive behavioural guideline exists, Prochaska (1995) has suggested that 5 years of maintenance may result in termination. The purpose of the present study was to empirically test the meaningfulness of including the termination stage in the exercise domain. Participants were 157 undergraduate students in the maintenance or termination stages who completed a questionnaire assessing the Theory of Planned Behaviour and the processes of change. Results indicated that only 4% of the sample possessed the cognitive characteristics of the termination stage and this low percentage did not differ between the maintenance and termination stages. We conclude that the present study provides little evidence that a termination stage exists in the exercise domain.

Prochaska (1995) a défini une sixième étape de la modification du comportement nommée l'extinction où le sujet n'éprouve aucune tentation à reprendre un ancien comportement et un succès autonome total dans toutes les situations tentantes précédentes. Bien qu'aucune ligne directrice définitive n'existe sur cet aspect du comportement, Prochaska (1995) suggère que cinq années d'entretien assurent l'extinction. L'objectif de la présente étude empirique était d'évaluer la pertinence d'inclure l'étape de l'extinction au domaine de l'exercice. Le groupe de participants est formé de 157 étudiants du premier cycle universitaire qui sont à l'étape de l'entretien ou de l'extinction et qui ont rempli le questionnaire d'évaluation en fonction de la théorie du comportement axée sur un objectif et du processus de changement. Les résultats indiquent que seuls 4 % des étudiants possédaient les caractéristiques propres à l'étape d'extinction et ce faible pourcentage ne variait pas entre les étapes d'entretien et d'extinction. Nous concluons que cette étude ne démontre pas que l'étape d'extinction existe dans le domaine de l'exercice.

One of the most popular stage models for examining exercise behaviour change is Prochaska and DiClemente's (1983, 1985; DiClemente, Prochaska, Fairhurst, Velicer,