A review of behavioural measures and research methodology in sport and exercise psychology

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Abstract

The present study examined the development of methodologies and measures used in sport and exercise psychology (SEP) publications between 1979 and 2013. A systematic coding process was conducted on a total of 1377 manuscripts sampled from four long-standing SEP publications, namely *Journal of Applied Sports Psychology*, *Journal of Sport and Exercise Psychology*, *Psychology of Sport and Exercise*, and *The Sport Psychologist*. Analyses compared the type of behavioural or non-behavioural measures used, and the research design employed. Findings suggested that overall SEP has included more behavioural measures in comparison to other psychology domains, and there has been substantial sampling of sport and exercise behaviours using direct rather than indirect behavioural measures. The proportion of cross-sectional research designs were significantly higher than other research approaches employed in SEP (e.g., quasi-experimental, interventions, experimental, qualitative), and questionnaires have remained a dominant non-behavioural measure over time. Nevertheless, results indicated that SEP outlets publish a greater diversity of research methods and designs compared to general social and personality psychology, and have seen a gradual increase in qualitative, idiographic research approaches. Findings are discussed in line with SEP practice, and the potential implications for future works.

Key words: behaviour, measures, methods, research design, methodologies

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Research emanating from the domain of sport and exercise psychology has developed substantially over several decades (Eklund, 2014) with an array of data collection methods used in research, including behavioural observations, psychometrics, questionnaires, psychophysiological measures, interviews, focus groups, and ethnography and action research (Breakwell & Rose, 2006). Diversity in research methods is required for the comprehensive examination of psychological theory and to improve scientific understanding that informs applied practice. Varied research methods also facilitate the collection of diverse data. Berkman and Lieberman (2011) described three main types of data within (social) psychology, namely: self-report psychological or mental processes (e.g., paper and pencil assessments of attitudes), indicators of neurological processes (e.g., task-related functional activation) and behaviour (e.g., observation and measurement of actions). A recent examination of the development of methodologies and measures in social psychology research has revealed a shift towards investigations of mental processes and a decline in behavioural measures (Patterson, 2008). Such observations indicate a trend toward studying internal, typically self-report, processes at the expense of measuring an individual's actual experiences of phenomena or behaviours (cf. Baumeister, Vohs & Funder, 2007) and foreshadow limitations of the generalizability of psychological research (Dhami, Hertwig & Hoffrage, 2004).

Arguably, a central aim of psychology research is to emphasise the development of understanding of or the control of behaviour, enabling psychologists to communicate theory for the benefit of society, wherein science and society constitute a feedback loop (cf. Gergen, 1973). For instance, within the context of sport and exercise psychology (SEP), practitioners are interested in how psychological constructs might affect behaviour in such settings, so that interventions can be implemented to positively impact health, performance, and wellbeing. Nevertheless, methodological trends in general social psychology suggest that the gap

between research and applied practice may be widening due to a decrease in the study of behaviour (Dhami et al., 2004; Baumeister et al., 2007; Patterson, 2008). Moreover, it has been argued that an overreliance on a small range of research methodologies and measures may decrease convergent validity and confidence in the body of knowledge that surrounds a given research topic - where this is pursued as part of the epistemological assumptions aligned with positivist research designs (Biddle, 2000). In line with such views, the present study seeks to explore the methodological and measurement developments in SEP journals over the last four decades. First, we provide a consideration of the inclusion of behavioural and non-behavioural measures in SEP research, before reviewing the types of methods employed.

Methodological and measurement issues in general social psychology

There has been renewed emphasis in social psychology research on studying brain and body processes at the behavioural level (Berkman & Lieberman, 2011). In a seminal review of social psychology literature, Baumeister et al. (2007) highlighted that there has been an overreliance on questionnaires and other techniques, which have supplanted behavioural observation. Indeed, Baumeister et al. revealed a downward trend in the measurement and study of behaviour in the *Journal of Personality and Social Psychology*, from approximately 80% of studies in 1976 to fewer than 20% of studies in 2006. In concluding their review, Baumeister and colleagues (2007) argued that despite the first ten years of the 21st Century being named the "decade of behaviour" by the American Psychological Association, social psychology research had maintained a focus on the study of internal mental and neural processes (see also Berkman & Lieberman, 2011). While the exploration of neural and psychological mechanisms is important, Baumeister et al. argued that these inner processes are meaningless without understanding of how they relate to the control of actual behaviour. That is, given the principle goal of psychological research to

create positive change in environmental settings, it is imperative that research samples and has application to these naturalistic contexts.

Consistent with the above arguments, there is a need to consider the type or level of behaviour measured within experimental contexts. For example, in examining the changing incidence of behaviour in personality and social psychology research, Patterson (2008) differentiated between direct (e.g., face-to-face behaviour/social interaction) and indirect behavioural measures (e.g., reaction times in response to static images). Patterson recognised that indirect measures have the potential to act as favourable alternatives to self-report measures (e.g., questionnaires to examine mental states, such as conscious thoughts and feelings). However, indirect measures, such as reaction time tests, differ substantially from the diverse behaviours typically displayed during day-to-day, face-to-face interactions. Indeed, despite observing a remarkable decline in overall behavioural measures from 70% in 1976 to 25% in 1996 and 2006 within the *Personality and Social Psychology Bulletin*, Patterson (2008) emphasised the dearth of studies reporting what people actually *do* in social settings (i.e., their contextual behaviours). That is, only 13% of the studies sampled by Patterson in 1976 used direct social-behavioural measures, with this proportion declining to just 4% in 2006. Therefore, a pressing concern highlighted across personality and social psychology research is the decline of requisite behavioural measures within experimental contexts (see also Davids & Araújo, 2010).

The shift observed in social psychology research toward the study of mental and neural processes is in line with the "cognitive revolution" and the heightened interest in attributing the causes of behaviour to these inner processes (Miller, 2003). That is, psychologists have arguably begun to focus on the study of internal mechanisms to understand the processes of behaviour without actually including behavioural measures (Patterson, 2008). Baumeister et al. (2007) suggested that the reduction in behavioural

measures in general psychology might be due to the nature of behavioural data collection, which can place a strain on time and resource demands in an area of research that is highly competitive. For example, observing, coding and analysing behavioural responses, such as an individual's facial expressions and nonverbal behaviour require a considerable amount of time and effort. Moreover, it may be considered unethical when such measures are collected in the context of an experiment that purposefully seeks to elicit anger or anxiety (Coan & Allen, 2007).

Methodological and measurement issues in sport and exercise psychology

It is unclear whether the decline in behavioural research in general social psychology, alluded to above, is evident within SEP. Nevertheless, methodological challenges in SEP have long been acknowledged (e.g., Abernethy, Thomas & Thomas, 1993; Schutz, 1994). For example, Schutz (1994) outlined various methodological problems in SEP, with the most pressing relating to the definition of psychological constructs and the validity and reliability of the instruments used to measure these. Specifically, psychological constructs are not always directly observable but are inferred from behavioural or self-report measures (i.e., they are latent variables). For instance, an exercisers mood, or an athlete's personality traits are often measured via completion of paper and pen questionnaires (e.g., Berger & Motl, 2000; Goldberg, 1990). Schutz (1994) proposed that researchers should consider the definition, operationalization and valid measurement of latent variables through sound theoretical foundations and rigorous standards in constructing measurement tools (i.e., questionnaire items). Moreover, Schutz suggested that researchers need to evaluate the magnitude of an effect through reporting effect sizes (e.g., Cohens *d*) and make conclusions about the importance of these magnitudes (i.e., the extent to which the change can make a practical difference).

Despite Schutz's (1994) methodological recommendations, many researchers do not always interpret effect sizes in terms of their practical significance (Cumming, 2014) and do not connect questionnaire metrics to sport and exercise behaviours (see Anderson, McCullagh & Wilson, 2007). For example, Anderson et al. (2007) sampled all the issues in the 2005 volumes of the *Journal of Sport & Exercise Psychology*, *The Sport Psychologist*, and the *Journal of Applied Sport Psychology* and found, of the 54 studies that used quantitative methods, 25 reported only paper-and-pencil metrics with no connections to behaviour. Typically these measures provide an insight into how an athlete might feel, but often provide little indication to how an athlete's behaviours might be affected. Therefore, findings could translate poorly to sport and exercise environments. For instance, questionnaire based studies that seek to assess psychological states prior to competition, such as the presence of certain emotions (e.g., fear, joy), would be more useful in practice if scores on the questionnaires were related to a magnitude of change in sports behaviours. Hence, Anderson argued that SEP needs to improve the triangulation of psychometric and behavioural data to provide a deeper understanding of individuals and psychological phenomena within naturalistic settings.

SEP research has progressed through different paradigms of inquiry alongside the changing nature of scientific discovery and the emergence of new methodologies and theoretical approaches. Martens (1979) found that early sport psychology research methods were borrowed from general social psychology, largely including stringent laboratory experiments and manipulations (e.g., reductionist approaches) that did not always accurately sample sport and exercise settings. Martens raised concerns over the gap between the knowledge produced in the laboratory and the knowledge needed for applied practitioners. That is, there may be limited generalization from the results derived from a laboratory task to the applied/practical situation that a given SEP experiment is proposed to sample (see

Pinder, Davids, Renshaw & Araújo, 2011). Further, researchers have called for the integration of data from a range of methodological approaches and study designs, in order to provide a broader, richer understanding of phenomena (Jones, 1996; Tenenbaum & Bar-Eli, 1995). For example, Martens (2007) advocated a heuristic paradigm for SEP, emphasizing idiographic and field study methodologies, which places humans in the centre of the process of knowing and emphasises experiential knowledge. Indeed, scholars have encouraged the use of idiographic (subjective) methods, including case studies, and qualitative designs, seeking patterns in groups and identifying individual differences (Jones, 1996; Martens, 2007; Tenenbaum, Eklund & Kamata, 2012).

The review above indicates that sport and exercise psychologists recognise the need to balance research approaches between nomothetic and idiographic designs, the integration of quantitative and qualitative methods, and a stronger emphasis on the inclusion of behavioural measures to bridge the gap between research and practice (see also Carron, 2007). Nevertheless, Biddle (1997) noted that a large proportion of the SEP literature had disregarded the importance of diversity in research methods, relying extensively on cross-sectional questionnaire designs (see Table 2). Biddle examined the research methodologies used in articles published in the *Journal of Sport and Exercise Psychology* and the *International Journal of Sport Psychology* between 1985 and 1994. Findings demonstrated that 40% of the studies used cross-sectional questionnaire designs, with less than one third using experimental or quasi-experimental designs (see also Morris, 1999). The predominant use of questionnaires in the SEP literature is in line with the increasing trend towards self-reported data observed in general social psychology (e.g., Baumeister et al., 2007). Further, Biddle (2000) suggested that SEP should reduce its use of cross-sectional questionnaires by employing a diverse range of research methods (e.g., randomised controlled trials, large scale

meta-analyses, narratives, in-depth qualitative studies), in order to establish, "a credible bank of evidence on which to base effective interventions" (p. 3).

In light of the above review, the aim of the present study was to examine the development of methodologies and measures used in SEP publications between 1979 and 2013. First, we analysed if the decline in behaviour observed within general social and personality psychology was mirrored in research published in SEP journals by comparing the proportion of behavioural measures with non-behavioural measures overtime. Second, we analysed whether behavioural measures included in SEP were indirect, or direct in nature, and the types of non-behavioural measures utilised. Finally, and in line with previous reviews of SEP research (see Biddle et al., 2001), we examined variation in the types of research designs and methods used over time.

Method

Sample

In line with previous research examining the frequency of behavioural measures in psychology (e.g., Baumeister et al., 2007) the current study adopted a systematic approach. A step-by-step coding process was conducted on a total of 1377 manuscripts sampled from four long-standing SEP publications, namely *Journal of Applied Sports Psychology*, *Journal of Sport and Exercise Psychology*, *Psychology of Sport and Exercise*, and *The Sport Psychologist*. Starting with the first odd numbered year of each journal, all the articles from issues 1, 2 and 4 for every other journal year (e.g., 1979, 1981, 1983…) were analysed. A coding system was adopted that allowed the quantification of the type of behavioural or non-behavioural measures used, and the research design employed. The systematic sampling approach adopted was informed by previous research in the general psychology domain. For example, Baumeister et al. (2007), selected issues from March and May in years 1966, 1976, 1986, 1996, and 2006 in the *Journal of Personality and Social Psychology* for coding. Only

full length manuscripts were included, and any editorials, newsletters, contents pages, and erratum were excluded from analyses. The number of manuscripts and studies for each journal coded are presented in Table 1.

TABLE 1 APPROXIMATELY HERE

Coding

Coding was conducted to quantify the extent to which the dependent and independent variables used in SEP were behavioural measures or manipulations. Behaviour was defined as the actions made by participants in relation to the immediate environment (experimental situation). Self-report measures (e.g., questionnaires and interviews) of past or hypothetical behaviours were coded as no behaviour. Each behavioural variable was differentiated according to the type or level of behaviour; specifically, direct behaviours entailed requisite sport and exercise actions, while indirect behaviours entailed simplified sport and exercise action (cf. Patterson, 2008). For instance, a "gold standard" direct measure of sports behaviour would be the measurement of a requisite sports action against opponents within a sports setting, such as the number of successful basketball free throws in a game, or a participant's competition running time. In contrast, indirect measures of sports behaviour included reaction time tests, and other simulated sports measures and manipulations, such as participants responding with shadow movements to a video or computer based display in the laboratory (see Dicks, Button & Davids, 2010).

The authors worked together to establish the comprehensive coding criterion, which was informed by extant literature (e.g., Baumeister et al., 2007; Patterson et al., 2011). Based on the methods of Patterson et al. (2011) two individuals in the research team piloted the coding for several issues (*Journal of Applied Sport Psychology,* year 2013, issues 1, 2 and 4).

The codes given to each article were then compared between authors to establish if any discrepancies existed. Although no discrepancies emerged, judging the codes helped in the development and improvement of the coding criteria. Following agreement of the coding criterion one author coded the selected studies, of which a sample of 10% was also coded by the remaining authors. No coding discrepancies were observed.

Each study was first coded for its topic (e.g., sport, exercise), before being coded for behaviour (i.e., behaviour or non-behaviour). If the study included behaviour, it was then coded as behavioural dependent, behavioural independent, or both behavioural independent and dependent. Next, the behavioural variable was coded as direct or indirect behaviour. If the study did not include behavioural measures, the research method adopted was coded (i.e., questionnaire; interview), or if the study was not empirical (i.e., reviews and commentaries) it was coded as "miscellaneous" (Figure 1). The coding process was also conducted to quantify the research designs used in SEP (cf. Biddle, 2000). Coding focussed on classifying research studies as either; cross-sectional, experimental and quasi-experimental designs as well as the inclusion of psychological interventions and qualitative approaches (see Table 2).

TABLE 2 APPROXIMATELY HERE

Analyses

The frequencies of every dimension and theme in the coding criteria (e.g., behaviour; no behaviour) were calculated as a proportion of each year and journal being analysed. The summative scores for all four journals were calculated for each year, and as a total of all years, before being converted into percentages. The different coded themes (e.g., behavioural measures vs. non-behavioural measures) were analysed over time by separating the publication year into three different time stamps. Each time stamp encompassed a total of ten

years (i.e., 1979, 1981, 1983, 1985, 1987, 1989 consisted of a time stamp). Thus, three different periods of time were compared; (i) 1979-1989; (ii) 1991-2001; and (iii) 2003-2013. Time was entered into the ANOVA as the within subjects factor and the dependent variables of interest, such as the frequency of behavioural measures vs. non-behavioural measures, were entered into the ANOVA as the between-subject factors. The dependent variables included behaviour vs. non-behaviour; direct behavioural measures vs. indirect behavioural measures; comparisons between the types of articles containing non-behavioural measures (questionnaires vs. interview vs. miscellaneous articles); and comparisons between research methods (cross-sectional vs. quasi-experimental vs. experimental vs. intervention, vs. qualitative). If the repeated measures ANOVAs indicated any significant effects, Bonferroni corrected post hoc analyses using independent one-way ANOVAs and t-tests were conducted to explore the relationships further, and effect sizes were reported (Partial Eta squared and Cohen's *d*, respectively).

FIGURE 1 APPROXIMATELY HERE

Results

Behavioural measures

Figure 3 illustrates that the number of behavioural studies published in the SEP journals sampled has remained lower than non-behavioural measures between 1979-2013. The proportion of behaviour and non-behavioural measures were similar in 1979. After which, there was a gradual decline in measures of behaviour up to 1997, before trends in behaviour increased between 1999 and 2013. The behaviour × time ANOVA revealed a significant main effect for behaviour, $F(1, 10) = 281.33$, $p < .01$, $\eta^2 = .97$. Overall, 35.4% of articles published between 1979 and 2013 in SEP included behavioural measures and 64.5%

of articles included non-behavioural measures or manipulations. No significant effect for time, $F(2, 20) = 0.01$, $p = .99$, $\eta^2 = .00$, or interaction effect, $F(2, 20) = 1.77$, $p = .19$, $\eta^2 = .150$ was observed (Figure 3). These data indicate consistent differences between the use of behavioural and non-behavioural measures in the SEP literature over time.

FIGURE 2 APPROXIMATELY HERE

FIGURE 3 APPROXIMATELY HERE

Direct-Indirect Behaviour

The behaviour type × time ANOVA revealed a significant main effect for type of behaviour, $F(1, 10) = 33.53$, $p < .01$, $\eta^2 = .77$. Overall, 28.51% of behavioural articles published between 1979 and 2013 in SEP included direct behavioural measures and 10.55% of articles included indirect behavioural measures and manipulations (Figure 2). Data indicated no significant effect for time, $F(1.33, 13.29) = .45$, $p = .57$, $\eta^2 = .04$, but there was a significant interaction effect, $F(1.33, 13.29) = 4.68$, $p < .05$, $\eta^2 = .32$ (Figure 4). Follow-up t-tests revealed that there were no significant differences between direct and indirect behavioural measures between 1979 and 1989, $t(10) = .82$. $p = .43$, $d = 0.47$. Nevertheless, in comparison with indirect behaviour, there were significantly more manuscripts published presenting direct behavioural measures between 1991 and 2001, $t(10) = 8.85$. $p < .01$, $d = 5.11$ as well as between 2003 and 2013, $t(10) = 5.47$. $p < .01$, $d = 3.16$.

FIGURE 4 APPROXIMATELY HERE

Non-Behaviour

Further breakdown of the non-behaviour articles (65.4%) revealed that 31.23% were questionnaires, 11.66% were interviews, and 20.68% were miscellaneous articles (i.e., reviews, comments, position statements). The non-behaviour × time ANOVA revealed a significant main effect for non-behaviour articles, $F(2, 15) = 86.45$, $p < .01$, $\eta^2 = .92$. There was no significant effect for time, $F(2, 30) = .46$, $p = .64$, $\eta^2 = .03$, however there was a significant interaction effect, $F(4, 30) = 9.65$, $p < .01$, $\eta^2 = .56$ (Figure 5). Follow-up one-way ANOVA comparing differences between non-behavioural methods between 1979 and 1989 ($F(2, 15) = 20.48$, $p < .01$, $\eta^2 = .73$) revealed a significantly higher proportion of questionnaire and miscellaneous articles in comparison with interviews (both *p*s <.01). There was no difference between the proportion of questionnaire and miscellaneous articles at this time-stamp. Similarly, between 1991 and 2001 ($F(2, 15) = 27.80$, $p < .01$, $\eta^2 = .79$) there was a significantly higher proportion of questionnaire and miscellaneous articles in comparison with interviews (both *p*s <.01) but no difference between the proportion of questionnaire and miscellaneous articles. Finally, between 2003 and 2013 ($F(2, 15) = 39.22$, $p < .01$, $\eta^2 = .84$) there was a significantly higher proportion of questionnaires in comparison with both interviews and miscellaneous articles (both *p*s <.01). No significant difference was observed between interviews and miscellaneous articles.

FIGURE 5 APPROXIMATELY HERE

Research Methods

The methods × time ANOVA revealed a significant main effect for research methods, $F(4, 25) = 18.29$, $p < .01$, $\eta^2 = .75$. There was no significant effect for time, $F(2, 50) = 2.10$, $p = .13$, $\eta^2 = .08$, however there was a significant interaction effect, $F(8, 50) = 2.16$, $p < .047$, $\eta^2 = .26$ (Figure 6 & 7). Follow-up one-way ANOVA comparing differences between

research methods between 1979 and 1989 ($F(4, 25) = 6.15$, $p < .01$, $\eta^2 = .49$) revealed a significantly higher proportion of cross sectional designs in comparison with intervention ($p < .01$) and qualitative designs ($p < .01$). Between 1991 and 2001 ($F(4, 25) = 6.51$, $p < .01$, $\eta^2 = .51$) there was a significantly higher proportion of cross sectional designs in comparison with both quasi-experimental ($p < .01$) and qualitative articles ($p < .05$) but no further differences between proportions in the remaining methods. Finally, between 2003 and 2013 ($F(4, 25) = 15.50$, $p < .01$, $\eta^2 = .71$) there was a significantly higher proportion of cross sectional designs compared to all other methods, including quasi-experimental ($p < .01$), experimental ($p < .01$), interventions ($p < .01$), and qualitative articles ($p < .02$). Moreover, there was a significantly higher proportion of qualitative articles compared to quasi-experimental articles at this time-stamp ($p < .05$).

FIGURE 6 APPROXIMATELY HERE

FIGURE 7 APPROXIMATELY HERE

Discussion

The aim of the present study was to quantify the proportion of research methodologies and behavioural measures used in SEP research between 1979 and 2013. Using a rigorous coding criterion, the current study analysed the types of measures and methods used across a total of 1377 manuscripts sampled from the *Journal of Applied Sports Psychology*, *Journal of Sport and Exercise Psychology*, *Psychology of Sport and Exercise*, and *The Sport Psychologist*. Previous research in other disciplines of psychology has reported a significant decline in the use of behavioural measures over the past several decades (Baumeister et al., 2007; Patterson, 2008). Rather than relying extensively on self-report measures (e.g.,

questionnaires), there have been calls in SEP for researchers to include behavioural measures, in order to effectively bridge the gap between research and practice (Biddle, 1997; Patterson, 2008). Further, in sport and exercise, a related issue is the proposed need to better represent the rich diversity of research methods in leading outlets (Biddle, 1997).

A key finding of the present analysis was that behavioural measures and manipulations used in SEP research between 1979 and 2013 represent a significantly lower proportion of studies (35.41%) compared to non-behavioural measures (64.85%). Baumeister and colleagues (2007) reported that personality and social psychology research has seen a significant decrease in behavioural measures overtime. In contrast, the current review of SEP research found no decline in the proportion of behavioural measures between 1979 and 2013 (Figure 3). Therefore, the rapid decline in behavioural studies in *JPSP* and *PSPB* over the past several decades (Baumeister et al., 2007; Patterson, 2008) was not replicated in *TSP*, *JSEP*, *JASP*, and *PSE* over the 1979-1989, 1991-2001, and 2003-2013 time periods. Further, when researchers have employed behavioural measures in SEP, there has been substantial sampling of sport and exercise behaviours (i.e., direct rather than indirect behavioural measures). That is, direct behavioural measures (i.e., requisite sport and exercise actions) were used significantly more often in SEP research than indirect behavioural measures (e.g., simulated sport and exercise tasks) between 1991-2001 and 2003-2013 (Figure 4). Although there have been renewed calls in some domains of SEP to ensure that researchers accurately sample experimental contexts that are representative of sport and exercise settings (e.g., Pinder, Davids, Renshaw, & Araújo, 2011), the current results place SEP favourably in comparison with other domains of psychological research (e.g., social and personality psychology).

According to Anderson et al. (2007) a common problem in SEP is the lack of studies empirically connecting self-reported metrics to sport and exercise behaviours. Anderson and

colleagues found that just under half of all quantitative studies reported paper and pencil measures within the 2005 volumes of the *Journal of Sport & Exercise Psychology, The Sport Psychologist,* and the *Journal of Applied Sport Psychology*. In support of this observation, results from the present study indicated that the proportion of published manuscripts presenting questionnaire and miscellaneous designs were significantly higher than interview articles between 1979-1989, and 1991-2001. Between 2003-2013 the proportion of questionnaires was significantly higher than both miscellaneous and interview articles. While questionnaires have remained a dominant method in SEP, the number of miscellaneous articles has substantially decreased between 2003 and 2013, and interview methodology articles have gradually increased between 1979 and 2013 (Figure 5). These data indicate two important findings. Firstly, SEP journals show a decline in miscellaneous articles and parallel increase in empirical research, and secondly, SEP has seen an increase in idiographic research approaches, such as the inclusion of qualitative interviews.

A potential implication for future work is for SEP research to become less reliant on questionnaires, whilst being mindful of the argument that psychological constructs cannot be directly observed or measured (see review of latent variables in psychology, Bollen, 2002). Indeed, self-report measures are commonly seen as an important tool within SEP to capture internal cognitions. For instance, the profile of mood states is commonly used to capture feelings associated with exercise (e.g., Berger & Motl, 2000). Nevertheless, it has been argued that researchers should be aware of the importance of connecting these cognitive processes to behavioural outcomes (Anderson et al., 2007; Martens, 1987). To elaborate, recent analysis revealed a potential dissociation between self-report measures of cognitive load and systematic physiological measures (heart-rate variability) of cognitive demands (Luque-Casado, Perales, Cárdenas & Sanabria, 2015), while self-report measures of decision-making did not correlate with on-field performance measures (Nortje, Dicks, Coopoo &

Savelsbergh, 2014). These findings complement the proposal that the study of cognition in sports performance is increasingly moving from a disjunction between mind and body to an integrated relationship between thinking and skilled action (see Moran, 2012). This view was inspired by James' (1890) dictum that, "my thinking is first and last and always for the sake of my doing" (p. 333). Subsequently, it could also be argued that a primary requirement of SEP is to conduct applied psychological research to help understand and address practical issues (e.g., Carron, 2007). The differences in behavioural patterns between SEP and broader psychology might, therefore, be due to the importance of research application within sport and exercise environments. Future research is needed to examine the use of experimental methods in other disciplines of applied psychology research to better understand such claims.

The present findings highlighted that the proportion of cross sectional designs were significantly higher than other research approaches employed in SEP (e.g., quasi-experimental, interventions, experimental, qualitative), especially between 2003 and 2013 (cf. Biddle, 1997). Nevertheless, results illustrated that, overall, cross sectional designs accounted for less than 25% of articles in SEP, compared to 40% reported in previous reviews (Biddle, 1997). This indicates that whilst cross sectional designs are used significantly more often than other research methods in SEP, overall, reliance on this approach has substantially decreased compared to previous reviews. This may be a consequence of the wide distribution of SEP articles across a diversity of methods, including qualitative, interventions, correlational, experimental, quasi-experimental, longitudinal, and case study designs (Figure 6). These findings are in line with calls for the integration of data from an array of study designs to provide more detailed knowledge of psychological phenomena (Jones, 1995; Tenenbaum & Bar-Eli, 1995). Notably, the gradual increase in qualitative and interview articles in SEP (see Figure 7E, and Figure 5, respectively), support calls for researchers to examine SEP with a focus on in-depth individual differences and experiences of phenomena, rather than relying

399 on the establishment of group averages (e.g., Barlow & Nock, 2009; Martens, 1987). This
400 emergence is in line with the growing appreciation and use of rich qualitative methodologies
401 in SEP research, including inter alia ethnography and narrative inquiry, in which researchers
402 can embrace complexity through examining the multiple meanings that individuals attach to
403 their subjective experiences (Smith & Caddick, 2012).

404 The emerging changes in SEP highlight an increased emphasis on studying individual
405 differences in research. Recently, it has been argued that SEP provides an ideal platform to
406 study the individual differences between elite athletes' cognitive processes and neuroanatomy
407 (Walsh, 2014). For instance, Taubert et al. (2015) examined expertise-related differences in
408 brain anatomy through measuring changes in MRI results of individual athletes over a period
409 of 2 years. Taubert and colleagues argued that group analyses may fail to detect structural
410 brain alterations linked to the individual performance levels of an athlete. Therefore, in light
411 of these findings and the potential adoption of research methods and measures from
412 neuroscience, it is possible that the proportion of such research designs will increase. Further,
413 these research directions can help identify meaningful differences between individuals, rather
414 than ignoring inter-subject variability (see Barlow & Nock, 2009). Nevertheless, it has been
415 suggested that some of the limitations imposed by the techniques used in some neuroscience
416 research might have implications for the degree to which findings can be generalised. For
417 instance, Mann, Dicks, Cañal-Bruland, and van der Kamp (2013) proposed that the
418 experimental requirements imposed by neuroimaging techniques can restrict experimental
419 tasks, causing them to be over simplified and not representative of skills used in a natural
420 sports environment. Hence, there might be some concerns with the appropriate replication of
421 experimental tasks with the fundamental components of behaviour, if and where such
422 applications are the aim of research.

It is plausible that the diversity of research methods reported in the current analysis reflects the different sub-disciplines of psychology (e.g., applied sport psychology, skill acquisition, social psychology) research that comprise SEP. Different research questions might benefit from a specific research method, or approach. For instance, to investigate positive organisational psychology in sport, Wagstaff, Fletcher, and Hanton (2012) used ethnography in order to capture a rich and in-depth understanding of how individuals perceived that they regulated their emotions. Elsewhere, Micai, Kavussanu and Ring (2015) used a correlational design to investigate the effects of executive function on aggression in sport. They measured athlete's executive function with cognitive tests in the laboratory and correlated these findings with self-reports of aggressive behaviour. Thus, there is a diverse array of methods that can be used in SEP depending upon the particular research aims. Alternatively, using varied research methods in SEP could prove invaluable for the development of knowledge on psychological phenomena. That is, the same research question could be examined with a variety of methods and approaches to provide a holistic analysis of a particular subject area. As technological advances permit the systematic manipulation and measurement of human behaviours outside of the confines of the laboratory environment, there may even be an increase in behavioural measures in future SEP works. Such advances would potentially place SEP in a favourable position in comparison with other disciplines of psychology (Baumeister et al., 2007; Patterson et al., 2011).

In conclusion, the findings from the present review suggest that overall SEP has included more behavioural measures in comparison to broader psychology. This finding is encouraging, and researchers should aim to maintain this positive development through including dependent behavioural variables in SEP, especially direct behavioural measures that can be generalised to sport and exercise environments. Although self-report data provides valuable data and has an important place among a pantheon of research methods,

448 researchers should be mindful of overreliance on such measures, and should aim for a
449 balanced research approach. The present findings suggest that SEP outlets are publishing a
450 greater diversity of research methods and designs compared to general social and personality
451 psychology. An iterative process of analysis between these different scientific approaches,
452 and integrated methodologies is encouraged for the development of research knowledge in
453 SEP (see Barlow & Nock, 2009). Together, researchers can evaluate the meaningfulness of
454 their data and how it might impact and benefit SEP practice.

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Table 1. The number of included and excluded manuscripts for each journal analysed over time from 1979 – 2013.

	JSEP			TSP			JASP			PSE		
Year	Study	Manuscript	Excluded	Study	Manuscript	Excluded	Study	Manuscript	Excluded	Study	Manuscript	Excluded
1979	20	20	7	_	_	_	_	_	_	_	_	_
1981	20	19	5	_	_	_	_	_	_	_	_	_
1983	26	26	6	_	_	_	_	_	_	_	_	_
1985	19	19	6	_	_	_	_	_	_	_	_	_
1987	23	20	6	16	16	7	_	_	_	_	_	_
1989	27	25	3	20	20	6	16	16	3	_	_	_
1991	29	23	3	23	23	7	11	11	3	_	_	_
1993	25	23	6	23	23	3	17	17	0	_	_	_
1995	22	21	3	20	20	8	11	11	2	_	_	_
1997	22	22	0	22	22	4	20	20	2	_	_	_
1999	18	16	1	23	23	2	20	19	2	_	_	_
2001	14	14	0	19	19	0	15	15	0	11	10	3
2003	24	24	1	16	16	14	20	20	1	23	20	11
2005	24	24	4	20	19	16	19	19	0	24	23	9
2007	21	21	4	19	19	9	26	23	0	29	26	7
2009	23	19	8	20	20	8	26	25	1	50	46	9
2011	23	22	4	19	19	14	23	22	1	43	38	10
2013	30	26	4	25	25	10	26	26	2	50	50	7

N.B. The study number for each journal has been illustrated separately as some manuscripts included multiple studies.

Table 2. Definitions of the primary research designs investigated in the current study (Smith, 2010).

Research method/ design	Description
Cross-sectional	A study that collects data from a sample at one point in time, as opposed to a longitudinal design that collects data on at least two separate occasions.
Experimental	A study that tests a hypothesis through the manipulation of an independent variable to measure changes in the dependent variable through using an intervention or a control condition.
Quasi-experimental	A research approach in which participants are not randomly assigned to groups, but selected based upon naturally occurring features, such as social economic status, sports skill level etc.
Qualitative	Studies adopting a methodological position that emphasizes words rather than quantification in the collection and analysis of data.
Intervention	Strategies or actions performed to bring about a change in an individuals' behaviour, or emotional state. For instance, in sport psychology a goal setting intervention might be used to enhance sports performance, or an exercise intervention could be implemented to improve mood.

Figure Captions

Figure 1. Coding categories, comprising the area of research (i.e., sport, or exercise), the inclusion of behavioural measures, or manipulations, and the type of behavioural and non-behavioural measures (i.e., direct vs. indirect, and questionnaire vs. interview vs. miscellaneous, respectively).

Figure 2. Coding themes from a cumulative score of all years (1979-2013) across the four sampled sport psychology journals (PSE, JASP, TSP, JSEP). The percentage of studies include behavioural measures (B); indirect behavioural measures (Indirect); direct behavioural measures (Direct); non-behaviour (N), questionnaire (Q); interview (I); and miscellaneous articles (Misc).

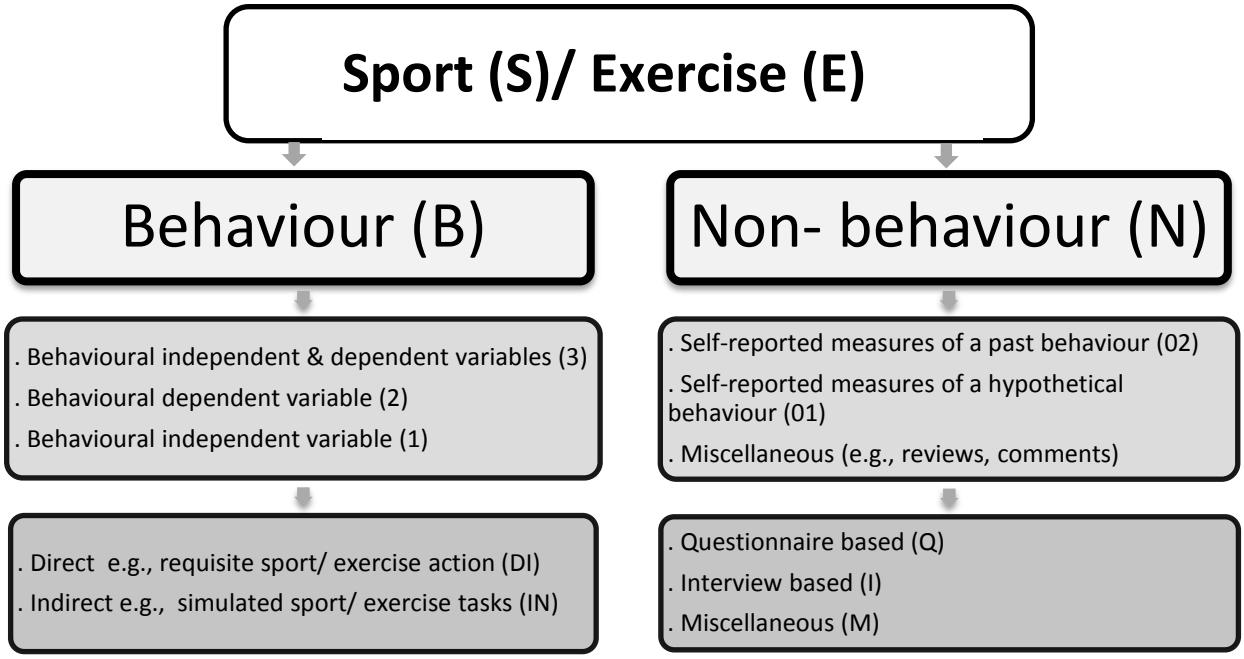
Figure 3. Percentage of studies including behaviour (B), or non-behaviour (N) from a cumulative score of all four journals for each year analysed.

Figure 4. The percentage of direct and indirect behavioural measures from the sum of four long standing journals over time (PSE, JASP, TSP, JSEP).

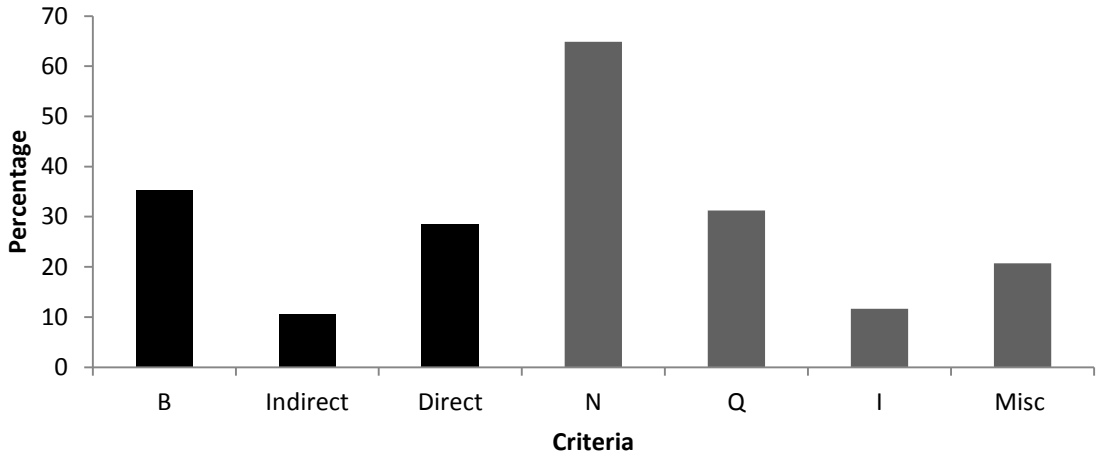
Figure 5. The percentage of studies including questionnaires (Q), interviews (I) and miscellaneous papers, such as reviews (Misc), over time within sport psychology.

Figure 6. The total proportion of research methods used for four sport psychology journals (PSE, JASP, TSP, JSEP) over time. Research method/ design include, cross-sectional (CS); experimental (EX); quasi-experimental (QEX); interventions (INT); qualitative (QUAL); longitudinal (LON); correlational (CORR); and case study design (CASE).

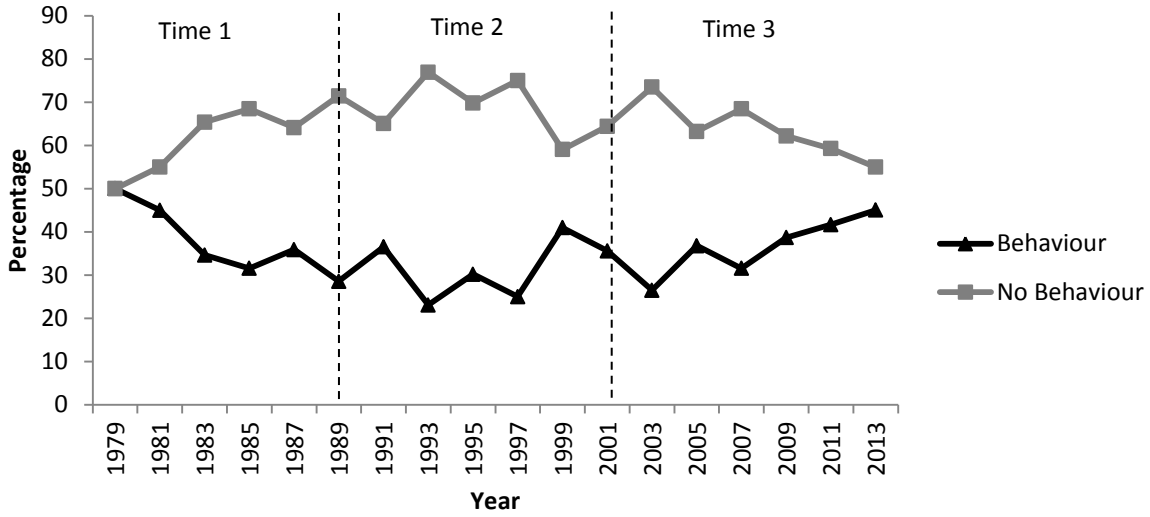
Figure 7. The percentage of research methods adopted over time. Figure A illustrates cross-sectional research patterns; figure B represents quasi-experimental proportions; figure C illustrates experimental patterns; figure D presents the percentage of interventions; and figure E illustrates qualitative approaches over time.


Sport (S)/ Exercise (E)
Behaviour (B)
Non- behaviour (N)
. Behavioural independent & dependent variables (3)
. Behavioural dependent variable (2)
. Behavioural independent variable (1)
. Self-reported measures of a past behaviour (02)
. Self-reported measures of a hypothetical behaviour (01)
. Miscellaneous (e.g., reviews, comments)
. Direct e.g., requisite sport/ exercise action (DI)
. Indirect e.g., simulated sport/ exercise tasks (IN)
. Questionnaire based (Q)
. Interview based (I)
. Miscellaneous (M)

1


70
60
50
40
30
20
10
0
Percentage
B
Indirect
Direct
N
Q
I
Misc
Criteria

2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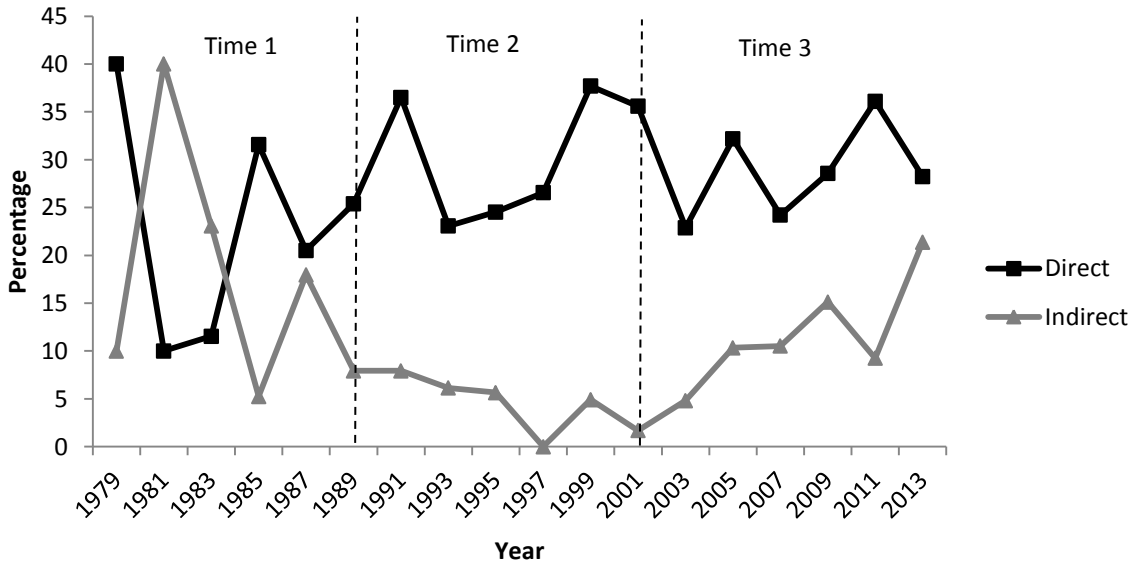
Time 2
Time 3
Percentage
Year
Behaviour
No Behaviour

3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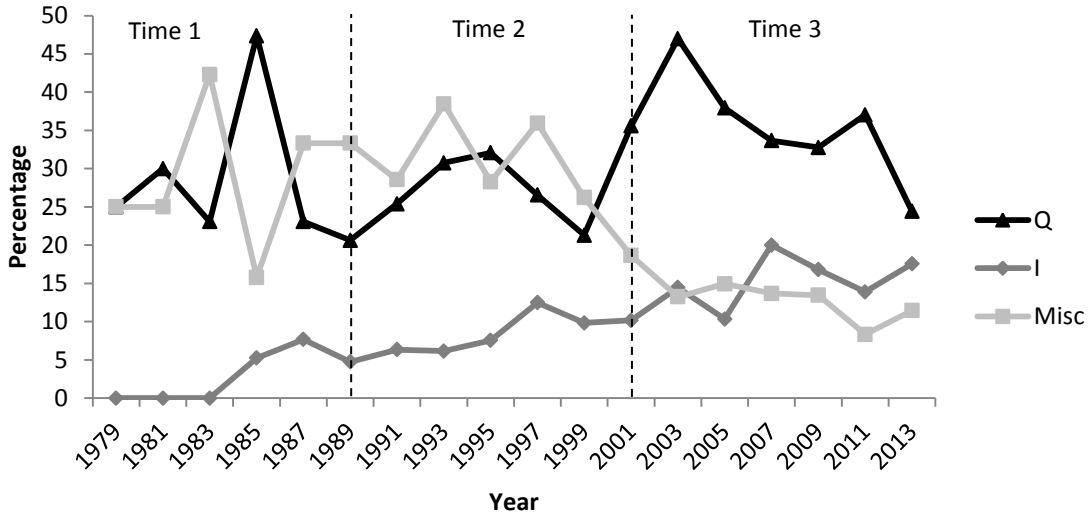
Direct
Indirect

4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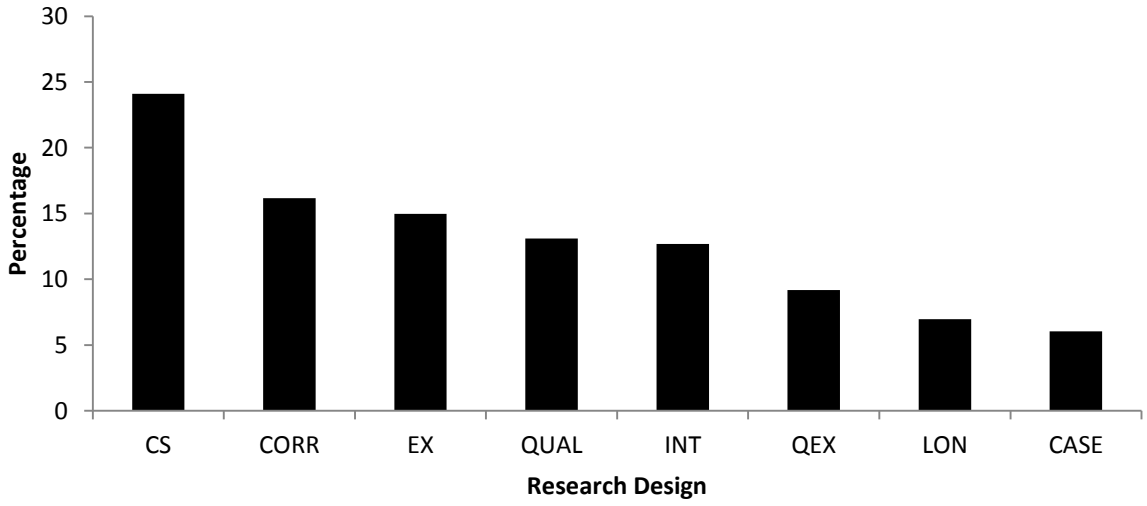
Percentage
CS
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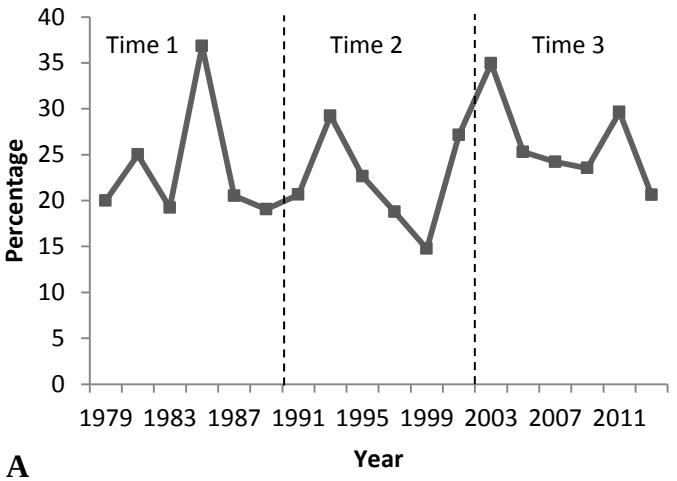
QEX
LON
CASE
Research Design

6


Time 1
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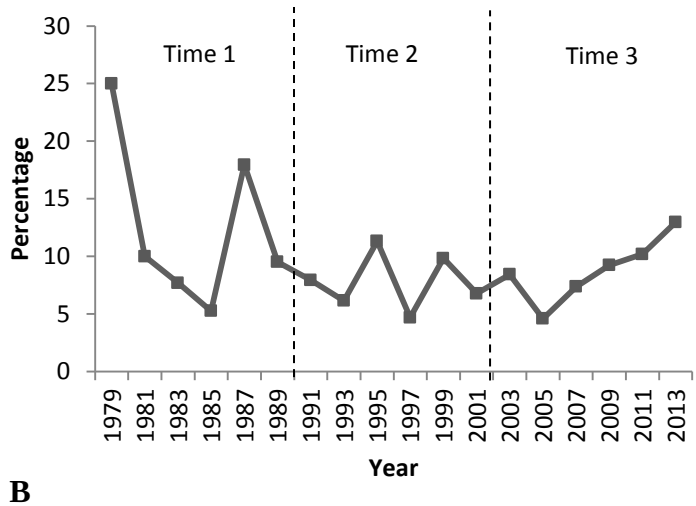
A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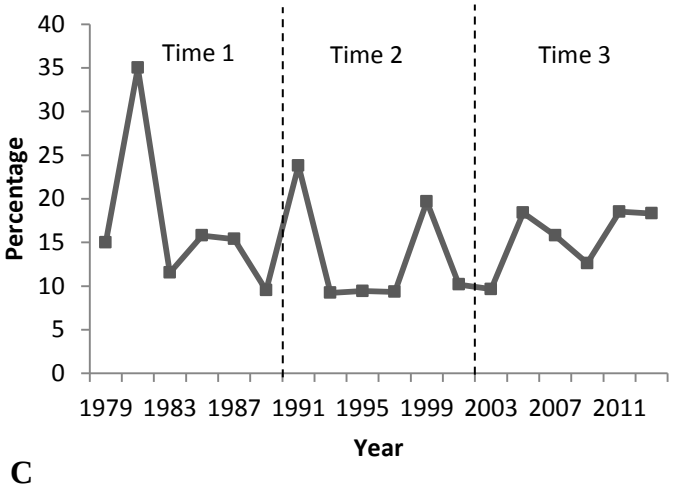
B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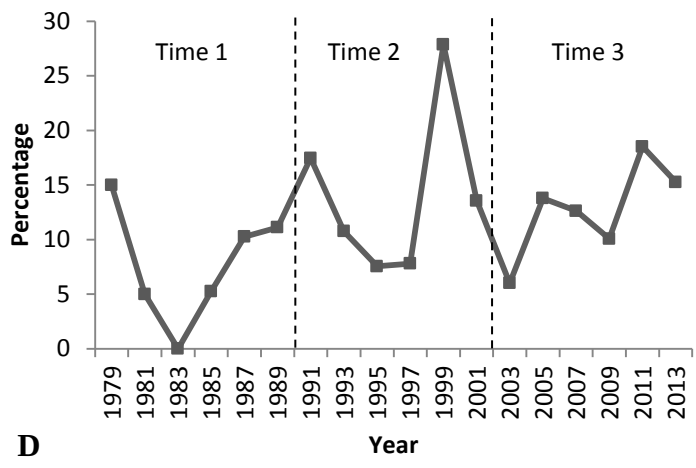
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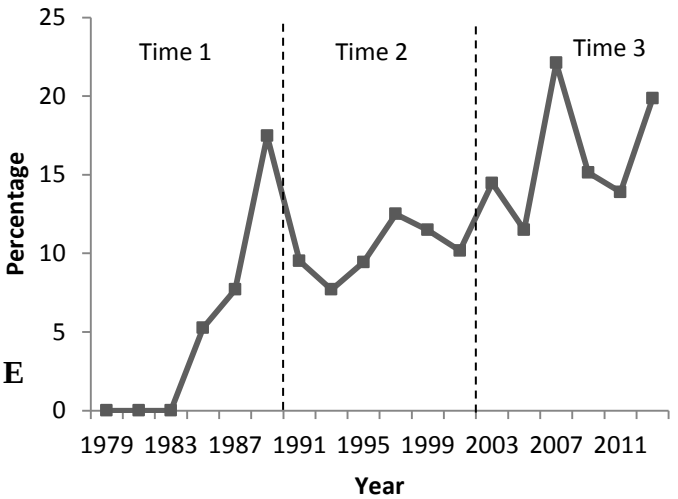
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