INVESTIGATING THE UTILITY OF IMPLICIT ASSOCIATIONS AND INDIRECT METHODS IN PREDICTING DOPING BEHAVIOUR

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Executive summary

Model building and/or working with representative samples require methods suitable for large scale data collection. Self-reports and surveys are inexpensive and effective ways of generating large datasets. However, it is well known that socially desirable responding can distort self-reported data, particularly in situations where the questions are related to socially unacceptable tendencies and behavior. Social desirability (SD) is a tendency of people to reply in a manner that is thought to be viewed favorably by others. This manifests in denying or deflating responses about what is perceived to be undesirable; and inflating answers on desirable behaviour. Because socially desirable responding affects both the key outcome variable in doping behaviour models (use of doping) and the social cognitive measures tested as predictors of doping behaviour, it should be taken into account and mitigate where possible.

The empirical work in 12 separate studies presented in this report was conducted between 2009 and 2018. The content of the literature review in the Background section was updated to capture the relevant research up to 2020.

The primary aim of this project was to address the gap in research methodology typically employed in doping behaviour research by pulling together results from previous studies to develop and pilot test an array of indirect measures.

These indirect measures include:

(1) measures based on reaction-time differences (often referred to as implicit association tests);
(2) measures based on social projection; and
(3) implicit priming task for honesty.

Caution in using these methods to determine doping behavior is warranted for multiple reasons. Started with a hope to counterbalance SD, even to obtain 'truthful' answer, implicit association-based tests were thought to provide the perfect solution to capture 'true attitudes or subconscious preferences' as well as truthful responses about doping behavior – often treated as some for a lie detector. Results suggest that response-time based measures are heavily influenced by a host of potential confounding factors, of which many are completely unrelated to the research interest. Despite the plethora of research, it remains unclear what the experimentally provoked latency represents and it is less understood how these measures relate to the explicitly expressed attitudes, beliefs or norms. Although the project initially set to find answers to these questions and explore if implicit association test s have predictive power for doping behavior over and above explicitly reported thoughts, the collective results raised more doubts and provided reassurances. It is imperative to be

mindful of the fact that these measures are research tool and they are not suitable for individual diagnostics; and under no circumstances they should be used as such.

Studies in this report contributes to a clearer methodological understanding of 'implicit attitudes'. First of all, implicit association is the recommended term because attitude – be definition – is a conscious evaluation of an object or behavior (e.g., doping as concept or using doping as behaviour) whereas in implicit association tests participants are not asked to make any evaluation. Implicit association is inferred from the response-time differences under experimentally induced conditions. Accepting that these implicit associations are related to one's attitude, the best we can say is that implicit associations taps into one's attitudes about the object or behaviour. It is recommended that instead of referring to the psychological construct as implicit or explicit, researchers refer to the measurement by which attitudes are assessed: (1) implicit assessment of doping attitude for response-time based measures, (2) indirect (explicit) assessment of doping attitude if it is measured by level of agreement on doping-related statements (e.g., the Performance Enhancement Attitude Scale), and (3) direct assessment of doping attitude when respondents are ask to make and report direct assessment of doping attitude (e.g., doping is good/bad; foolish/wise, ethical/unethical, beneficial/detrimental, risky/safe, etc.). The same conceptualization is valid for other social cognitive measures such as social norms, perceived control, perceived legitimacy, anticipated regret and so on.

Measures based on projection causes much confusion in the literature. Often, outcomes from these studies are interpreted as prevalence figure when in fact projections are more revealing about the respondent than about the population which we asked about. This is caused by the ever-present egocentric bias, which is magnified by the distance between the respondent and the target population. The larger the distance, the less likely that the respondent is in possession of the information asked (e.g., percentage of athletes using doping) and thus the more the respondent has to rely on projecting oneself to others.

Having doubt over response-time based measures as 'true responses', particularly the concerns over using implicit autobiographic testing for detecting concealed behavior, leaves a gap in the array of methods about motivation to respond truthfully. One approach is to present a convincing argument why the information is important for the greater good and to solicit participants' help with addressing the problem (e.g., doping).

Another way for obtaining truthful answer is with implicit priming for honesty. The latter involves a degree of deception and a relatively new, and thus under-documented, approach in doping research. Preliminary results presented in this report indicate that this is a potentially useful avenue, along with the acknowledgement that further research is definitely warranted about the exact nature and duration of the effect; and evidence for its practical usefulness. One aspect has become clear from the studies

in this report already, which is the need to 'force' participants to engage with and complete the priming task.

Individually the studies focused on various indirect methods of assessing doping related social cognition (attitudes, implicit association and perceived prevalence) in the context of doping behaviour. Conditions around these measurements included the observation and assessment of social desirability; and experimentally created conditions to induce truthful responding.

Collectively, results from this project make an important contribution to improving behaviour science research on doping and anti-doping, particularly to the design and validation of assessment tools. Because of the sensitivity of these measures and the implicit nature, implementation of any or the combination of these measures requires expert advice in setting up the assessments and involvement in interpreting the results.

Discovering and describing the 'invisible' community structure via Social Network Analysis (SNA) can help to understand the immediate athlete environment; and this research avenue is worth pursuing further. Over time, findings from these studies has been **disseminated** via journal articles and conference presentation. Through working closely with WADA, these studies have **made impact** on WADA's approach to anti-doping education; capacity to evaluate the effectiveness of anti-doping education and outreach activities, and made material contribution to assessing doping prevalence via survey methodology.

Specifically:

(1) Results from the studies **informed and elements been incorporated into the Athlete Learning Programme for Health and Anti-doping (ALPHA) and its evaluation**: modules 7 & 8 as well as a short 8-item measure of doping attitude and a single-question social desirability measure incorporated into ALPHA evaluation; and

(2) Cumulative evidence **offered robust evidence against using projective questioning as bona fide doping prevalence**; or interpreting outcome from such approach (perceived prevalence) as prevalence.

(3) Outcomes from implicit measured **cautioned against using response-time based measures** (e.g., implicit association tests) **for individual level diagnostic tool; or treat such approach as 'lie detector**'.

(4) **Honesty goal priming concept** has trialed and refined in studies piloted in the first phase of **WADA Doping Prevalence project** (2011-2012)

(5) **Results for and against doping.**

What this research programme adds

- A new, developmental model of doping behaviour (Incremental Model of Doping Behaviour, IMDB) is proposed and placed in broader context of anti-doping legitimacy and values-based and information-based anti-doping education.
- The concept of 'Performance mindset' and its impact on performance enhancement, decision about doping, and approach to anti-doping education.
- Evidence-based argument for the need for a positive approach to anti-doping working together with and not against athletes; and the need to focus on helping athletes to manage the demands of sport and staying clean as oppose to focusing on trying to stop athletes from using doping.
- Comprehensive set of implicit association tests, including measures for affective, moral, and instrumental implicit 'attitude' and implicit norms (perceived prevalence).
- Applications of the IAT concept to capture doping-related social cognition moved away from using affective attributes. Moral and instrumental attitudes, although each showed some difference in the expected direction at the aggregated level, did not produce significantly different implicit measures between self-admitted doping users and non-users. The self-referential doping BIAT contrasting target words with me/not me categories had better discriminatory power.
- Highlights the importance of research framing and limitations of implicit measures on doping due to the complexity of doping and doping-related cognition.
- Guidance for using projective questioning to estimate perceived prevalence of doping; and consider reported perceived prevalence as an indicator of the athlete's mindset (which is influenced by the dynamic between behaviour and environment).
- Introduce Social network Analysis, and associated methodology, to doping behaviour research.
- A functional and effective honesty priming task (word-search puzzle).
- Short form of the Performance Enhancement Attitude Scale with additional evidence for validity (PEAS-8).
- Single Question measure of social desirability in research settings.

- Analysis of reasons for and against doping.

Disclaimer

Psychometric tests and approaches presented in this report are research tools. The intended use of these tools is for assessments at group level (e.g., as mean scores of athlete groups or subgroups). The tools developed, tested, used or discussed in this report are **not validated for individual diagnostics**, therefore they are not suitable for profiling individual athletes or to inform targeted testing.

Publications

Over the years, results and parts of this report were published in peer-reviewed articles and book chapters; and disseminated via conference presentations between 2011 and 2019.

Journal articles & book chapters:

- Petróczi, A., Norman, P., & Brueckner, S. (2017). Can we better integrate the role of anti-doping in sports and society?. A contemporary values-based psychological approach to prevention. In: O Rabin & Y Pitsiladis (Eds.) Medicine and Sport Science, Vol. 61. *Acute Topics in Anti-Doping*. Chapter 4.2. (pp. 160-176) Karger.
- Petroczi, A. (2016). Indirect measures in doping behavior research. In: Barkoukis, V., Lazuras, L., & Tsorbatzoudis, H. (Eds.). *The psychology of doping in sport*, 93-110. Routledge (book chapter)
- Petróczi, A. (2015). Indirect measures in doping behaviour research. Barkoukis, V., Lazuras, L., & Tsorbatzoudis, H. (Eds.). *The Psychology of Doping in Sport*, pp 93-110. *Routledge* (book chapter)
- Petróczi, A., Backhouse, S.H., Barkoukis, V., Brad, R., Elbe, A-M., Lazuras, L., Lucidi, F. (2015). A call for policy guidance on psychometric testing in doping control. *International Journal of Drug Policy*, *26*(11):1130-1139 (position paper).
- Petróczi, A., Backhouse, S.H., Barkoukis, V., Brand, R., Elbe, A-M., Lazuras, L., Lucidi, F. (2015). A matter of mind-set in the interpretation of forensic application: Response to comments in “Science 1, Religion 5: A Reply to Petróczi et al. (2015)” *International Journal of Drug Policy*, *26*(11):1142-1143 (Reply letter)

- Petróczi, A. (2013). The doping mindset—Part I: Implications of the functional use theory on mental representations of doping. *Performance Enhancement & Health, 2*(4), 153-163.
- Petróczi, A. (2013). The doping mindset - Part II: Potentials and pitfalls in capturing athletes' doping attitudes with response-time methodology, *Performance Enhancement & Health*, *2*, 164-181.
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- Uvacsek, M., Nepusz, T., Naughton, D. P., Mazanov, J., Ránky, M. Z., & Petróczi, A. (2011). Self-admitted behavior and perceived use of performance-enhancing vs psychoactive drugs among competitive athletes. *Scandinavian Journal of Medicine & Science in Sports, 21*(2), 224-234.
- Petróczi, A., Mazanov, J., & Naughton, D. P. (2011). Inside athletes' minds: preliminary results from a pilot study on mental representation of doping and potential implications for anti-doping. *Substance Abuse Treatment, Prevention, and Policy, 6*(1), 10.
- Petróczi, A., Mazanov, J., Nepusz, T., Backhouse, S. H., & Naughton, D. P. (2008). Comfort in big numbers: Does over-estimation of doping prevalence in others indicate self-involvement?. *Journal of Occupational Medicine and Toxicology, 3*(1), 19.
- Petróczi, A., Uvacsek, M., Nepusz, T., Deshmukh, N., Shah, I., Aidman, E. V., Barker, J., Tóth, M., & Naughton, D. P. (2011). Incongruence in doping related attitudes, beliefs and opinions in the context of discordant behavioural data: in which measure do we trust?. *PLoS One, 6*, 4, e18804.
- Petróczi, A., Aidman, E. V., Hussain, I., Deshmukh, N., Nepusz, T., Uvacsek, M., Tóth, M., Barker, J., & Naughton, D. P. (2010). Virtue or pretense? Looking behind self-declared innocence in doping. *PloS one, 5*, 5, e10457.

Conference keynote presentations:

- ‘Research on athletes’ perspectives on clean sport’. Invited Keynote lecture, Second WADA Global Education Conference, Beijing, China, October 2018
- 'Where are we now and where are we going with doping behaviour research?', 50th annual convention of the German Society of Sport Psychology, Münster, Germany, May 2016
- ' The future of anti-doping in the era of human enhancement: A plea for simplicity and athlete-centred values-based prevention', Sport Psychology Conference, Barletta, Italy, February 2016
- Getting inside the athletes’ minds: potentials and pitfalls of self-reports and timed response measures in doping research. Keynote paper presented at the 5th International INHDR Conference, Aarhus, Denmark, August 2013.

Method development into hair analysis progressed parallel:

- Naughton, D. P., & Petróczi, A. (2015). Rapid and simultaneous analyses for multiple drugs in hair samples using dynamic multiple reaction monitoring. *Clinical Laboratory International*, 24-25.

- Shah, I., Petróczi, A., Uvacsek, M., Ránky, M., & Naughton, D. P. (2014). Hair-based rapid analyses for multiple drugs in forensics and doping: application of dynamic multiple reaction monitoring with LC-MS/MS. *Chemistry Central Journal*, 8, 73.

Aims

This project aimed to address the gap in research methodology typically employed in doping behaviour research and investigate (1) the effects of social desirability bias on different self-reported measurements; and (2) the feasibility of gaining unbiased (or at least less affected) information using indirect measures. Specifically, this project was set to develop and pilot test an array of indirect measures based on response-time differences (also called 'implicit associations'), social projections and implicit honesty priming.

The novelty of this project came from simultaneously considering both implicit and explicit cognitions about doping and drug use along with assessment of social desirability; supplemented with objective measures of behavior where possible. In addition, the project aimed to develop and validate a new method for estimating the prevalence of doping and drug use at the sample level.

It was expected that the outcomes of the proposed studies reveal the extent to which the tendency of socially desirable responding influences the results from explicit and implicit assessment with the view of providing researchers with assessment tools that are more likely to produce valid data than self-reports. Having valid information on the extent of doping use and underlying situational factors is much needed to develop anti-doping prevention programmes, as well as making a step toward having outcome based objective evaluation of their effectiveness.

Background

Having reliable information on the extent of doping use in sport is important for prevention and intervention activities, and it is a fundamental requirement for the outcome-based evaluation of the effectiveness of any anti-doping efforts. Establishing the prevalence rate of doping in elite sport is a challenging task. Whilst analytical methods are objective on the individual test level, inferences made from the adverse analytical findings have been challenged on many grounds, including inter-individual variations and lifestyle factors (Jenkinson et al., 2013), statistical interferences (Pitsch, 2009) and inconsistencies (Henne et al., 2013; Dimeo & Taylor, 2013). Furthermore, from the epidemiology point of view, one can question the representativeness of the tested samples for the entire elite athlete population.

Having understanding of the motivators and vulnerability factors for doping, as well as the motivators and barriers to staying clean amidst of doping suspicions is equally important in devising effective doping-control and -prevention strategies and meaningful anti-doping education programmes.

Theoretically, self-reports would be perfect and inexpensive ways to obtain information on unobservable behavior. Setting aside the possibility of inadvertent doping (which is nonetheless a doping offence, along with possessing and trafficking doping substances or supporting such activity), the athletes themselves are in the best position to provide information on doping – either reporting on their own actions or of others. However, in addition to the well-known benefits of ease of use and information richness, the method has attracted considerable criticism for potentially distorting effects. Combining social science with analytical science to verify self-reported information on behaviour is not feasible for all projects, especially not for research that requires large sample size. Self-report methodology is, and will be, widely used for practical reasons. As the overwhelming majority of social science research in doping is based on self-reports, the field would benefit considerably from improvement in research methodology and measurements. Self-report measures assume that respondents are capable and willing to report the information sought after by the researchers.

Limitations to self-reports

The self-report method is the most commonly employed method in psychological assessment and sociology polls. In addition to the well-known benefits of ease of use and information richness, the method has attracted considerable criticism for potentially distorting effects arising from response set and styles (Paulhus & Vazire, 2010). Self-presentation (socially desirable responding) is one of these potentially distortions. Social desirability, a tendency of respondents to reply in a manner that will be viewed favorably by others, is one of the common method variance mechanisms that can create

artefactual association. Owing to this effect, respondents may deny or deflate their responses about undesirable whilst inflate their answers on desirable attributes and/or behaviour.

The completed WADA Social Science Grant entitled “Measurement tool for estimating the prevalence of doping: development and validation of a self-report measure of performance enhancing drug use” (2008-2009/Petroczi) provided data from 115 Hungarian athletes (competitive) and controls (sport/PE students) comprised of explicit doping related measures (self-reports via paper-and-pencil questionnaires) and cut hair samples covering the period of 0.5-6 months prior to data collection (Petroczi et al, 2010; Uvacsek et al, 2011). Owing to a parallel project investigating executive functioning, data on implicit doping attitude were also available for the same population.

From the triangulation afforded by the two parallel projects, evidence emerged suggesting that taking self-reports at face value could lead to a very different conclusion about the social cognitive processes underlie doping behavior, but with implicit measures (reaction times) being more revealing (Petroczi et al., 2010). Our results show that not only the information on doping behaviour but also on self-reports on social cognitive processes (attitude, social projection and perceived pressure) could be affected by some form of response bias. Whilst differences in explicit (self-reported) social cognitive measures between user and non-user groups were observed in the expected direction when groups were created from self-reports, generally the reverse was evidenced when the user status was based on hair analysis results. Implicit measures were consistent with the grouping based on hair analysis. These results not only reinforced the long-lived lingering doubt over the validity of self-report data on socially sensitive topics but suggest that respondents may consistently manipulate their answers on all related measures in order to maintain the image they wish to project. Hence strategic responding can seriously undermine the validity of self-reports, with reliability (= consistency) remaining unaffected as respondents’ answers appear to be consistent with the image they try to create.

Limitations in self-reports stem from two fundamental assumptions. One is that the respondent is *able* to self-report and the other one is that he/she is *willing* to self-disclose. In other words, the respondent is assumed to have sufficient insight into what is being measured and able to report on, thus provide the solicited information; yet has no intention to distort his or her responses. Violations of either of these two assumptions can seriously compromise the validity of self-report assessment. Notwithstanding, athletes’ self-reports on doping or drug use can be assumed to be more accurate than self-reported absence of doping. The first might be influenced by uniqueness bias (i.e. desire to appear different), whereas the latter is affected by the desire to appear in the only socially acceptable role of a clean athlete.

Perceptions and understanding of doping by the research participants

In sport, a wide array of substances with true or putative performance enhancing properties is used. Many of these are fully acceptable, whilst a defined set is prohibited by WADA. The list of prohibited substances is revised annually. Thus in this ever-changing terrain, athletes less involved in regular WADA-harmonised doping testing (e.g., sub-elite level, emerging young talented and amateur club level athletes; or athletes falling outside of the WADA regulation such as some classes in bodybuilding) may not have the same understanding of what constitute 'doping' as the researcher has; or athletes responded to doping questions in other surveys (Lentillon-Kaestner & Ohl, 2011). Surveys without precise definition rely on personal definitions of doping and thus not only vary widely but also often differs from the official definition likely to be adopted by the researchers. Such variety also makes any literature review difficult and the much-needed meta-analysis close to impossible.

Social Desirability

Social desirability (SD), a tendency of respondents to reply in a manner that will be viewed favorably by others, is one of the common method variance mechanisms that can create artefactual association. Owing to this effect, respondents may deny or deflate their responses about undesirable whilst inflate their answers on desirable attributes and/or behaviour. The considerable effort made in social psychology to eliminate social desirability effect in researching socially sensitive issues has included ensuring anonymity, using indirect measures and developing tests that are less prone to manipulation such as implicit association tests or other computerised tests that based on response times. As a last resort, when social desirability bias cannot be eliminated, researchers often include a scale that measures respondents' tendency to give socially desirable answers and correlate the SD scale scores with the target measures. When SD responding is considered, typically a distinction is made between SD in response set (that is a property of a particular scale) or SD response style, which is an individual difference variable and as such, affects many if not all responses given by the individual (Paulhus, 2002). This distinction is important in dealing with SD responding with response set SD being less problematic in psychological assessments as it affects all respondents equally with information not used in absolute levels but compared to other groups' results. However, SD as an individual difference variable could distort the data obtained (McCrae & Costa, 1983) and may lead to false interpretation if scores were taken at face value (Petroczi et al, 2010). Despite the fact that people with certain personality characteristics (i.e. conscientiousness) are known to score high on the SD scales, studies using objective criteria show that in most cases SD scales do not measure individual differences, hence high correlation between the SD scale and other variables indicate significant shared substantive variance (McCrae & Costa, 1983), thus indicating the presence of SD distortion. This has also been observed in doping-related variables (Petroczi & Nepusz, 2006).

Socially desirable responding is a motivated process in which respondents deliberate alter the information they report and the extent of this distortion depend on whether the respondent has anything compromising to report and on design features of the survey (Tourangeau & Yan, 2007). This deliberate distortion also presents to a degree when the reporting is done anonymously, hence there is no danger to be embarrassed directly or having consequences of the admitted behaviour. The intrusiveness of the question, the level of social undesirability of the response and the perception of disclosure to a potentially transgressing or embarrassing event to a third party (Tourangeau et al, 2000) influences athletes' willingness to reveal doping behaviour. There have been considerable efforts made to estimate, and potentially eliminate, the social desirability effect in researching socially sensitive issues. The difficulty of such work is that it requires having objective, as well as self-reported information available on the same person. In our recently completed, WADA funded research project, benefitting from a multidisciplinary approach combining social aspects (social cognition underlying behaviour) with analytical science (drug testing), evidence emerged suggesting that taking self-reports at face value could lead to a very different conclusion about the social cognitive processes that underlie doping behavior, but with implicit measures (reaction times) being more revealing. For the first time in social science doping research, our results showed that not only the information on doping behaviour but also on self-reported attitudes toward doping, perceived pressure and estimates given on doping prevalence among athletes could also be affected by some form of response bias. These outcomes not only reinforce the long-lived lingering doubt over the validity of self-report data on socially sensitive topics but suggest that respondents may consistently manipulate their answers on all related measures in order to maintain the image they wish to project.

Investigations of socially sensitive or transgressive behaviours (e.g. doping, illicit drug use or abuse of cognitive enhancing drugs) are hindered by the well-known fact that people may not answer truthfully to questions about their potentially discriminating behaviour (Tourangeau & Yan, 2007). Elite athletes, like celebrities from other spheres of the entertainment industry, are constantly in the public eye. However, unlike their counterparts in the music, film or fashion industry, athletes more often face the expectation to embody the universally held values of the amateur sport. Participant recruitment for meaningful research in this environment is incredibly difficult. Elite athletes at the very top level are often inaccessible, carefully guarded by their sport federations, national sport organisations or coaches; or are reluctant to reveal and discuss socially unacceptable practices. Thus much of the psychological research has been conducted with either a very small number of elite athletes, or with sub-elite samples, often university students. Even under trust and anonymity that eliminate individual exposure, truthful information on doping practices inevitably tarnishes the socially desirable image of sport. One can argue that with voluntary participation, only those athletes are included who are willing to discuss doping. In reality, it is not necessarily the case. Regardless of

the methodology, there is an ever present danger that athletes who agree to participate in research only do so to avoid suspicion that could arise from refusing to participate (but this does not guarantee honest responding) or deliberately use the research as a 'public relation vehicle' to show or reinforce the view desired by the public.

Addressing the limitations to self-reports

The prevailing social norms surrounding doping, its sensitivity and potentially career changing consequences for athletes make doping research an excellent field for employing indirect methodology and innovative techniques. Researchers in favour of incorporating indirect assessments typically justify this choice on counterbalancing social desirability bias or the assumed dual nature of thought processing.

Limited, albeit slowly increasing, number of doping projects (e.g., Gucciardi et al, 2010; Petróczi, 2007) made at least an attempt to account for SD by adding some established psychometric scales that measure one or more facets of SD and assessed the potential SD effect based on correlations between the SD scale and the target variables. Whilst such approach is common and generally accepted in survey methodology, pairwise correlation cannot adequately assess social desirability effect at behavioural model level (Petróczi & Nepusz, 2011).

In the quest for obtaining measures that are free of or less prone to SD effect, researchers have turned to indirect or implicit measures. Employing such measures may help to obtain more valid response sets owing to the reduced demand for giving SD responses or creating less precise context – both of which are usually required for manipulative answers (i.e. respondents are fully aware of the purpose of the investigation and the options for giving strategically selected responses are available by the questionnaire design). Therefore, it was assumed that removing one or both conditions could help reducing SD bias.

The elements comprise Figure 1 are connected at many levels. As brain function, processes related to the Self and mind-perception and projection (and attitudes) to others shares a common neutral substrate in the prefrontal cortex substrate in the medial prefrontal cortex. (Banaji & Heiphetz, 2010). As social function, the relationship between self and perception of others forms a loop in which the Self influences one's perception of others through projection, and perception of others through subjective norms exerts influence on the Self. To obtain reliable, valid and relevant information on these elements poses multiple methodological challenges on empirical research.

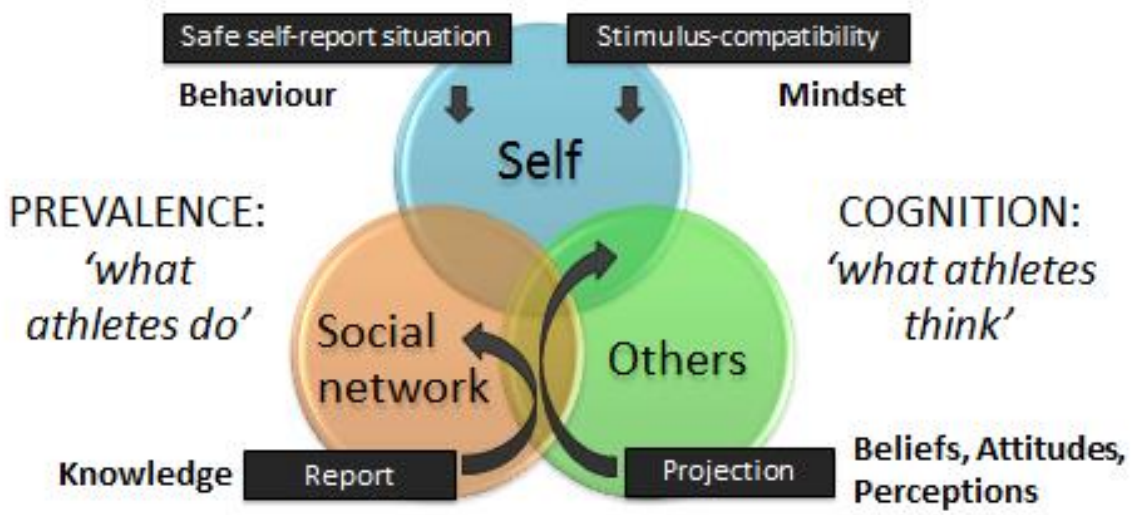


Figure 1: *Conceptual map of the indirect measures of social cognition and behaviour. Studies presented in this report focus on the 'mindset' (presented on the right-hand side of the figure).*

Building on the assumption that social desirability arises from the combination of the sensitivity or the question, fear of exposure and consequences if exposed (Tourangeau & Yan, 2007), a family of indirect estimation techniques (e.g., Randomized Response Techniques or Fuzzy Response models) has been developed to manipulate the survey situation to make it safe. Although in this set-up, the answer is directly reported to the interviewer, or self-reported by the respondent, the deliberately added 'noise' makes relating the sensitive information to individuals impossible. Another distinct group of self-reported methods changes the focus from the self and ask about others instead of the respondent. Whilst the answer is directly sought and explicitly reported, typically in self-report surveys, the fact that the obtained information can be indicative of the respondent can make the application of this method indirect. Whether or not the third-person-based answer is truly about the others (as thus should be interpreted as such) or more reflective of the person completing the survey (and thus should not be interpreted as true information about the others) depends on the survey setup. This distinction is captured in Table 1. The fourth group of indirect techniques depicted in Figure 1 contains those implicit measures that make inferences from reaction-time differences produced in stimulus-response compatibility (SRC) tasks to the person's thought processes. Whilst the true essence of these implicit measurements is still uncertain, the currently prevailing view links these implicit measurements directly to subconscious thoughts. Proponents of implicit social cognition measures agree that explicitly expressed views under cognitive control (even if the respondent is willing to disclose his/her

views fully) only provide a small window into people's thought processes (Nosek & Riskind, 2012), but differ in their conceptualisation of the implicit measurement (Payne & Gawronski, 2010).

Making inferences from response-time differences: utility of 'implicit associations' to predict doping behaviour

The inherent limitation of self-report methodology is the assumption that respondents are not only willing but also able to report their feelings, thoughts, motivations, beliefs and explicitly express their preferences and attitudes. However, what is available to conscious self-examination is only a small fraction of people's thought processes. Although people may experience cognitive certainty of knowing their preferences and motives for their actions, this self-assured feeling is deceptive because mental experiences one is aware of are not equivalent to the mental processes that determined or influenced the behavioural choices (Nosek et al, 2011). For example, social projection, attribute substitution and heuristical decision making happens outside conscious awareness (Kahneman, 2003; Kahneman & Frederick, 2002; Robbins & Krueger, 2005), self-reported and automatic motivations or preferences can differ widely (McClelland et al, 1989; Nosek, 2007).

To capture reasons beyond verbal declaration requires alternative methods, such as implicit assessment where participants are i) unaware of what being measured or ii) have no conscious access to the assessed property or iii) have no control over the measurement outcome. It is known that individuals may be biased in how they see themselves and this bias is often not recognised by the individual (Pronin, 2008). Self-reported, explicit assessments of individual differences are particularly prone to distortion, which may or may not be deliberate. A current research stream in psychology focusing on the uncontrolled, unconscious processes (Fazio & Olson, 2003; Greenwald et al, 2002) provides a promising avenue to compliment the explicit assessments. Recent research has shown that implicit association (Greenwald et al, 1998) adds to the predictive power of explicit attitude measures, especially in researching highly sensitive issues such as caring for drug abusers or suicide (von Hippel et al, 2008; Nock et al, 2010).

In contrast to explicit reports, implicit measurements do not make explicit connection between the test and the target construct, nor ask respondents to make any evaluations. Rather, these measures utilise the stimulus-response compatibility (SRC) or task-irrelevant feature inference (TIFI) concepts and make inference from response time differences between test conditions. The key difference between these and the explicit measurements is that respondents are not asked to make evaluations directly (e.g., recording agreement with direct attitude statements or placing the target construct on a bipolar semantic-differential scale) but rather, these 'evaluations' are inferred from performance between

experimental conditions in a within-subject design. All implicit measurements that utilise response time and make inferences from the difference between combinations of stimuli-response *sets* (e.g., words and/or pictures) forming contrasting target and attribute *categories*. Each combination of these categories (or stimuli sets) constitutes a *trial* within the test.

The SRC-based taxonomy follows de Houwer's structural analysis (2001; 2003b) and considers each test according to its compatibility features at the trial level, not at the stimuli set level (Kornblum et al, 1990; Kornblum, & Lee, 1995). One key difference between the classic S-R compatibility tasks and the implicit assessments of social cognition is that in the latter, stimuli used in measures of social cognition have valence. In fact, the test builds on this valence to measure, for example, implicit attitudes, preferences or motivation. An exemption to this is the group of implicit tests, such as the autobiographical IAT (Sartori et al, 2008) and the Timed Antagonistic Response Althiometer (Gregg, 2007), which aim to capture memory of a specific life event. However, despite the seemingly objective nature of the target concept (a life event that either happened or it did not happen), the recall - record process is not free from interference from the *Self* (Greenwald, Banaji, Rudman, Farnham, Nosek & Mellott, 2002) or false memories (Takarangi et al, 2013). In addition to the aIAT being sensitive to both the instructions and stimuli statements can carry a valence inadvertently from an unwanted framing effect which can, in turn, confound the outcome of the test, Vargo et al (2014) showed that propositional thinking can interfere with the performance on the aIAT test and called for caution in using aIAT outcomes as behavioural index (i.e., determining whether someone used doping or not).

For details and additional tests, readers should consult the original references in Table 1 and reviews by Nosek et al (2011) and De Houwer and Moors (2010) on a wide range of implicit measurement procedures employed in researching social cognition; Lane et al (2007) for an overview of the Implicit Association Test; Golijani-Moghaddam et al (2013) on implicit relational assessments and Agosta & Sartori (2013) on implicit measurements of autobiographical memory.

Using Stimulus-Response Compatibility (SRC)

One group of response-time-based implicit tests relies on the demonstrated effect of the compatibility between (a) the stimuli and the required response (S-R) and/or (b) features of the stimuli (S-S) on the speed by which one is able to perform the task (Kornblum et al, 1990). A significant proportion of implicit measures utilises dimensional overlap influence between the stimuli and response when contrasts one compatible S-R pair with one incompatible S-R pair and uses the difference between the response times in each task to asses which of the two pairs is 'more' or 'less' compatible for, and thus implicitly preferred by, the individual. For example, in the Implicit Association Test (Greenwald et al, 1998), target stimuli sets of 'flowers' and 'insects' are paired with valenced attributes such as 'pleasant' and 'unpleasant', forming one compatible pair ('flower' and 'pleasant' for most people) and

one incompatible pair ('insects' and 'pleasant'). The task is set so it is easier to perform when the compatible pair shares the same response key (e.g., the letter 'E' on the computer keyboard is pushed for both the 'pleasant' words and 'flowers') and thus resulting in faster response time, compared to when the pairing is not compatible (e.g., pushing the keyboard letter 'I' for both 'pleasant' words and 'insects'). Faster response time for the 'flowers' + 'pleasant' stimuli set is interpreted as implicit preference for flowers over insects.

Exploiting Task-Irrelevant Feature Interference (TIFI)

The other major group in the implicit measurement family exploits task-irrelevant feature inferences. For example, the Extrinsic Affective Simon Task (De Houwer, 2003a) are based on performances on trials within the single task focusing the instruction on the irrelevant S-R feature (e.g., colour of the word, or whether it is printed in capital letters or not; a noun or not, etc.) regardless of the meaning of the word. Similarly, in the Approach-Avoidance Task (Rinck & Becker, 2007) participants are instructed to push away or pull closer a picture (literally, using a joystick), depending on the shape of the picture frame (e.g., round or square) or colour of the picture background, regardless of what is depicted. In both cases, the tests rely on the measurable interfering effect of the seemingly hidden relevant feature (e.g., meaning of the word or picture).

Predicting Behaviour

Perugini et al (2010) proposed that based on the single vs. dual-entity assumptions the explicit-implicit attitude relationships, characteristic patterns emerge for the interplay between explicit and implicit processes in predicting behaviour. These patterns are formed around single association, moderation, additive, double-dissociation, interactive/multiplicative, partial-dissociation and double additive patterns, each predicting behaviour in a specific way. Intuitively it has been assumed that associative processes trigger automatic responses, thus implicit measures predict spontaneous behavioural choices; whereas propositional processes are linked to deliberate responses thus explicit measures should predict behavioural responses under conscious control. Those favouring independence (e.g., Cohen & Reed, 2006) propose that depending on the situation, these two systems influence and motivate behaviour via different pathways; one usually overwriting the other. When people have the opportunity and are motivated to deliberate, the reflective system will govern their behaviour. In contrast, when motivation is low and time or capacity for deliberation is sparse, the impulsive system will become more important (Friese et al, 2008).

However, social cognitive factors that underlie real-life decisions often do not fall squarely into the neat categories of the dual attitude model but rather, they represent an enduring integrated unit where implicit measures are best seen as moderators rather than determinants of behavioural choices. The

situational dominance of one system over the other is influenced by a host of contextual and personal moderators (Perugini et al, 2010). The influencing situational factors are procedural matters (processing time, ego depletion, affective/cognitive focus, mood, priming) and most of the personality factors (e.g., working memory capacity, preference for intuition) are independent of the target construct. Their combined effect can moderate the relationship between the social cognitive measures and the actual behaviour. It is argued later that in socially sensitive domains, such as doping, this complex relationship is further moderated by the degree of congruency between one's action and self-admittance of that action. Establishing predictive validity for non-observable general behaviour (such as doping use) is further complicated, in most cases, by the absence of valid data on the outcome variable. Table 1 provides a summary and taxonomy of the selected implicit measurements, along with all implicit measurements that – to date - have been adapted to doping research.

Response Time Based Measurements in Doping Research[1]

Affective IATs

Parallel to the first doping IAT (Petroczi et al, 2008), Lotz and Hagemann (2007) used the classic IAT setup to measure underlying automatic evaluations of doping among athletic population. Participants were grouped as bodybuilding and athletics (representing high level of doping) vs. handball and table tennis (representing low level of doping) comparison. In their implicit tests, first doping words were contrasted against tea blends in a good/bad evaluative frame, followed by a control-IAT task where attribute discrimination focused on whether the word was a real word or a non-existing word. They found more positive implicit attitudes toward doping in the high doping group than in the low doping group, but also in the control task, which was unexpected and cannot be explained by any assumed difference between the two groups. Unfortunately the details presented about this study are not sufficient for even an attempt to explain the existence of associations between semantically unrelated concepts and attribute categories other than the mere familiarity with doping words; which was assumed to be higher in bodybuilding and athletics than in handball and table tennis.

Later, Brand et al (2011) aimed to connect previous findings and devised two variants for a doping IAT where one used supplements (Petroczi et al, 2008) as contrast whereas the other, following Lotz and Hagemann (2007) used tea blends. The authors' rationale for including a tea variant was to investigate whether a performance-relevant contrast category (nutritional supplements) produces a different IAT effect than the performance-irrelevant contrast category (tea blends). Following similar

[1] Petróczi, A. (2013). The doping mindset–Part II: Potentials and pitfalls in capturing athletes' doping attitudes with response-time methodology. *Performance Enhancement & Health*, *2*(4), 164-181.

logic, Chen and Zhang (2007) investigated the effect of various degrees of social approval on the relationship between explicit and implicit attitudes toward doping as socially disapproved and beverages as socially neutral targets, using elite university athletes as participants. Whilst a difference was found between explicit and implicit attitudes; the degree of social approval did not appear to influence the attitude measures. In contrast, for the study by Brand and colleagues (2011), participants were recruited among sport and exercise science students, which may ensure familiarity but limits the personal relevance of doping. The results, again, evidenced the presence of the IAT effect in both tests, showing negative implicit evaluation of doping. Doping IAT and control, again, were correlated. The contrast with tea blend appeared to be stronger than nutritional supplements. One possible explanation is that the distinction between doping and supplements were unclear. Alternatively, the small IAT effect could be due to the fact that the functional association prevails over legality (Petroczi et al, 2011) or having ambivalent implicit attitudes (Petty & Briñol, 2009). Also using the tea vs. doping variant, Lotz & Hageman (2007) showed more positive implicit doping attitude among bodybuilders than handball and tennis players, suggesting discriminatory power but the conclusion being weakened by failing to show statistically significant difference between the doping IAT and the control task. The authors propose that the speed of categorisation of doping substances might be independent of the evaluative categories, hence questions the interpretation of the doping IAT effect. An alternative explanation however hints that participants focus on the substance category they are more familiar with or found easier to recognise when performing the categorisation task while simply treat the contrast category as 'other' - the concept actually exploited in the Single-Category IAT (Kaprinski & Steinmann, 2006) and the Brief IAT (Sriram & Greenwald, 2009). Paradoxically, Rothermund and Wentura (2004) argue that it is the unfamiliar that makes recognition easier (the ‘figure’); thus familiarity may bias the implicit measurements in the opposite way to the expected IAT effect.

Two mixed method studies using explicit and implicit measures (Petróczi et al, 2010; Petroczi et al, 2011) also reported general preference for nutritional supplements over doping. However, the unique combination of social science techniques with analytical chemistry afforded identifying a distinct group within the sample consisting of athletes who have taken banned drugs but denied having done so. Interestingly in this group, the implicit preference for nutritional supplements diminished but explicit responses took on extreme negative values. The consistent patterns in the answers of those who denied using any prohibited performance-enhancing drugs suggested that those who deny doping are likely to manipulate all their answers on questionnaires to make themselves akin to the image of an athlete who is ‘clean’ and strongly anti-doping. One of the most important implications of these findings is the clear evidence that anonymity does not guarantee honesty. Misreporting was not limited to behavioural choices that might attract attention and sanctions. Self-representation bias had

an effect on all cognitive measures. The other implication is the emergence of a distinctive cognitive pattern separating doping users according to whether they are acknowledging (under anonymity) their doping behaviour or denying it. The 'action - self-admission' incongruence showed to have a moderating effect on both explicit and implicit measures, bringing the cognitive pattern of admitting athletes closer to clean athletes. Consequently, as long as the discriminative or predictive power of implicit associations is judged against self-reported behaviour, IATs cannot demonstrate power over and above explicitly reported social cognition.

Wolff et al (2015) adopted Brand et al.'s (2014) doping BIAT in an experimental examination of faking attitudes towards doping amongst athletes. Whereas participants incentivized to present an overly negative view of doping were found to have less positive explicit attitudes towards doping in comparison to a control group, no differences were found for IAT scores between the two groups. This study provides evidence that the adopted BIAT is relatively robust against faking attempts. Baumgarten et al (2016) also utilised Brand et al.'s (2014) doping BIAT, this time in an examination of discrepancies between athletes' explicit and implicit evaluations of doping and how they are cognitively resolved. They found a significant link between discrepant explicit/implicit evaluation and intentions to dope, and that moral disengagement helped explain this association.

Next, Whitaker et al (2016) used two BIAT's when examining athletes' implicit and explicit prototype perceptions of performance enhancing substance users and non-users. Interestingly, in comparison to those who would not contemplate doping, athletes who would contemplate it evidenced a positive bias towards doping. However, this was only seen with implicit measures (i.e., their BIAT scores) and was not identified through explicit assessment. Finally, Chan et al, (2017, 2018a, 2018b) examined whether implicit doping attitude, explicit doping attitude, or both, predicted athletes' vigilance towards unintentional doping. Utilising a single-category BIAT to measure implicit attitudes, they found athletes with positive implicit and explicit doping attitudes were less likely to read the ingredients table of an unknown food product, but were more likely to be aware of the possible presence of banned substances in a certain food product. Across this series of studies there is a tendency in doping research adopting response-time based measure to compare the ability of scores obtained with explicit versus implicit measures to predict doping outcomes. Overall, such research suggests implicit measures are more predictive of doping outcomes than explicit measures.

Emotional Stroop doping task

The assumption that implicit tests may not measure intrapersonal construct but rather, some environmental effects is evidenced in the results of a study using emotional Stroop task with doping and cheating words (Schirlin et al, 2009). The fact that a non-athletic population exhibited some attentional bias toward doping clearly suggests that the outcome was influenced by environmental

cues, rather than intrapersonal thoughts. However, the findings from this study should be interpreted with caution. The target stimuli set contained a mix of doping, cheating and some ambiguous words, making the outcome unclear as to what exactly influenced the speed by which the task was performed: cheating or the relatively unfamiliar set of doping related words. Furthermore, the doping stimuli contained words such as 'tonic' (not clearly associable with doping), 'disqualification' (not uniquely linked to doping as a consequence), and 'drug' (which can be associated with at least three different types and most often used in relation to illicit substances). The authors suggest that unfamiliarity should not have an effect on task performance because participants took part in a familiarisation exercise - which in turn might have functioned as priming and thus confounded the emotional Stroop test results.

Study characteristics, category labels and stimuli used in the reviewed studies are summarised in Table 1. The samples used in these studies, with one exception, were comprised of athletes and/or sport science students with sufficient sport background to support the assumption that participants were cognisant with the concept of doping and able to distinguish doping from other, acceptable form or performance enhancement. However, these athlete samples appear to represent a dominantly non-elite athlete category thus it is likely that doping control issues were not present in their daily life. In the only study without sporting background, general adolescent population was surveyed (Schirlin et al, 2009).

Table 1: *Selected Stimulus-Response Compatibility Measures*

Measurement type (by target)	Test	Target construct[a]	Task manipulation	Reference	Doping adaptation
Assessing the effect of evaluative tags attached to target concept	Implicit Association Test (IAT)	association or 'attitude'	task-relevant S-R compatibility	Greenwald et al, 1998	yes
	Single-category Implicit Association Test (SC-IAT)	association or 'attitude'	task-relevant S-R compatibility	Karpinski & Steinman, 2006	yes (unpublished)
	Brief Implicit Association Test (B-IAT)	association or 'attitude'	task-relevant S-R compatibility	Sriram & Greenwald, 2009	yes
	Implicit Relational Assessment Procedure (IRAP)	implicit belief/'attitude' as relative preference	task-relevant S-R (Relational-Response) compatibility	Barnes-Holmes et al, 2006	no
	Single-attribute implicit association tests (SA-IAT)	unipolar implicit 'attitude'	task-relevant S-R compatibility	Penke et al, 2006	no
	Go/No-Go Association Task (GNAT)	Automatic preferences/ 'attitude' (evaluation)	task-relevant S-R compatibility[b]	Nosek & Banaji, 2001	no
Utilising attentional bias interference to evaluative tags	Emotional Stroop[d]	attentional bias	task-irrelevant feature (e.g., ink colour)		yes
	Extrinsic Affective Simon Task (EAST)	'attitude'	task-irrelevant feature (e.g., font or word type)	De Houwer, 2003a	no
	Identification-EAST (ID-EAST)	'attitude'	task-irrelevant feature (e.g., font or word type)	De Houwer & De Bruycker, 2007	yes (unpublished)
	Approach-Avoidance Task (AAT)	automatic motivation	task-irrelevant feature (e.g., picture frame)	Rinck & Becker, 2007	no

Retrieving (potentially concealed) auto-biographical memory	Autobiographical Implicit Association Test (aIAT)	stored memory of life event	task-relevant S-R compatibility	Sartori et al, 2008	no
	Brief Autobiographical Implicit Association Test (B-aIAT)	stored memory of life event	task-relevant S-R compatibility	Vargo & Petroczi, 2013	yes
	Timed Antagonistic Response Alethiometer (TARA)	stored memory of life event	task-relevant S-R compatibility	Gregg, 2007	no

Note:

[a] Target construct refers to the construct the test is intended to measure. The true nature of these measures is still debated (Blanton et al, 2007; Payne & Gawronski, 2010; Vargo et al, 2014).

[b] All but the GNAT make inferences from response-time differences; GNAT relies on ability to perform the task within set time limit (accuracy).

Perception of Others: Projective Questioning

The broader scope of projective techniques refers to a family of techniques that, through verbal or visual stimuli, indirectly tap into people's feelings and thoughts outside conscious awareness (Kline, 1983). Projective Questioning (PO) was a popular method in personality assessments (Piotrowski et al,1993), educational research (Catterall & Ibbotson, 2000), and has been widely used in consumer research (Donoghue, 2000). Asking about others has been used as a mean to gather prevalence information, particularly in socially sensitive domains to reduce perceived risk from revealing compromising information about oneself and for estimating hard to find populations. Unfortunately, the ambiguity surrounding the terminology, definitions and underlying assumptions often lead to some confusion what projective measures actually represent. The interpretation of projections is highly dependent upon how the projection is obtained, namely whether it is specific knowledge or guessing; or it is an estimate for 'most people' or for a specific group or a hypothetical 'third person'. The key characteristics of these measures individually and differences between them are captured in Table 2.

Third-Person Questioning

Third-person projective questioning asks respondents to answer the question for ‘most people’, and thus allows respondents to detach him/herself from the target behaviour. Because respondents are most likely to not have exact information on ‘most people’ (unless it is a small and defined group of which the respondents belongs to), the ‘most people’s view’ are derived from the Self. In fact, much work theorised the Self to be central to the structure of social knowledge (Greenwald et al, 2002) and argued that the mostly strong positive self-evaluation is the introspective source for favourable explicit attitudes toward the object, people or groups one chooses or is affiliated with (Gawronski et al, 2007; Walther & Trasselli, 2003). Therefore views and thoughts expressed through a third person, with or without instructing the respondents about this third person (e.g., asking respondents to pretend and answering as if they were a doping user), essentially reveal information about one's Self in an indirect way. This projective process, at least in forming first impressions, is influenced by the ease for retrieval of how the Self is perceived in relevant situations (Woltin et al, 2014). Despite that most work assumes that egocentric influence happens outside conscious control, it must be noted that in conditions where respondents are motivated to be accurate, people are capable of actively disregarding their egocentric bias (Epley et al, 2004), which then raises questions about the source of projection and compensatory thinking.

Table 2: *Conceptual Differences Between Objective and Subjective Prevalence Measures*

Characteristics	Prevalence	Social Cognition	
Method	Network scale-up	Projective questioning / Third person questioning	
Estimation	Calculated from two answers given independently	Given as agreement ('most people do..'), proportion (%) or rating scale ('all, most, half, some, none') by the respondent; or choice in hypothetical situations	
Social context	Defined social network characteristics (e.g., close friends)	Undefined / Loosely set social environment (e.g., 'other in general' / 'others in a sport/country')	
Sampling	Ensure representativeness and avoid overestimation from social network overlap	Ensure representativeness Clean group boundaries (real groups)	
Involvement of the respondent	Extraneous [a]	Not involved / Unconcerned	Involved or Concerned
Construct	Prevalence estimate of the target behaviour	Outgroup projection Descriptive norms related to the target behaviour (perceived prevalence)	Ingroup projection Descriptive norms related to the target behaviour (perceived prevalence)
Inference	Indicative of the population the behaviour question is about	Indicative of the individual's or group of individuals' perception of the target-relevant social environment	Indicative of the Self (individual or group of individuals who answer the behaviour question)
Confounding factor	Affected by memory and recall	Based on the degree of beliefs/assumption of similarity of others to the individual regarding the target behaviour	
Bias	No	Yes	Yes

	Factual information	Perception with some degree of Self-referential bias (heuristics) Ease of retrieval of relevant autobiographical memories / activation of relevant self-concept	Egocentrically biased (projection of own onto others), distorted perception, also influenced by social desirability/undesirability of the behaviour, cognitive consistency and position (ingroup vs. outgroup; minority vs. majority)
Source	Knowledge	Heuristics fills in for lack of knowledge	The Self
Potential consequence of prevalence estimation	Strive for network balance may lead to involvement or can act as deterrence	Misperception can influence the behaviour (initiate or act as motivation)	Biased perception justifies and/or reinforce the behaviour

Note: [a] Involvement in the target behaviour is reflected in the proportion of friends involved in the same behaviour, but does not lead to distortion of the estimation.

Projective Questioning as Normative Estimation

The underlying cognitive process in projective questioning (PQ) is social projection, which is a judgemental heuristic that allows people to make intuitive judgements about ambiguous situations quickly and efficiently, but doing so at a risk of imposing bias on people's thinking process, fostering the egocentric view over objective judgements or potential alternatives (Kahneman & Frederick 2002). Systematically cataloguing factors that moderate the outcome of PQ, the meta analysis by Robbins and Krueger (2005) found that differential projection to in- and outgroup is robust across studies and is leading to cognitive and behavioural consequences, with only the true nature of the group (real vs. ad hoc) acting reliably as moderator variable. Thus social projection is an "egocentric inductive inference" in which process the self-referent information have greater cue weight over information from others and the self serves as focal point for social categorisation (Robbins & Krueger, 2005, p44). Because of this egocentric anchoring, results from PQ can be interpreted as declared descriptive norms; people's naturally biased perceptions of how people generally behave or feel in given situations (Aronson et al, 2010); but cannot be interpreted as objective prevalence estimation of the given attribute. Notably, biased estimation manifests in various degrees of under- or overestimation; whereas the underlying mechanisms is referred to as Uniqueness Bias (Goethals et al, 1991) and False Consensus Effect (Ross et al, 1977), respectively.

In the context of 'prevalence', PQ methodology has been tested whether it could be a valid method to capture the prevalence of sensitive issues (behaviour, views, attitudes, etc.). Being administered in conjunction with other prevalence estimation methods such direct questioning (DQ) and randomized response techniques (RRT) afforded multi-method comparison. One recent example is Ostapczuk and Musch (2011) who indirectly investigated the prevalence of negative 'attitude' toward people with disability using what they called 'most people projective questioning' (MPPQ). For the MPPQ part, the survey asked people's agreement with two questions individually (Do you think most people would feel uneasy in the presence of (1) physical / (2) mental disabilities?) then calculated the percentage of affirmative answers for each. The argument the authors put forward inferred that the outcome of the MPPQ reflects, (and in their case overestimates) the prevalence of negative attitudes, which in turn resulted in a distorted perception of social norms about disability. The overestimation was established by comparing MPPQ results to DQ and RRT. Whist the authors did not recommend MPPQ as a reliable method

for estimating the prevalence of socially sensitive issues or as a way of reducing social desirability bias in responding, the reasons for such inflations were not discussed. A very likely explanation was already suggested by Bégin and Boivin (1980) 30 years earlier noting that PQ assesses a different concept than DQ and RRT do in prevalence context, thus it is not a bona fide measure of prevalence.

In stark contrast to taking projected prevalence at face value, PQ in psychology stems from social projection, which is a phenomenon that refers to an unconscious assumption that one's own beliefs, attitudes and motivations are generally shared by others. Projective techniques utilise this when presenting deliberately ambiguous situations where respondents must fill the gap in order to complete the task. In the absence of information, it is assumed that in this process, a person uses his/her own (and thus egocentrically bias) views without being aware of doing so. More importantly for this chapter, social projection is also a tendency for biased perception of the prevalence of one's own behaviour among others. Social projection has been shown to lead to over- and underestimation as well as false consensus; and likely to be driven by different cognitive and motivational mechanism (Mullen & Hu, 1988). Projection depends on whether (1) the respondent is perceived to be part of the minority or majority, (2) the projection is made to the respondent's own group (ingroup) or to others (outgroup) and (3) the projected attribute is desirable or undesirable.

Because of the egocentric perceptual bias present in social projection, projected views are not (and should not!) be taken at face value as a prevalence estimate of the shared behaviour, thoughts or positions. Although seemingly similar to the projective methods discussed in the previous section, projective techniques detailed in this section aim to discover something about the target person through his/her perception of others. Whilst the distinction between network scale-up and the other projective techniques is unambiguous (based on exact knowledge in a well-defined network, independent of involvement), the lines between the different outcomes of projective questioning and their interpretation is blurred (Table 2). The separation of normative estimation and social projection is somewhat artificial, but nevertheless necessary because there is a difference between the two based on the relevance of the target behaviour or feelings to the respondent.

Priming

In addition to projective testing and similar interpretive methods traditionally employed to assess 'the unspoken', recent developments in cognitive methodology offer a host of new methods ranging from priming (Rasinski et al, 2005) and implicit association (Greenwald et al., 1998) through semi-projective techniques (Aidman, 1999) to performance based methods such as video-game embedded assessment protocols (Aidman, 2006; Aidman & Shmelyov, 2002). Priming is a phenomenon in which exposure to a stimulus, such as a word or image, influences how one responds to a subsequent, related stimulus. It is thought to occur when particular mental representations or associations are activated before a person carries out an action or task.

The literature on priming differentiate subliminal and supraliminal priming. In the case of subliminal priming, people are not aware of the prime, or how it might influence their behaviour (Elgendi et al, 2018; Blanchfield et al, 2014). In supraliminal priming, people are aware of the stimuli and often actively participate in a related task but without being aware of the purpose (James et al, 2011; Kettle et al, 2017).

Despite the demonstrated impact of priming in perceptions, such approach has a very limited application in doping behaviour research. Potential application of priming in doping behaviour research is multifaceted:

(1) Framing to test malleability of social cognitive measures: Does research framing, or a task that precedes the assessment exert influence on how participants respond?

For example, priming can be used to explore whether people respond to a question about doping use differently if it is phrased neutrally (have you used prohibited substances?) or in a negative judgmental frame (have you cheated by using prohibited substances?) or perhaps in a permissive way (have you levelled the playing field by using prohibited substances when you believed that your competitors did the same?). Another potential application is to embed the neutral question in a negatively or positively framed context to ascertain whether the context have influence on how people respond to the questions. A variation of this was demonstrated in a study by James et al (2011) which tested whether a single exposure knowledge-based information intervention led to increased knowledge and subsequently result in changes in beliefs and automatic associations regarding performance enhancements.

(2) Honesty priming to elicit truthful responses about sensitive/transgressive issues: Does 'thinking of honesty' make people be more honest when answering a question about such behaviour?

For example, studies can explore in experimental settings whether exposing participants to a cognitive task, which involves concentrating on 'honesty', enhance the level of admitted use of doping; or answering more truthfully to sensitive questions (Pashlet et al, 2013; Rasinski et al, 2005), enhance self-report validity (Vinski & Watter, 2012) or behave more honestly (Schorn & Maurhart, 2009). The challenge in this line of research is to determine what is 'more truthful'; and how far 'more truthful' is from being totally honest. As a rule of thumb and in the absence of an objective benchmark, it is generally assumed that 'higher is better'. That is, if a higher level of doping use is admitted under primed condition than in non-primed condition; then the higher prevalence is thought to be more valid.

Ethical consideration

Participation in all studies were voluntary and conducted with informed consent.
Depending on the study requirements, data were either collected anonymously, or fully anonymized after data collection (before data analysis). The research was approved by the Faculty Research Ethics Committee, Faculty of Science, Engineering and Computing, Kingston University (Appendix A).

Overview of the studies included in this report

This report summarizes findings from sixteen studies. Each study was conducted as a standalone piece of research and – in most cases - involved collecting data beyond what is reported here.

In this report, only data relevant to (1) explicit and implicit doping 'attitude', autobiographical implicit associations, other implicit social cognitive measures, (2) projective questioning and perceived prevalence; and (3) priming effect for testing malleability and honest responding are reported. Table 3 maps each study presented in this report to the target construct(s) or effect of interest.

Table 3: *List of studies included in this report*

Study	Focus	Page
1	Explicit and Implicit Assessments of 'Attitudes'	**34**
2	Malleability of implicit and explicit moral and functional attitudes toward doping	**52**
3	Predicting doping use from Implicit Association Tests	**68**
4	Piloting the Autobiographical Implicit Association Test (aIAT) and Social Network Analysis	**72**
5	Social Network Analysis with a team of American football players – shared views and values about doping in close friendship groups	**91**
6	Social projection and prevalence	**114**
7	Ingroup – outgroup bias in perceived prevalence estimations	**129**
8	Explicit and implicit normative prevalence of doping, drug and supplement use with honesty goal priming	**134**
9	Impact of honesty goal priming: synonym-test and worldsearch puzzle task	**142**
10	Single question measurements (self-esteem and social desirability)	**146**
11	Short form of the Performance Enhancement Attitude Scale (PEAS-8)	**153**
12	Reasons: Incentives & Deterrence	**156**

The studies are grouped by constructs and methods for reporting. In some studies, multiple research questions were investigated. The grouping and order presented in Table 3 are based on the primary focus of the study, and do not reflect the order in which these studies were conducted.

Figure 2 signposts studies to the key research questions.

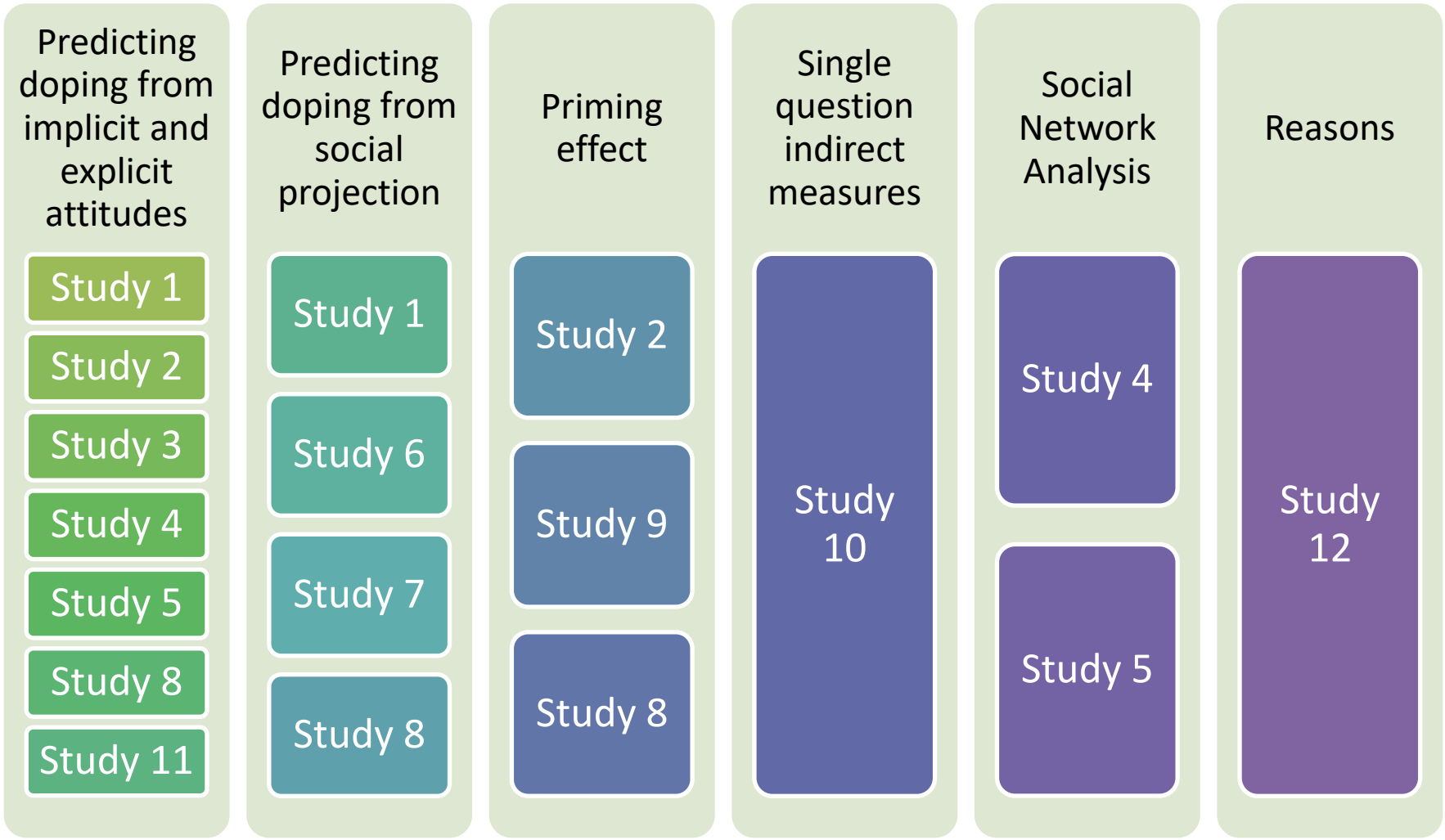


Figure 2: *Map of research questions and relevant studies*

Completed Work

Study 1: Explicit and Implicit Assessments of 'Attitudes'

Aims

The primary aims of this project are to investigate;

i) the effects of social desirability bias on different self-reported measurements; and

ii) ii) the feasibility of gaining unbiased (or at least less affected) information using indirect measures.

Methods

Participants

The sample comprised of 150 club level competitive athletes. Almost half of the sample (44.7%) were male. The mean age was 21.37 ± 2.46 years. Sports represented in the sample, in decreasing order, were track & field (18.7%), basketball (16.0%), handball (10.7%), football (7.3%), triathlon (6.7%), gymnastics (5.3%), volleyball (4.0%), aerobic (2.7%), water polo (2.7%), equestrian (2.0%), cross country running (1.3%), dance (1.3%), ice hockey (1.3%), tennis (1.3%), acrobatic dance, badminton, biathlon/cross ski, boxing, cheerleading, conditioning, cycling, diving, futsal, judo, karate, kayak, kendo, kickbox, mountain bike, ninjutsu, orienteering, rafting, rope jumping, sailing, speedskating and other (0.7% each).

Measures

The Brief Implicit Association Test format was used. A matric of implicit assessments and social cognitive measures is offered in Appendix B. The Brief Implicit Association Test (BIAT, Sriram & Greenwald, 2009) consists of 2 trial blocks with 4 categories, 4 exemplars in each. BIAT is a versatile tool that affords various measures with the same 2 x 2 sets of targets and attributes, depending on the combination of focal and non-focal pairs. Contrary to the classic IAT, the BIAT only focuses on 2 (focal) categories in each test block. Unlike the standard version, one of the four categories although presented in the BIAT is a non-focal category so participants are never asked to focus or pair this category with another. At the start of each block, 2 category labels and the stimuli belonging to these categories representing one target and one attribute concept (e.g.

flowers [target] and pleasant [attribute]). Participants are instructed to press the focal response key (right key, typically the 'I' key on the keyboard) if any stimuli appear on the screen belongs to one of the two set categories; and press the non-focal key (the left response key, usually assigned to 'E' on the keyboard) for 'anything else' (e.g. stimuli for insects [target] and unpleasant [attribute]).

Figure 2 illustrates the flexibility of the BIAT setup. Depending on the pairing and whether a target concept or an attribute is set as the non-focal category, the BIAT measures different constructs. When two targets are contrasted using the same (usually positive) attribute, the BIAT outcome is a relational association (e.g., preference [*good*] for *supplements* over *doping* or vice versa). When two attributes are used in combination with a single target category, the BIAT measures the strength of the attribute valence (e.g., *doping* is more *good* than *bad*, or vice versa).

As Figure 3 shows, depending on which three of the four categories are selected to be focal, the BIAT can be used as a shortened classic IAT (relational target association with one attribute, e.g., flowers - pleasant vs. insects - pleasant) or as a single category IAT (attribute association valence; e.g., insects – pleasant vs. insects unpleasant).

	Target 1	Target 2	Attribute 1 (+)	Attribute 2 (-)
Attribute association valence	focal	non-focal	focal	focal
Relational target association	focal	focal	focal	non-focal

CLASSIC BRIEF IAT (Relational target association)	SINGLE-CATEGORY VARIATION OF THE BRIEF IAT (Attribute association valence)
Target 1 + Positive attribute = FOCAL	Positive attribute + Target category = FOCAL
Target 2 + Positive attribute = FOCAL	Negative attribute + Target category = FOCAL

Figure 3: *Brief Implicit Association Test (BIAT) Variations*

In terms of structural characteristics, a typical BIAT consists of 48 trials in 2 blocks where each block contains 24 trials (8 practice followed by 16 trials). Each stimulus appears 4 times in the

trials and each appearing twice for the 8 practice trials. The order of the blocks within each test is counterbalanced; order of the target and, if more than one test is used at once, the order of the tests is randomised. Through a validated algorithmic score, raw data is transformed into D-scores (Greenwald, Nosek & Banaji, 2003).

The test set-ups, category labels and stimuli words for these seven tests are provided in Tables 4 and 5. Tests were administered in Hungarian. The Hungarian words are presented in brackets.

Table 4: *The set-up of the Brief IATs*

Test	IAT Effect
Doping affective	[Unpleasant+Doping] - [Pleasant+Doping]. Altitude training is non-focal.
Doping cognitive	[Foolish+Doping] + [Wise+Doping]. Altitude training is non-focal.
Doping self-referential	[Doping+Not Me] - [Doping+Me]. 'Supplements' is non-focal.
Doping utility	[Disadvantageous+Doping] - [Advantageous+Doping]. 'Supplements' is non-focal.
Illicit drug / Doping self-referential	[Illicit drug+Not Me] - [Illicit drug+Me]. 'Doping' is non-focal.
Illicit drug automatic motivation	[Avoid+Illegal substance] - [Approach+Illegal substance]. 'Legal substance' is non-focal.
Doping automatic motivation	[Avoid+Doping substance+] - [Approach+Doping substance]. 'Supplements' is non-focal.
Illicit drug affective	[Unpleasant+Illegal substance] - [Pleasant+Illegal substance]. 'Legal substance' is non-focal.
Illicit drug cognitive	[Foolish+Illegal substance] - [Wise+Illegal substance]. 'Legal substance' is non-focal.
Self-image	[Desirable behaviour+Me] - [Undesirable behaviour+Me]. 'Not me' is non-focal.

Table 5: *Category Labels and Stimuli of the Brief IAT Tests*

	Category label	Stimuli
Targets	Doping (Dopping)	steroid, drug, stimulant, hormone (szteroid, tesztoszteron, stimuláns, hormon)
	Altitude training (Magaslati edzés)	oxygen, mountain, acclimatisation, elevation (oxigén, hegy, alkalmazkodás, magaslat)
	Supplements (Táplálék-kiegészítő)	vitamin, ginseng, mineral, calcium (vitamin, ginseng, ásványok, kálcium)
	Illegal substance (Tiltott [élvezeti szer])	cocaine, marijuana, speed, ecstasy (kokain, marihuána, speed, extasy)
	Legal substance (Nem tiltott [élvezeti szer])	coffee, beer, Red Bull, cigarettes (kávé, sör, Red Bull, cigaretta)
Attributes	Pleasant (Kellemes)	beautiful, happy, fun, friendly (gyönyörű, boldog, vidám, barátságos)
	Unpleasant (Kellemetlen)	sad, ugly, hostile, nasty (szomorú, ronda, rosszindulatú, csúnya)
	Foolish (Ostoba)	stupid, dumb, idiotic, unwise (idióta, oktalan, buta, esztelen)
	Wise (Bölcs)	sensible, clever, smart, intelligent (értelmes, okos, eszes, intelligens)
	Me (Én)	I, myself, mine, my (személyem, magam, nekem, enyém)
	Not me (Nem én)	they, their, them, others (ők, övék, nekik, mások)
	Advantageous (Előnyös)	useful, beneficial, worthy, rewarding (hasznos, jótékony, érdemes, segitő)
	Disadvantageous (Hátrányos)	useless, worthless, unrewarding, harmful (haszontalan, érdemtelen, káros, kártékony)
	Approach (Megközelít)	advance, closer, toward, forward (odamegy, halad, közeledik, elér)
	Avoid (Elkerül)	away, escape, leave, withdraw (távolodik, elmegy, visszavon, elmenekül)
	Desirable behaviour (Kívánatos [magatartás])	honesty, helpfulness, care, giving (őszinteség, segítőkészség, törődés, önzetlenség)
	Undesirable behaviour (Nem kívánatos [magatartás])	cheating, lying, stealing, ignorance (csalás, hazugság, lopás, önzés)

Procedure

Volunteers were completed ten Brief IATs in three blocks (4+3+3) with rest between the blocks. The order of the tests was randomised within blocks and order of the blocks was counterbalanced to avoid learning effect.

Results

In the sample of 150 athletes, of whom 25 were tested positive for common illegal drugs (16.7%) and 14 (7.8%) were tested positive for at least one commonly used performance enhancing drugs (mainly anabolic steroids). Only two of these positive samples were for both doping and social drug. There was only one participant who admitted using doping, who also admitted having used social drugs. Only two of the 25 who were tested positive for recent use of social drugs admitted doing so.

Thirteen samples were tested positive for common illegal drugs (8.7%) and 14 samples (9.3%) were tested positive for at least one commonly used performance enhancing drugs (anabolic steroids). There was only one participant with both types of drugs. None but one admitted using doping.

There was very little congruence between self-reported recent (past 3 months) use of doping or illicit drugs. Of the 180 athletes, only one admitted using doping (in the past 3 months and ever); whereas athletes were more open about illicit drug use (35 admitted life-time use, of 10 of whom also being recent users).

Differences in BIAT measurements are detailed in Tables 6 - 8 and Figures 4 - 7. **Based on d-scores and differences in d-scores (effect sizes), the best performing BIAT variant across both drug categories was the affective pleasant/unpleasant version.**

Table 6: *Differences in the Brief IATs Between Doping Users and Non-users; if Behaviour Indexed on Hair-Analysis*

Brief Implicit Association Test	Range	Test statistics MW-U (p)	Effect size (d)
Avoid + doping	-1.0250 - 1.2190	1303.00 (.411)	0.2463
Avoid + illegal drug	-1.3650 - 1.4340	1410.50 (.794)	0.0820
Doping + foolish	-.9390 - 1.1590	1438.50 (.909)	0.0335
Illegal + foolish	-1.0500 - 1.1750	1247.00 (.265)	0.2586
Doping + not me	-1.0580 - 1.3890	1318.50 (.459)	0.1770
Social drug + not me	-.9310 - 1.1270	1261.00 (.298)	0.2577
Doping + unpleasant	-1.0490 - 1.0700	1163.00 (.121)	0.3268
Illegal + unpleasant	-.9970 - .9580	1261.50 (.299)	0.2432
Disadvantageous + doping	-1.4890 - .9110	1325.00 (.480)	0.1851
Desirable + me	-1.4530 - 1.1240	1340.00 (.530)	0.0884

Note: identified doping users are also deniers; effect sizes were calculated taking the unequal sample sizes into account using http://www.campbellcollaboration.org/escalc/html/EffectSizeCalculator-SMD2.php

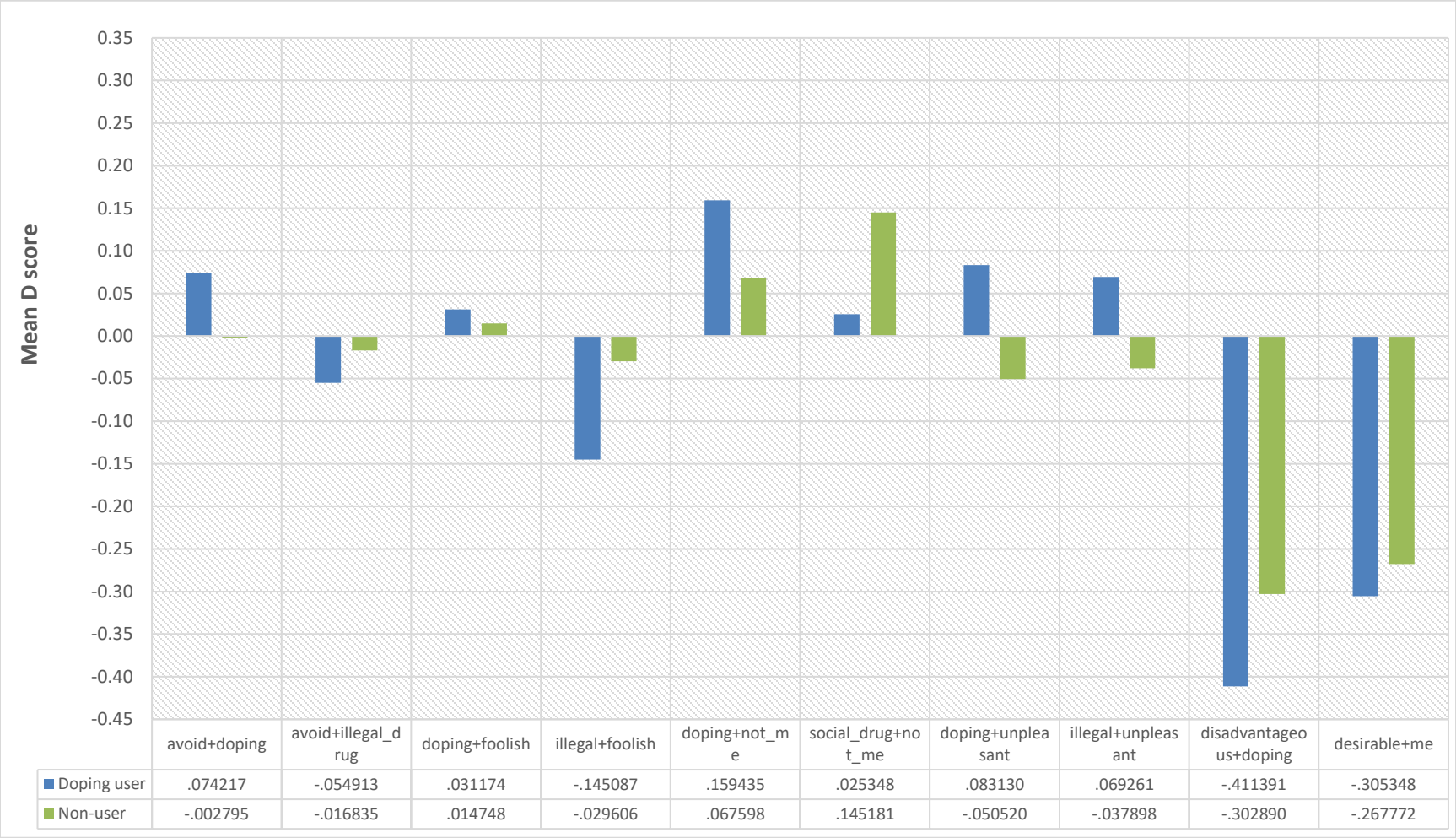
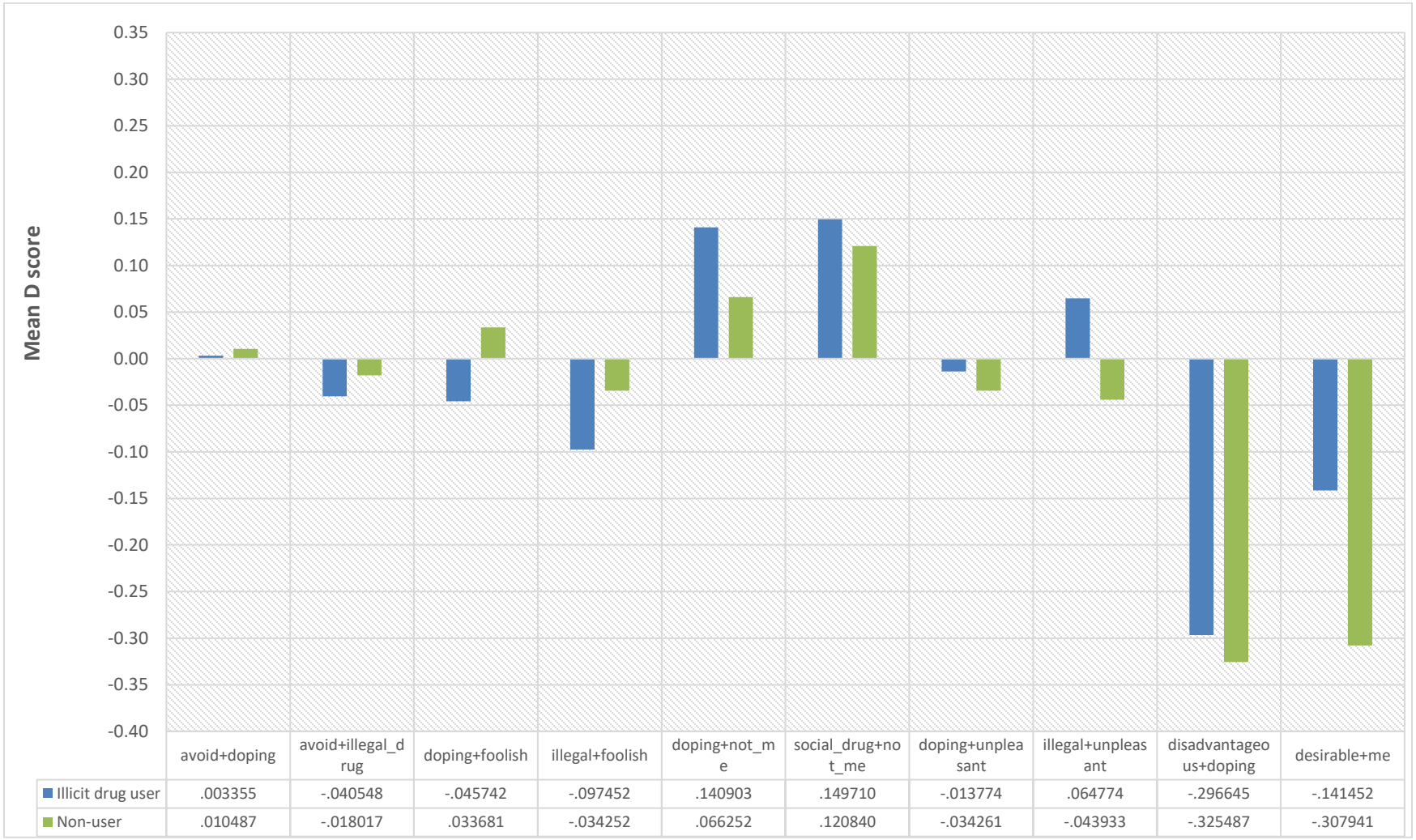


Figure 4: *D-scores by doping user groups based on hair analysis. Note: (1). Definite doping. Following a conservative approach, elevated EPO and testosterone levels were excluded. (2) Interpretation of the BIAT scores are: negative D score shows the tendency toward the pair shown in the headings; positive D score shows the tendency for the opposite pair. Note: error bars are omitted for 'readability'.*



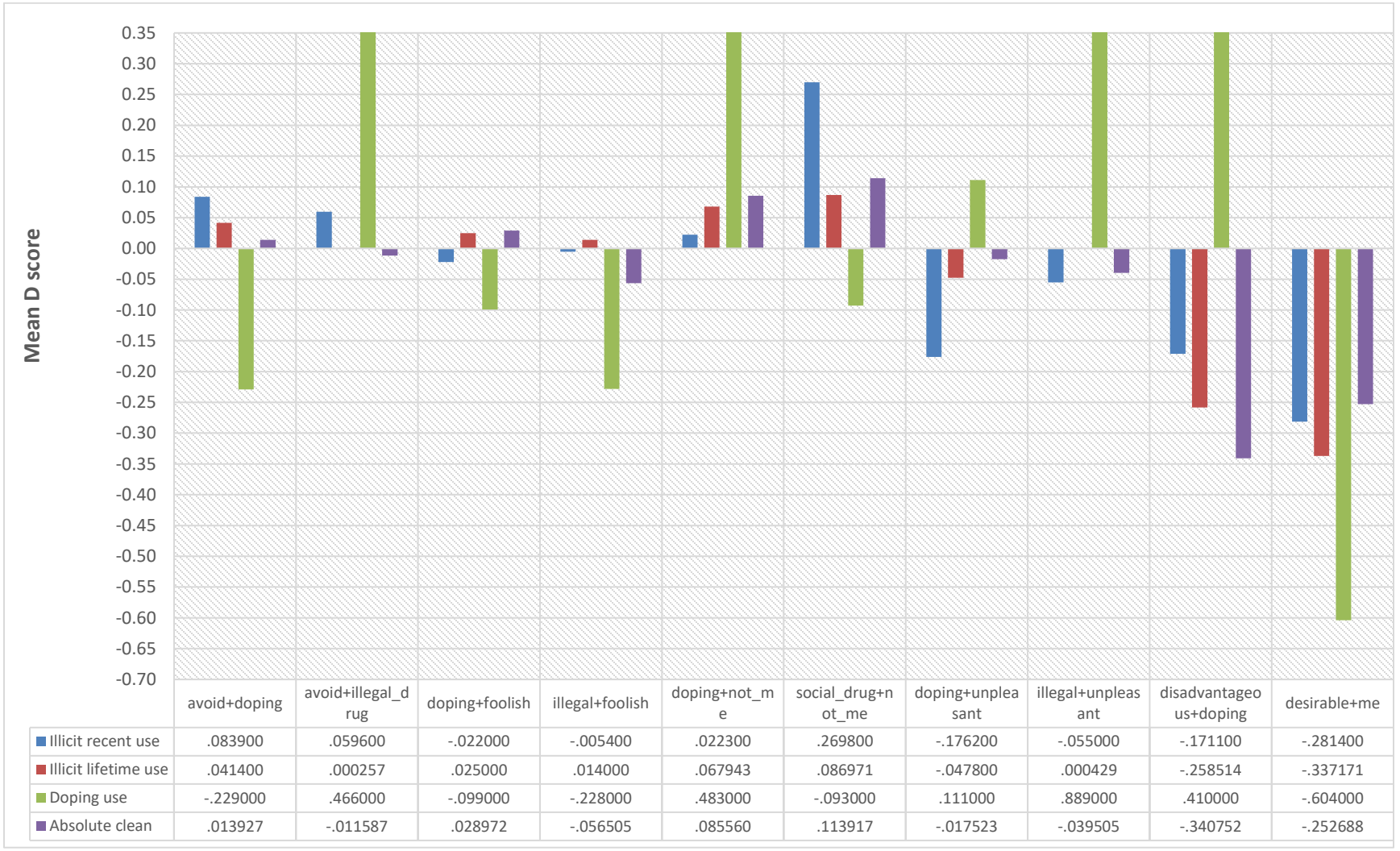
	avoid+doping	avoid+illegal_drug	doping+foolish	illegal+foolish	doping+not_me	social_drug+not_me	doping+unpleasant	illegal+unpleasant	disadvantageous+doping	desirable+me
Illicit drug user	.003355	-.040548	-.045742	-.097452	.140903	.149710	-.013774	.064774	-.296645	-.141452
Non-user	.010487	-.018017	.033681	-.034252	.066252	.120840	-.034261	-.043933	-.325487	-.307941

Figure 5: *D-scores by illicit user groups based on hair analysis. Interpretation of the BIAT scores are: negative D score shows the tendency toward the pair shown in the headings; positive D score shows the tendency for the opposite pair. Note: error bars are omitted for 'readability'.*

Table 7: *Differences in the Brief IATs between doping users and non-users; if behaviour is indexed on hair-analysis*

Brief Implicit Association Test	Range	Test statistics MW-U (p)	Effect size (d)
Avoid + doping	-1.0250 - 1.2190	1750.00 (.661)	0.0159
Avoid + illegal drug	-1.3650 - 1.4340	1839.00 (.980)	0.0484
Doping + foolish	-.9390 - 1.1590	1658.50 (.388)	0.1629
Illegal + foolish	-1.0500 - 1.1750	1642.00 (.347)	0.1412
Doping + not me	-1.0580 - 1.3890	1745.50 (.646)	0.1440
Social drug + not me	-.9310 - 1.1270	1783.00 (.775)	0.0742
Doping + unpleasant	-1.0490 - 1.0700	1835.50 (.967)	0.0498
Illegal + unpleasant	-.9970 - .9580	1619.00 (.295)	0.2470
Disadvantageous + doping	-1.4890 - .9110	1759.00 (.691)	0.0609
Desirable + me	-1.4530 - 1.1240	1511.00 (.122)	0.3968

Note: Effect sizes were calculated taking the unequal sample sizes into account using: http://www.campbellcollaboration.org/escalc/html/EffectSizeCalculator-SMD2.php



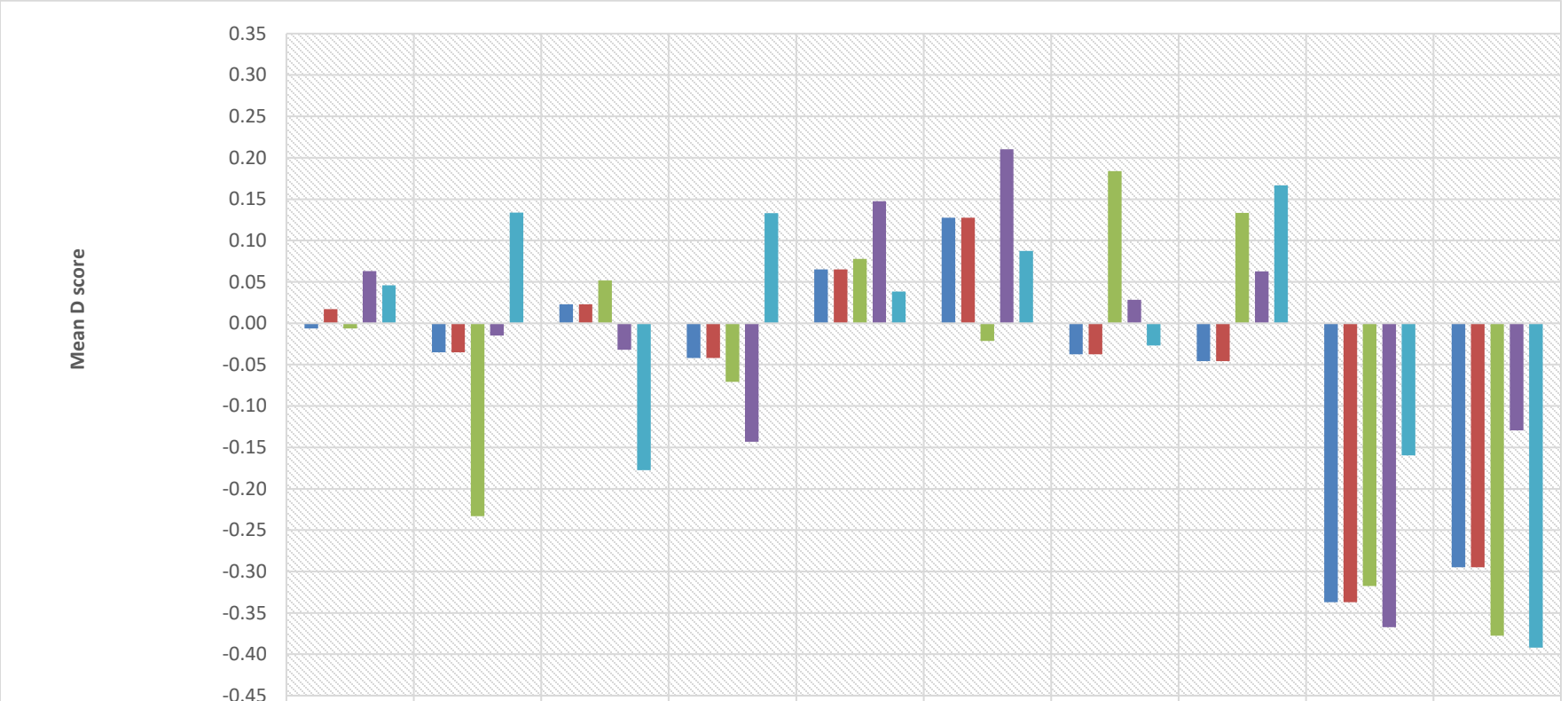
	avoid+doping	avoid+illegal_drug	doping+foolish	illegal+foolish	doping+not_me	social_drug+not_me	doping+unpleasant	illegal+unpleasant	disadvantageous+doping	desirable+me
Illicit recent use	.083900	.059600	-.022000	-.005400	.022300	.269800	-.176200	-.055000	-.171100	-.281400
Illicit lifetime use	.041400	.000257	.025000	.014000	.067943	.086971	-.047800	.000429	-.258514	-.337171
Doping use	-.229000	.466000	-.099000	-.228000	.483000	-.093000	.111000	.889000	.410000	-.604000
Absolute clean	.013927	-.011587	.028972	-.056505	.085560	.113917	-.017523	-.039505	-.340752	-.252688

Figure 6: *Mean D-scores based on self-reports. Note: doping use n = 1. Interpretation of the BIAT scores are: negative D score shows the tendency toward the pair shown in the headings; positive D score shows the tendency for the opposite pair. Note: error bars are omitted for 'readability'.*

Self-reported information was only available for social drugs. Corroborating self-reported abstinence with hair analysis (Table 8) revealed that 16 participants (10.7%) admitted current use, 13 (8.7%) admitted past but denied current use, 24 (16.0%) denied current and past use with further 5 (3.3%) denied current but admitted past use. (Note that the discrepancy between hair analysis positives and self-admitted use is possible. A single exposure of social drugs or use of drugs not tested for can account for this discrepancy). The remaining 92 participants (61.2%) were abstinent of social drugs (at least 3 months prior to the data collection).

Table 8: *Differences in the Brief IATs between social drug user groups (based on hair-analysis corroborated self-reports)*

Test	KW-H (p)	Effect size (partial η^2)
Avoid + doping	0.173 (.996)	.004
Avoid + illegal drug	8.202 (.084)	.039
Doping + foolish	1.441 (.837)	.010
Illegal + foolish	3.222 (.521)	.016
Doping + not me	0.221 (.994)	.004
Social drug + not me	2.021 (.732)	.014
Doping + unpleasant	6.396 (.171)	.058
Illegal + unpleasant	5.569 (.234)	.041
Disadvantageous + doping	1.959 (.743)	.013
Desirable + me	2.573 (.632)	.029



	avoid+doping	avoid+illegal_drug	doping+foolish	illegal+foolish	doping+not_me	social_drug+not_me	doping+unpleasant	illegal+unpleasant	disadvantageous+doping	desirable+me
Clean	-.006326	-.035152	.022783	-.041913	.065152	.127522	-.037435	-.045652	-.336935	-.294859
Admits current and past	.016938	-.035152	.022783	-.041913	.065152	.127522	-.037435	-.045652	-.336935	-.294859
Admits past but not current	-.006308	-.233000	.051615	-.070846	.077923	-.021308	.183769	.133308	-.317538	-.377462
Denies all	.063125	-.014958	-.032042	-.143125	.147542	.210208	.028500	.062750	-.367375	-.129583
Denies recent but admits past	.046000	.133600	-.177400	.133000	.038200	.087400	-.027000	.166800	-.159800	-.392000

Figure 7: *Mean D-scores based on hair-analysis corroborated self-reports for social drugs. Interpretation of the BIAT scores are: negative D score shows the tendency toward the pair shown in the headings; positive D score shows the tendency for the opposite pair.*

The results displayed in Figure 7 provide support to the observation made in the previous WADA funded project and published in Petróczi et al 2010 and 2011. Namely, the IAT performance was similar in those who admit doping and those who clean (both are exhibiting 'harmony' between behaviour and related cognition); but distinctly (if not statistically) different from those who denied doping.

Among the doping and illicit drug BIAT variants, the affective pleasant/unpleasant version performed the best in both drug categories. The other BIATs were: approach/avoidance, foolish/wise, self-referential Me/Not me for doping and social drugs; and advantageous/disadvantageous for doping only.

Relationship between and within implicit and explicit measures of 'attitude'

Correlation within the implicit measures were small (all $|r| < .2$ but for the Doping-unpleasant and Illegal drug - unpleasant pairing, where $r = .245$; $p = .002$). Reassuringly, the doping-related BIATs showed stronger and more meaningful correlation with the explicit doping attitude (PEAS).

Correlation coefficients are given in Table 9.

The small but still significant correlation between PEAS and illicit drug BIATs may be partially explained by the fact that some PEAS items contain reference to recreational drugs in a sporting context.

The strong observed correlation between explicit doping attitude and the self-referenced IAT in the user group, with the absence of strong correlation in the self-declared non-user subsample supports the findings reported in Petroczi et al, 2010; 2011.

Table 9: *Correlation coefficients between Explicit and Implicit Doping and Illicit drug 'Attitude' Measures (r, p and n, respectively)*

		Doping					Illicit drugs				
	PEAS	Foolish - Wise	Me - Not me	Desirable - Undesirable	Pleasant - Unpleasant	Beneficial - Detrimental	Foolish - Wise	Me - Not me	Desirable - Undesirable	Pleasant - Unpleasant	Beneficial - Detrimental
PEAS	-	**-.416**	**-.349**	**-.388**	.136	**-.201**	**-.276**	**-.169**	**-.188**	**-.167**	**-.330**
		.000	**.000**	**.000**	.109	**.018**	**.001**	**.047**	**.027**	**.050**	**.000**
		141	**138**	**139**	140	**138**	**140**	**138**	**138**	**138**	**140**
Avoid + doping	.105	**-.175**	**-.205**	-.009	-.085	.000	-.117	-.056	-.051	-.052	-.132
	.217	**.033**	**.013**	.911	.304	1.00	.155	.499	.537	.529	.108
	141	**150**	**147**	148	149	147	149	147	147	147	149
Avoid + illegal drug	-.010	.098	.129	.032	**-.260**	-.001	-.038	-.118	-.082	-.014	-.108
	.909	.231	.121	.701	**.001**	.993	.648	.154	.323	.865	.192
	141	150	147	148	**149**	147	149	147	147	147	149
Doping + foolish	.130	.101	-.022	-.138	.016	-.024	-.125	**-.191**	-.121	-.037	-.154
	.125	.221	.791	.095	.850	.774	.130	**.020**	.146	.655	.060
	141	150	147	148	149	147	149	**147**	147	147	149
Illegal + foolish	.161	-.041	-.095	-.130	.105	-.035	-.052	-.059	-.111	.032	-.155
	.057	.619	.250	.114	.201	.678	.532	.481	.182	.704	.059
	141	150	147	148	149	147	149	147	147	147	149
Doping + not me	-.053	-.038	-.036	-.065	-.119	.031	.083	-.020	.059	.085	-.086
	.532	.645	.667	.434	.147	.706	.316	.810	.478	.305	.298
	141	150	147	148	149	147	149	147	147	147	149
Illicit drug + not me	**.179**	-.069	-.155	.011	.099	-.014	.009	.124	.108	.128	.016
	.033	.400	.062	.893	.230	.862	.916	.134	.192	.123	.842
	141	150	147	148	149	147	149	147	147	147	149
Doping + unpleasant	-.023	.117	.025	.067	-.017	-.009	.026	.002	.061	.060	.001
	.783	.155	.765	.417	.833	.916	.755	.981	.464	.469	.986
	141	150	147	148	149	147	149	147	147	147	149

Table 9 (cont): *Correlation coefficients between Explicit and Implicit Doping and Illicit drug 'Attitude' Measures (r, p and n, respectively)*

	Doping						Illicit drugs					
	PEAS	**Foolish - Wise**	**Me - Not me**	**Desirable - Undesirable**	**Pleasant - Unpleasant**	**Beneficial - Detrimental**	**Foolish - Wise**	**Me - Not me**	**Desirable - Undesirable**	**Pleasant - Unpleasant**	**Beneficial - Detrimental**
Illegal drug + unpleasant	.159	-.136	-.264	-.129	.077	-.108	-.096	-.084	-.100	-.068	-.025
	.059	.098	.001	.118	.350	.195	.246	.312	.228	.414	.758
	141	150	147	148	149	147	149	147	147	147	149
Desirable + me	-.035	-.026	-.098	.103	**.254**	.021	-.023	.020	.042	-.145	.016
	.684	.754	.240	.212	**.002**	.798	.781	.811	.612	.080	.845
	141	150	147	148	**149**	147	149	147	147	147	149
Disadvantageous + doping	-.059	-.013	-.048	-.078	.054	.157	.012	-.028	-.046	.007	.029
	.485	.879	.561	.348	.510	.057	.885	.740	.584	.931	.729
	141	150	147	148	149	147	149	147	147	147	149

Social projection: Perceived prevalence of doping

Projected use for doping was M = 11.93%, SD = 16.06%. It is surprisingly low compared to the figures obtained from other studies and literature precedence. In contrast, social drug use among athletes was estimated at 52.54 ± 28.41%. Keeping to the pattern of the False Consensus Effect, those who admitted having experience with social drugs gave higher but not statistically different estimates for social drugs use compared the abstinent athletes (58.37 ± 28.76% and 50.75 ± 28.19%, respectively; $F(1,147) = 1.941$, $p = 0.116$). The estimation from the only person who admitted doping was 20%. There was no difference in doping estimations between those who denied doping and 'clean' athletes ($F(1,147) < 0.001$; $p = .987$). Conversely, there was no significant difference in social drug use estimation by user status based on hair analysis ($F(1,147 = 0.465$; $p = .496$).

Psychometric properties of PEAS

General doping attitude was assessed with the full 17-item PEAS. The internal reliability consistency (Cronbach alpha) was 0.712.

Means and standard deviations in total and by gender and self-admitted doping use are shown in Table 10. The difference between males and females was statistically significant for the full PAES ($t(139) = 3.277$, $p = .001$). The small observed difference by detected doping use (based on hair analysis) did not reach statistical significance ($t(139) = 0.546$, $p = .586$). Interestingly those who tested positive for prohibited substance(s) exhibited less permissive attitude toward doping.

Table 10: *PEAS score by gender and self-admitted doping use (PAES sums and scale average [sum/number of items])*

	Total	Male	Female	Doping use (based on hair analysis) N = 13	No doping use (based on hair analysis) N = 128
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Full PEAS (17-item)	34.95 (10.30) 2.06 (0.61)	37.92 (11.05) 2.23 (0.65)	32.41 (8.92) 1.91 (0.52)	33.46 (7.94) 1.97 (0.47)	35.10 (10.52) 2.06 (0.62)

PAES score for self-admitted users vs. non-users cannot be compared due to the lack of data. Only one athlete admitted experience with doping (who scored visibly higher on PEAS than self-declared non-users ($M = 49.00$ vs. $M = 34.85$ (10.27)). The discrepancy between self-admitted and detected doping use suggests that the PEAS score for the self-reported group was contaminated by those who used doping but denied.

Hungarian translation of the PAES items. Items of the short version (PEAS-8) are in bold.

1. **Dopping kell ahhoz, hogy valaki versenyezzen. [Doping is necessary to be competitive.]**
2. **A dopping nem számít csalásnak, mivel mindenki csinálja. [Doping is not cheating since everyone does it.]**
3. A sportolók gyakran veszítenek időt a sérülések miatt a dopping segít a felépülésben. [Athletes often lose time due to injuries and drugs can help to make up the lost time.]
4. **Csak az eredmény számít, nem az, hogy hogyan értük el. [Only the quality of performance should matter, not the way athletes achieve it.]**
5. A sportolók rá vannak kényszerítve a teljesítményfokozó szerek használatára. [Athletes (in my sport) are pressured to take performance-enhancing drugs.]
6. A szabadidős drogokat használó sportolók, azért használják ezeket a szereket, mert segít nekik a sportban [Athletes who take recreational drugs, use them because they help them in sport situations.]
7. **A sportolóknak nem kéne bűnösnek érezniük magukat a szabályok megszegéséért és a teljesítményfokozók használatáért. [Athletes should not feel guilty about breaking the rules and taking performance-enhancing drugs.]**
8. **A doppinggal kapcsolatos rizikó eltúlzott. [The risks related to doping are exaggerated.]**
9. A sportolóknak a sportot kivéve nincs más alternatív karrier lehetőségük. [Athletes have no alternative career choices, but sport.]
10. A szabadidős drogok segítik a magas szintű edzésmunkát és a versenyzést.[Recreational drugs give the motivation to train and compete at the highest level.]
11. **A dopping elkerülhetetlen a versenysportban. [Doping is an unavoidable part of the competitive sport.]**
12. A szabadidős drogok segítenek az unalom leküzdésében az edzések alatt. [Recreational drugs help to overcome boredom during training.]
13. **Nincs különbség a drogok az üvegszálas rúd, és a speedy fürdőruhák között, mindet teljesítményfokozásra használják. [There is no difference between drugs, fiberglass poles and speedy swimsuits that are all used to enhance performance.]**
14. A médiának kevesebbet kéne beszélnie a doppingról. [Media should talk less about doping.]
15. A média aránytalanul felfújja a dopping témát. [The media blows the doping issue out of proportion.]

16. A rendszeres edzés következtében kialakuló egészségi problémák és sérülések éppen annyira rosszak, mint a dopping. [Health problems related to rigorous training and injuries are just as bad as from doping.]
17. **A teljesítményfokozó szerek legalizálása hasznára lenne a sportnak. [Legalizing performance enhancements would be beneficial for sport.]**

Study 2: Malleability of implicit and explicit attitude – moral vs. functional attitudes toward doping

Aims

The aim of this study was to investigate the mental representations of performance enhancing substances in athletes and non-athletic comparison sample, focusing on the functional vs. moral distinction. Specifically, this study was set out to test whether:

H_1: there is a difference in mental representations of doping between athletes and non-athletic controls;

H_2: changing the research frame would result in a congruent change in the implicit doping associations in the same respondent; and

H_3: this effect can be influenced by frame-relevant priming.

It was expected that mental representation drug-using athletes or gym patrons hold about doping substances are more closely aligned with functionality than morality; and that metal representation of performance enhancing drugs in nonathletic controls is more align the prevailing moralized anti-doping messages.

Methods

Participants

Forty-eight undergraduate sport and exercise science students (70.8% male, mean age of 21.62 ± 2.36 years) participated in this study. The majority (79.2%) of the sample participated in sport at some level with university and club level dominating. Students participated in the study received no compensation for participation but exercise was presented as part of their respective research method classes and thus followed by a brief lecture on implicit assessment as an indirect method.

Measures[2]

The study used a combination of implicit and explicit measures. The concept of moral vs. functional frames emerged from previous studies and literature, mainly from studies employing qualitative methodology. The target categories (doping and nutrition [non-focal]) were set to represent behaviours related to substances with as much similarity as possible (i.e., taking a substance is deliberate, goal oriented behaviour that is not part of the everyday routine outside 'performance enhancement' as drinking tea or eating healthy food would be). Stimuli were selected to avoid

[2] The scripts for the two doping BIATs (MF-BIAT and FF-BIAT) for this study were set up by Saira Khan who also contributed to data collection, along with Ricky James (both were at Kingston University London at the time of the study).

overlaps. The attribute category names were set to contrast the 'moral' aspect in two different reference frames (against ethical and against performance). Stimuli for MF-BIAT Attributes 1 & 2 (and used in FF-BIAT Attribute 1) were selected in pairs (i.e., an adjective and its antonym such as 'right' and 'wrong'). The stimuli for performance attribute category was set to be neutral, avoiding judgemental connotation. This is the first empirical application of these BIATs.

Implicit measures included two attribute association valence Brief IATs, one using moral (MF-BIAT) and the other one using functional frame (FF-BIAT). Stimuli for each test are given in Table 11. Target stimuli were identical in the two BIATs. Stimuli for 'unethical' in the MF-BIAT and 'principle' in the FF-BIAT were identical but used under different category labels. Non-focal category was always instructed as 'everything else'.

Table 11: *Moral/Immoral and Functional/Moral categories and stimuli*

Test version		Category label	Stimuli
	Target 1:	Doping	steroid, drug, stimulant, hormone
	Target 2 (non-focal):	Nutrition	vitamin, mineral, protein, superfood
MF-BIAT	Attribute 1:	Unethical	shameful, wrong, unfair, cheat
	Attribute 2:	Ethical	honest, principled, fair, right
FF-BIAT	Attribute 1:	Principle	shameful, wrong, unfair, cheat
	Attribute 2:	Performance	progressing, increasing, gaining, improving

The BIATs consisted of two trial blocks with four categories, four exemplars in each. Each test consisted of 112 trials in four blocks where each test block contains 20 trials (four practice followed by 16 trials). Each stimulus appeared four times in the trials and each appearing twice for the practice blocks and once for the practice trials (Table 12).

The order of the test blocks within each test is counterbalanced within the group; order of the attribute/target was randomised.

Table 12: *The test setup for MF-BIAT and FF-BIAT*

		Stimuli	Reps.	Pract.	Trials	All
Practice block 1	Targets	4	2	8	-	8
Practice block 2	Attributes	4	2	8	-	8
Test block 1	Target 1 + Attribute 1	8	3 each	8	16	24
Test block 2	Target 1 + Attribute 2	8		8	16	24
Test block 3	Target 1 + Attribute 1			8	16	24
Test block 4	Target 1 + Attribute 2			8	16	24
				48	64	112

Explicit measures were taken via a self-reported questionnaire, completed online using surveymonkey. Explicit attitude was measured via four semantic differential items. "DOPING IS..." statement was answered on a 10-point scale with endpoints anchored as ethical/unethical; beneficial/detrimental; justifiable/unjustifiable and fair/unfair. Scoring were reversed for data analysis so higher score represent more positive attitude toward doping (α = .802).

Participants also completed the short form of the Performance Enhancement Attitude Scale (PEAS, Petroczi, 2002; Petroczi & Aidman, 2009) and were asked to rate their agreement with eight statements on a 6-point Likert-type scale anchored as strongly disagree (1) to strongly agree (6). Of the eight statements, 3 contained typical arguments for doping (α = .636): "Without doping, many fantastic sport records would not exist", "Taking doping is justifiable if others are also taking it", and "Medical, psychological and social support should be given to athletes to use doping safely"; whereas 5 items were typical anti-doping arguments (α = .695): "Doping ruins modern sport", "Doping is a shortcut for lazy athletes"; "Doping cannot be justified on any grounds", "Athletes can reach their athletic potential without doping", and "Athletes with doping should be banned from sport for life". High score shows agreement with the general tone of being pro- or anti-doping, respectively. The PEAS is a previously validated 17-item, unidimensional general doping attitude scale, scored on a 6-point Likert-type scale anchored as strongly disagree (1) to strongly agree (6). Scores were reversed before data analysis so the higher score would indicate a more lenient attitude toward doping (α = .849). All statements scored on the 6-point agreement scale were presented in a single list with the order randomised for each respondent.

An additional two questions were related to respondents' views regarding the 'legal' status of performance enhancements (α = .736): "Doping should be allowed to top level athletes" and "Doping should be allowed for all athletes at any level if they wish to use it". The higher score again shows stronger agreement.

Finally, participants were asked if they ever used a prohibited performance enhancing substance; and if not, have they ever considered using a prohibited performance enhancing substance.

Age, gender, level of sport involvement (club/country/regional/national/ international/university/none) and type of sport where applicable were recorded.

Priming condition was achieved by a short reading task (Table 13), followed by a manipulation check as part of the explicit assessment.

Table 13: *Priming reading task for the three conditions*

Positive frame (functional) 324 words	*A charitable sport agency is planning to develop a training program to help world class athletes currently competing. The Agency believes that doping should not be differentiated from other acceptable performance enhancing methods and athletes' voices should be heard. To capture this, the Agency commissioned a research into this issue involving athletes from many sport. Athletes feel that doping is part of their professional training. It does not guarantee winning or give unfair advantage. Doping helps getting the best possible results from hard work and training; helps athletes reach maximise their talent and reach their athletic potential. Doping should be allowed in sport because it is one of the tools of the trade; and athletes should be supported in using doping substances instead of spending millions on pointless testing and prosecution.* *Some quotes from athletes in the study:* *"They are not magic pills or anything like that, they just let your body train harder"* *"I wanted better performances, better results from training and a better body"* *"I got tired of being left behind and not riding at the ability I know I am capable of on a level playing field..."* *As part of this initiative, the Agency want to develop a rapid test called Doping Task (DT) to be used for mental training. To make this program work, it is extremely important to make quick and accurate choices regarding doping. Imagine the following is a tutoring program that is supposed to train people to make these kinds of choices as quickly and accurately as possible. Its goal is to establish firmly in athletes' minds, even in difficult and misleading situations that doping aids hard work and there is nothing inherently unethical about trying to do achieve the best results. Thus, while performing the task, please try to keep in mind that doping is not cheating and athletes should not be labelled cheater because they do everything they can to do better in their sport.*
Negative frame (moral) 327 words	*A charitable sport agency is planning to develop a training program to help world class athletes currently competing. It is crucially important that the panel members truly share athletes' view about doping. The Agency believes that anti-doping effort should be involve athletes more and their voices should be heard. To capture this, The Agency commissioned a research into this issue involving athletes from many sport. Athletes feel that doping is morally wrong; it is not only against the rule but also against the spirit of sport that brings shame to all involved. No money should be spared to fight against doping and keep sport clean. All athletes should undergo values-based education programs that can foster anti-doping behaviours to create a strong anti-doping culture where doping is equivalent to cheating and disgrace.*

	Some quotes from athletes in the study: *"Sport is meant to be man versus man."* *"Doping is against the spirit of sport, it's against fair play."* *"I wouldn't do it… I'd just feel like a disgrace to my country."* *"It's not up to the USADA or WADA to end cheating in sports -- it's up to us (athletes)."* *"It was hard for me to motivate myself in races… I knew I had cheated…"* *As part of this initiative, the Agency want to develop a rapid test called Doping Task (DT) to be used for mental training. To make this program work, it is extremely important to make quick and accurate choices regarding doping. Imagine the following is a tutoring program that is supposed to train people to make these kinds of choices as quickly and accurately as possible. Its goal is to establish firmly in athletes' minds, even in difficult and misleading situations that doping is cheating and trying to do achieve the best results is no excuse for being unethical. Thus, while performing the task, please try to keep in mind that doping is cheating that can destroy the spirit of sport if not stopped.*
Control 346 words	*A charitable sport agency is planning to develop a training program to help world class athletes currently competing. This initiative is part of the ongoing Code review process which provides stakeholders with the opportunity to contribute constructively to the improvement of the Code. The current Code is the results of a worldwide consultation process which has started in 2006.* *The Code is the core document that provides the framework for harmonized anti-doping policies, rules and regulations within sport organizations and among public authorities. It works in conjunction with five International Standards: testing, laboratories, Therapeutic Use Exemptions, the List of Prohibited Substances and Methods, and for the protection of privacy and personal information.* *Following an open and transparent consultation process that included three phases and the publication of several preliminary drafts, the revised Code was unanimously adopted by 1,500 delegates on November 17, 2007, the final day of the Third World Conference on Doping in Sport, in Madrid, Spain. The revisions to the Code took effect on January 1, 2009. The current Code consultation process includes three stages The Code consultation process commenced on 28 November 2011. The 2nd Consultation Phase commenced on June 1, 2012 when a call for comments was sent to all stakeholders. The 3rd Consultation Phase commenced on December 3, 2012 when a call for comments was sent to all stakeholders and will conclude at the Fourth World Conference on Doping in Sport in Johannesburg, South Africa in 2013.* *As part of this initiative, the Agency want to develop a rapid test called Doping Task (DT) to be used for mental training. To make this program work, it is extremely important to make quick and accurate choices regarding doping. Imagine the following is a tutoring program that is supposed to train people to make these kinds of choices as quickly and accurately as possible. Its goal is to establish firmly in athletes' minds, even in difficult and misleading situations to make the choices that is best for them. Thus, while performing the task, please try to do so with this scenario in mind.*

Procedure

Data were collected in a semi-controlled classroom setting (computer room) under supervision of the investigator and at least one research assistant. Participants were randomly allocated to one of the three experimental conditions after completing the first implicit association tests (MF-BIAT and FF-BIAT). The sequence of the data collection procedure is depicted in Figure 8.

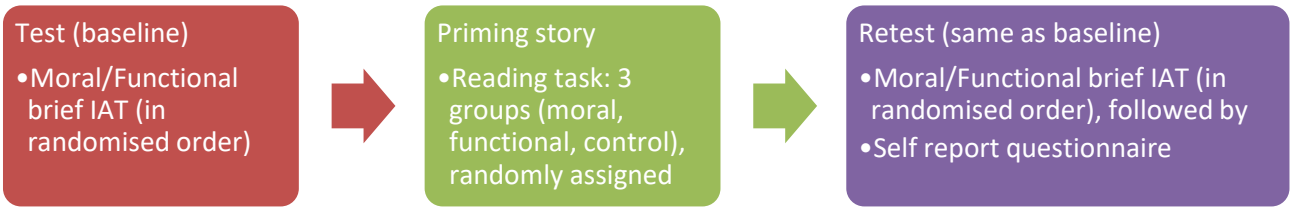


Figure 8: *Sequence of tests and priming tasks used in study 1 (Chapter 5 section 2), using a pre-and post-intervention repeated measure design.*

Priming tasks consisted of either a neutral story about the Anti-Doping code revision, focusing on procedures and timelines, or athletes' quotes s from qualitative studies focusing on the functionality or morality. The text in each condition was roughly equal in length with 346, 324 and 327 words, respectively. All three reading tasks were labelled as 'The doping task'. The priming reading task materials are given in Appendix 16. Because of the random allocation to the experimental groups, the sample sizes of the groups were not equal: 27% were allocated to the control condition; 42% read the moral story and the remaining 31% were exposed to athletes' functional justification of doping.

Data analysis

For measuring IAT effect, the difference in latency was calculated as (Target 1 + Attribute 1) - (Target 1 + Attribute 2), and then D-scores were derived. Target 2 'nutrition' is nonfocal and instructed as “everything else”. In this setup, negative latency or D score indicates preference for Attribute 1. Thus positive D-score indicates associating doping with 'ethical' (MF-BIAT) and 'performance' (FF-BIAT); whereas negative D-score means association with 'unethical' (MF-BIAT) and 'principle' (FF-BIAT). D-scores were interpreted as < 0.15 = means "little to no"; > 0.15 ="slight"; > 0.35 = "moderate"; >= 0.65 = "strong" association. Explicit scores were derived by adding the scores together for each scale. Scale reliability is expressed as Cronbach alpha. Independent sample t-test was used to test for differences between athletes and non-athletes; and between those who admitted considering or using doping and those who do not. Group differences in the second measures were tested using covariate analysis of variances (ANCOVA), controlling for scores in the first implicit tests. Effect size for nonsignificant results is expressed as Cohen's *d* (small = 0.2, medium = 0.5, large = 0.8) or partial eta squared (0.01 = small, 0.06 = medium, 0.13 = large). Relationships between the various

measures are shown with Pearson correlation coefficients. Convergence/divergence between the two BIATs for each individual was calculated by multiplying the two D-scores.

Results

Differences between athletes and non-athletic controls

Explicit and implicit measures of doping attitudes and related social cognition showed some but not always statistically significant difference between athletes and non-athletes (Figure 10). Interestingly, non-athletes (but people with interest in sport and sport performance) showed consistently more positive explicit attitude and support toward doping than their athletic counterparts but exhibited stronger association with doping being unethical (as opposed to ethical) in the implicit test performance. This peculiar pattern may be explained by the low level of sport involvement among the athletes (i.e., they are not under pressure or in need to push their athletic performance to the limits) and a possibility that what the MF-BIAT measured in this sample was social knowledge or strongly influenced by the general social perception of doping. A similar pattern was observed in the functional frame (FF-BIAT) where athletes associated doping with 'principle' to a lesser degree, but this difference was less pronounced and did not reach statistical significance.

Differences between users vs. non-users

Seven of the 48 participants reported either use or considering using doping (two of them stated no current sport involvement). The difference in explicit doping-related measures was in the expected direction and all but one reached statistical significance.

Those who used or considered doping had a more positive view of doping (Figure 9). Means and standard deviations, along with the relevant test statistics are shown in Table 14.

In the moral framework, respondents more associated doping with being unethical, but the effect was smaller among those who considered doping use. Congruently, in the functional framework respondents still associated doping with being unethical (as oppose to associating with performance) but somewhat surprisingly, the effect was stronger among those who considered doping. None of these differences reached statistical significance. The effect sizes indicated small to medium (MF-BIAT: d = 0.3611) and small (FF-BIAT: d = 0.1853) effects. Notably, the implicit association scores were in the neutral range (-0.2 and + 0.2).

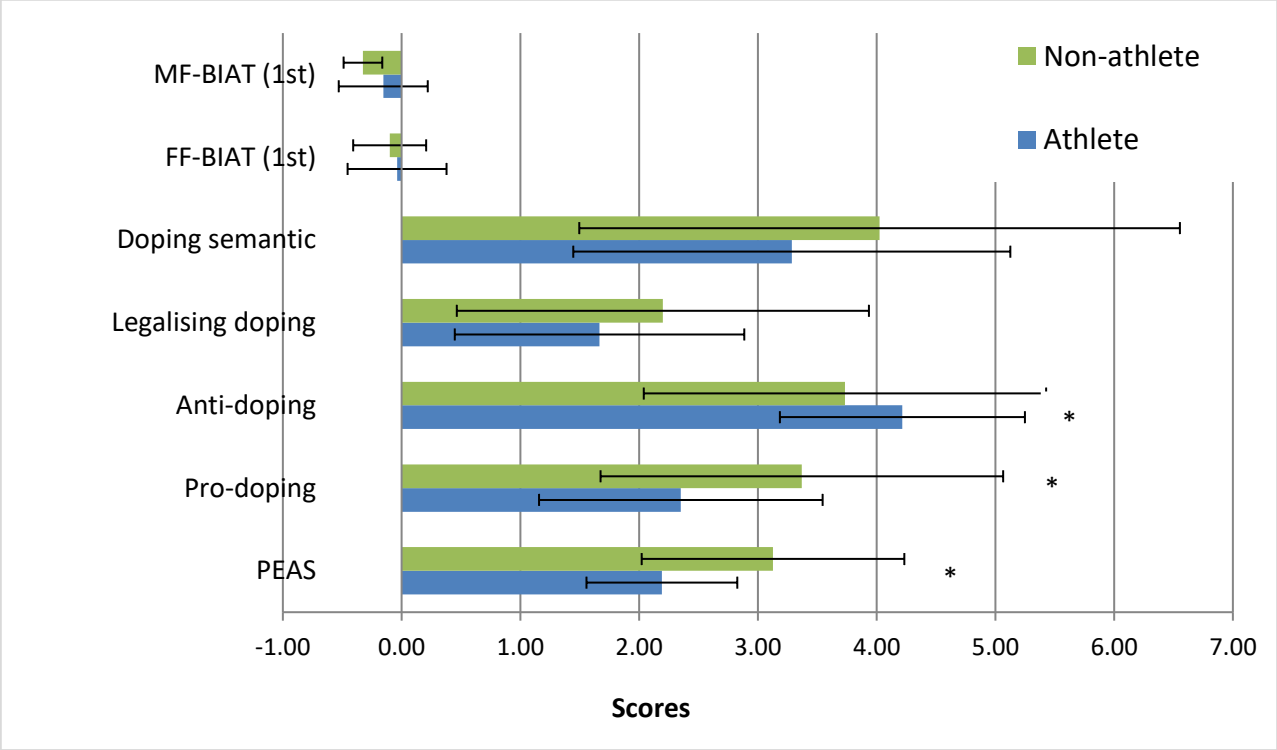


Figure 9: *Explicit and implicit measures of doping attitudes and related social cognition by sport involvement. Scores are scale means and not standardised for the whole set, thus only within measure comparison can be made; * denotes statistically significant difference (p < .05).*

The effect sizes for the implicit measures (MF-BIAT: Cohen's *d* for athlete/non-athlete was 0.636 and 0.369 for doping user/non-user; FF-BIAT: 0.195 and 0.214, respectively) suggest that the two tests are sensitive to detecting expected differences (i.e., between athletes and non-athletes; doping users and non-users, etc.) but would benefit from further refinements to increase its sensitivity. The current functional frame version appeared to be less sensitive to differentiate between doping-related groups perhaps owing to the low level of sport involvement.

Table 14: *Means and standard deviations of the explicit and implicit measures*

Construct	Theoretical range	Considered doping	No doping	t test value (p)
Doping semantic differential	4 - 24	23.43 ± 11.90	11.86 ± 5.72	-2.795 (.008)
Doping attitude (PEAS)	17 - 102	54.20 ± 22.21	37.59 ± 10.43	-3.353 (.002)
Legalising doping	2 - 12	6.43 ± 3.82	3.05 ± 2.14	-4.039 (< .001)
Pro-doping statements	3 - 18	10.86 ± 5.58	7.00 ± 3.51	-2.425 (.020)
Anti-doping statements	5 - 30	16.00 ± 8.96	21.69 ± 4.75	2.475 (.018)

MF-BIAT D score (1st take)	-2 and +2	-0.077 ± 0.334	-0.204 ± 0.353	-0.883 (.382)
FF-BIAT D score (1st take)	-2 and +2	-0.113 ± 0.362	-0.038 ± 0.408	0.453 (.652)

Priming effects

After controlling for the baseline BIAT scores, the priming task had an observable but statistically not significant ($F(2,42) = 1.645$, $p = .205$, partial $\eta^2 = 0.073$) effect on the FF-BIAT, whereas there was practically no effect on the MF-BIAT ($F(2,42) = .158$, $p = .854$, partial $\eta^2 = 0.007$). Mean D scores for each priming condition and timepoint are shown in Figure 10.

The priming task did not affect the implicit association result when doping was set in a moral frame (MF-BIAT) but priming did produce a small effect on the functional frame (FF-BIAT) in the expected direction. When participants were implicitly had to contrast 'principle' (as being unethical) and 'performance' (as being functional) while sorting words of doping substances, the priming story with athletes' supportive argument for doping shifted the implicit associations from 'principle' to 'performance'. Congruently, the opposite effect was observed in the group where participants read a priming story with athletes' comments on rejecting doping on moral grounds. The fact that the control task also resulted in a change similar to the functional priming story suggest that the reading task might not have been completely neutral.

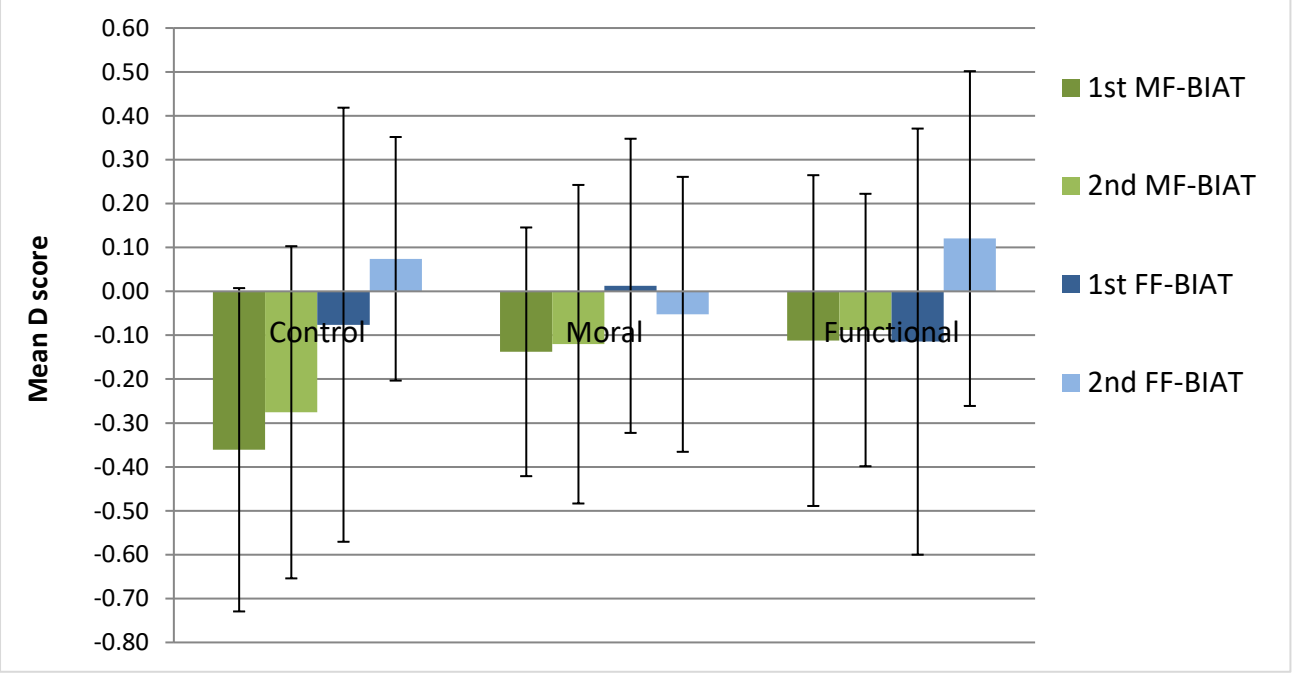


Figure 10: *Mean D scores obtained by priming task groups. Error bars are SDs*

The observed priming effect from the functional frame is particularly interesting in the context of explicit rejection of the functional approach. Participants who received the functional priming expressed, without exception, strong disagreement with the viewpoint presented in the functional story and formulated argument along the moral story line. There were 14 incongruent MF-BIAT and FF-BIAT pairs (i.e., changing from ethical to performance or vice versa) at the first take of the test, which increased to 25 after the priming task. The highest increase in the number of incongruent pairs were noted in the functional condition (3 to 9), followed by the moral condition (4 to 7), whereas control condition only resulted in a small change (7 to 9). Implicit preference changes for each group after priming is detailed in Table 15.

Table 15: *Priming effect as implicit preference changes*

Test	Condition	Functional	Moral	Control
Ethical/ unethical	No change	14 (93.3%)	9 (45.0%)	8 (61.5%)
	Ethical to unethical	1 (6.5%)	6 (30.0%)	2 (15.4%)
	Unethical to ethical	0 (0.0%)	5 (25.0%)	3 (23.1%)
Performance/ principle	No change	8 (53.3%)	15 (75.0%)	4 (30.8%)
	Principle to Performance	6 (40.0%)	2 (10.0%)	6 (46.1%)
	Performance to principle	1 (6.7%)	3 (15.0%)	3 (23.1%)

Note: The numbers (and corresponding percentages for comparison) in the table cells show the number of FF-BIAT and MF-BIAT pairs respectively remained unchanged and changed in either direction in each experimental group separately. 'Pairs' refer to the repeated measure pre- and post intervention implicit test results.

The proportion of incongruent pairs at the first take were similar between those who admitted considering or using doping and those were not considered (28% and 29% respectively) but increased significantly in the second take for those who considered doping (71% and 50% respectively). In line with literature precedence, no significant correlation was found between the implicit and explicit measures; but strong and statistically significant correlations were observed within these assessment categories (Table 16). The strongest association found was between the MF-BIATs and explicit doping attitudes. This outcome is likely to be the result of both explicit measures being dominantly morally focused.

Table 16: *Relationship between the implicit and explicit measures (Pearson's r, p)*

		2	3	4	5	6	7
1	**Doping semantic**	.770***	.520***	-.554***	.683***	.156 (.305)	.219 (.149)
2	**PEAS**	-	.480** (.003)	-.448*** (.007)	.695***	.238 (.155)	.229 (.172)
3	**Legalising doping**		-	-.275 (.071)	.586***	.034 (.820)	.132 (.382)
4	**Anti-doping**			-	-.348* (.022)	.153 (.323)	.007 (.962)
5	**Pro-doping**				-	.194 (.197)	.125 (.408)
6	**MF-BIAT (1st take)**					-	.680***
7	**FF-BIAT (1st take)**						-

Note: * $p < .05$; ** $p < .01$; *** $p < .001$; exact p is reported for all correlations with $p > .001$.

The correlation matrix (Table 17) shows that the strength of the relationship between the implicit pre- and post measures has reduced in all three groups. However, the change in relationships between the explicit and implicit measures showed a pattern in line with the priming conditions.

Table 17: *Relationship between the implicit and explicit measures (Pearson's r, p) by condition*

Condition	Variables	PEAS	Legalising doping	Anti-doping	Pro-doping	MF-BIAT (1st take)	FF-BIAT (1st take)	FF-BIAT (2nd take)	MF-BIAT (2nd take)
Functional	Doping semantic	.913***	.870***	-.386 (.193)	.821***	.335 (.222)	.353 (.197)	-.039 (.891)	.368 (.177)
	PEAS		.926***	-.599 (.088)	.940***	.227 (.529)	.441 (.202)	.011 (.976)	-.174 (.630)
	Legalising doping			-.550 (.051)	.817** (.001)	.149 (.626)	.073 (.814)	-.253 (.404)	.294 (.330)
	Anti-doping				-.541 (.056)	-.146 (.635)	.072 (.815)	-.014 (.963)	.125 (.684)
	Pro-doping					.181 (.535)	.324 (.259)	.030 (.918)	.129 (.659)
	MF-BIAT (1st take)						.748** (.001)	.246 (.376)	.570* (.027)
	FF-BIAT (1st take)							.297 (.283)	.286 (.302)
	FF-BIAT (2nd take)								-.098 (.728)

Note: * $p < .05$; ** $p < .01$; *** $p < .001$; exact p is reported for all correlations with $p > .001$.

Table 17 (cont): *Relationship between the implicit and explicit measures (Pearson's r, p) by condition*

	Variables	PEAS	Legalising doping	Anti-doping	Pro-doping	MF-BIAT (1st take)	FF-BIAT (1st take)	FF-BIAT (2nd take)	MF-BIAT (2nd take)
Moral	Doping semantic	.721** (.002)	.068 (.788)	-.620** (.010)	.709** (.001)	.173 (.492)	.204 (.418)	.341 (.166)	.258 (.301)
	PEAS		-.077 (.770)	-.142 (.599)	.435 (.093)	.332 (.193)	.152 (.560)	.525 (.030)	-.007 (.979)
	Legalising doping			.108 (.670)	.305 (.204)	.092 (.698)	-.029 (.903)	-.013 (.955)	.038 (.873)
	Anti-doping				-.478 (.052)	.193 (.444)	.025 (.922)	.183 (.466)	-.167 (.508)
	Pro-doping					.114 (.644)	.158 (.519)	.152 (.533)	.477* (.039)
	MF-BIAT (1st take)						.790***	.634** (.003)	.121 (.613)
	FF-BIAT (1st take)							.521* (.019)	.189 (.426)
	FF-BIAT (2nd take)								.352 (.127)

Note: * $p < .05$; ** $p < .01$; *** $p < .001$; exact p is reported for all correlations with $p > .001$.

Table 17 (cont): *Relationship between the implicit and explicit measures (Pearson's r, p) by condition*

Condition	Variables	PEAS	Legalising doping	Anti-doping	Pro-doping	MF-BIAT (1st take)	FF-BIAT (1st take)	FF-BIAT (2nd take)	MF-BIAT (2nd take)
Control	Doping semantic	.681* (.043)	.531 (.076)	-.722** (.008)	.571 (.052)	.064 (.844)	-.179 (.579)	-.183 (.570)	.090 (.781)
	PEAS		.586 (.075)	-.709* (.022)	.718* (.019)	.020 (.957)	-.099 (.786)	.093 (.798)	.073 (.841)
	Legalising doping			-.412 (.162)	.667* (.013)	.180 (.557)	.084 (.785)	.279 (.357)	.038 (.901)
	Anti-doping				-.111 (.717)	.114 (.712)	.370 (.213)	.009 (.977)	.136 (.657)
	Pro-doping					.200 (.512)	.054 (.861)	-.051 (.870)	.176 (.565)
	MF-BIAT (1st take)						.590* (.034)	.153 (.617)	.489 (.090)
	FF-BIAT (1st take)							.119 (.697)	.392 (.186)
	FF-BIAT (2nd take)								.146 (.634)

Note: * $p < .05$; ** $p < .01$; *** $p < .001$; exact p is reported for all correlations with $p > .001$.

In the functional story condition, the relationship between the explicit attitude score (PEAS) and the functional frame implicit attitude score (FF-BIAT) has changed; whereas in moral story condition, this relationship remained unchanged but the association between the explicit attitude score (PEAS) and the moral frame (MF-BIAT) has changed. Similar pattern was observed for the pro-doping explicit attitude. The same pairings in the control group remained unchanged in both.

The correlation matrix shows that the strength of the relationship between the implicit pre- and post measures has reduced in all three groups. However, the change in relationships between the explicit and implicit measures showed a pattern in line with the priming conditions. In the functional story condition, the relationship between the explicit attitude score (PEAS) and the functional frame implicit attitude score (FF-BIAT) has changed; whereas in moral story condition, this relationship remained unchanged but the association between the explicit attitude score (PEAS) and the moral frame (MF-BIAT) has changed. Similar pattern was observed for the pro-doping explicit attitude. The same pairings in the control group remained unchanged in both. Table 17 shows the correlations between the measured explicit and implicit variables by conditions. The repeated implicit measures are included to examine if there is any change in the relationship between the implicit and explicit measures pre- and post priming intervention; and to ascertain whether the relationship between the functional and moral frames for implicit measures changed after priming.

The explicit measures showed medium to strong correlations in the expected direction (Table 16). The two BIATs showed strong positive correlation with each other when first taken without any influence from the priming story but this relationship disappeared after priming. Furthermore, no strong correlation was observed between the two BIATs and the explicit doping attitude and belief measures. Table 17 shows that the correlations between the explicit measures were present in all three conditions, but meaningful ($r \geq .3$) relationships between explicit and implicit measures were only observed in the two experimental conditions but in controls. The persistent relationship between the two BIATs in the first take with a reduced/diminished relationship in all experimental groups suggest that the two BIATs may share a common dimension (most likely the moral aspect coming from social knowledge), but this dimension was influenced by the elaboration evoked by the priming stories.

Taken all together, the detailed correlation patterns, along with the observed differences (Figure 11), provide some support for the effectiveness of the functional priming story, but they also suggest that the control condition might not have been as neutral as planned. Reading the story about the Anti-Doping Code revision might have inadvertently evoked some deliberative thinking about doping and thus influenced the measurements of doping related cognitive factors that followed reading the story (Horcajo & De la Vega, 2014).

The key limitations of this study lie in the sample characteristics and in small sample size once the sample is broken into subgroups by intervention conditions. Participants in this sample were non-athletes with interest in sport and sport science students with relatively low (amateur) level of sport involvement. Doping is, by definition, the signature feature of high performance sport thus caution is warranted in generalising the results from this study to high performing athletes. Furthermore, this is the first study where the moral and functional BIAT variations were empirically tested. As discussed before, the tests, particularly the functional frame version, would benefit from further work refining the test and exploring the underlying mechanism of people's test performances.

In summary, the results suggest that a 'functional frame' is present in athletes' mental representation of doping. If this result can be replicated in a larger sample, with potentially stronger effect among athletes actually used or more in contact with doping, then such finding would have important implications on doping-prevention. Solely targeting the moral aspect of doping might not produce the desired effect if doping use is or partly influenced by its functionality.

Study 3: Predicting doping use from Implicit Association Tests

Background

The overarching aims of the project are to identify (1) transition phases in assisted performance enhancements and map these phases across chronological age groups of emerging young athletes; (2) social cognitive markers, along with their synergy, of transition phases in assisted performance enhancement; and (3) factor(s) that catalyse or can act as barriers to doping and health compromising performance enhancing practices.[3] As part of the project, four implicit association tests were developed and tested. The results presented in this report are limited to these measures.

Aims

The aim of this section is to test four BIAT measures to see which one(s) can differentiate between (self-reported) doping users and non-users.

Participants

A large cohort of Hungarian young elite athletes (*n* = 363, 64% male, mean age: 16.33 ± 1.807 years) from a variety of sports participated in this study. Young athletes represented 21 sports. These were, in decreasing order of frequency: handball (14.6%), volleyball (11.0%), judo (12.7%), kayak/canoe (12.9%), gymnastics (8.0%), fencing (8.8%), ice hockey (8.5%), water polo (8.3%), track and field (6.1%), shooting (3.3%), basketball (1.9%), table tennis (1.4%), football (0.8%), rowing, weightlifting, tennis and triathlon (0.3% each). Level of competition represented in the sample is shown in Table 18.

Table 18: *Competitive Level Distribution in the Hungarian Young Elite Athlete Sample*

Competitive level (personal best level in brackets)		Count	%
Valid	National (1-8)	145	39.9
	Small international/regional 1-8	138	38.0
	European championship 4-8	10	2.8
	European championship 1-3	22	6.1
	World championship 4-8	0	0.0
	World championship 1-3	23	6.3
	Olympic	7	1.9
	Total	345	95.0
Missing		18	5.0
Total		363	100.0

Methods

[3] This project is funded independently by WADA. Results are reported separately.

Participants were administered four brief Implicit Association Tests in random order. Category labels and stimuli are shown in Table 19. Target category (doping) and the non-focal target (altitude training) were the same in all four BIATs. The battery of BIATs was completed in Hungarian, followed by a paper and pencil survey which included a matched explicit attitude measure (semantic differential).

Table 19: *Category Labels and Stimuli of the Brief IAT*

Tests	Category label	Stimuli
Focal target	Doping (Dopping)	steroid, drug, stimulant, hormone (szteroid, drog, stimuláns, hormon)
Non-focal target	Altitude training (Magaslati edzés)	oxygen, mountain, acclimatisation, elevation (oxigén, hegy, alkalmazkodás, magaslat)
Affective	Pleasant (Kellemes)	beautiful, happy, fun, friendly (gyönyörű, boldog, vidám, barátságos)
	Unpleasant (Kellemetlen)	sad, ugly, hostile, nasty (szomorú, ronda, roszindulatú, csúnya)
Cognitive	Safe (Veszélyes)	harmless, risk-free, nontoxic, secure (veszélyes, kockázatos, mérgező, ártalmas)
	Dangerous (Biztonságos)	hazardous, risky, toxic, harmful (ártalmatlan, kockázat nélküli, nem mérgező, biztonságos)
Moral	Clean (Fair-play)	honest, open, respectable, fair (becsületes, segítőkész, tiszteletreméltó, egyenes)
	Cheating (Csalás)	deceptive, misleading, dishonest, unfair (csaló, félrevezető, becstelen, tisztességtelen)
Self-referential	Me (Én)	I, myself, mine, my (Én, magam, nekem, enyém)
	Not me (Nem én)	they, their, them, others (ők, övék, nekik, mások)

Results

Thirty-seven young athletes (10.5%) admitted having knowingly tried and/or currently using doping. Numbers by competition level are shown in Table 20.

Table 20: *Admitted doping use by competition level*

Competitive level (personal best level in brackets)		Count	Percent
Valid	National (1-8)	12	31.6
	Small international/regional 1-8	14	36.8
	European championship 4-8	0	0.0
	European championship 1-3	4	10.5
	World championship 4-8	0	0.0
	World championship 1-3	6	15.8
	Olympic	1	2.6
	Total	37	97.4
Missing		1	2.6
Total		38	100.0

Of the four doping BIAT tested, the personalised BIAT showed discriminatory power at statistical significant level (Table 21). However, two other tests (affective and moral BIAT) also showed difference between the user groups (Table 22 and Figure 21) to the expected direction but the difference did not reach statistical significance. he explicit doping attitude measure also showed difference in the expected direction, self-confessed doping users showing more permissive attitude toward doping (Table 38). Personalised BIAT correlated strongly and significantly with the overall explicit attitude measure (r = -.690, p = .027) in the self-admitted doping users but no significant correlation was found in the other groups.

Table 21: *Doping BIATs Results by Self-admitted Doping Users and Nonusers*

BIAT name	BIAT pairs	D-score (Mean±SD)[a]		Test statistics
	Doping +	Doping users[b]	Non-users	Mann-Whitney U (p), user vs. nonuser
Affective	Pleasant/ Unpleasant	-0.197 ± 0.4326	-0.098 ± 0.537	5362.5 (0.234)
Cognitive	Safe/ Dangerous	-0.122 ± 0.492	-0.120 ± 0.497	6218.0 (0.844)
Moral	Clean/ Cheating	-0.168 ± 0.544	-0.105 ± 0.491	5580.5 (0.391)

Personalised	Me/ Not me	-0.139 ± 0.476	0.027 ±0.517	4890.5 (0.049)

[a] D-score calculation: average RT of minus, thus negative value indicates pro-doping associations, with maximum range is between -2 and +2
[b] based on self-reports (63.2% male)

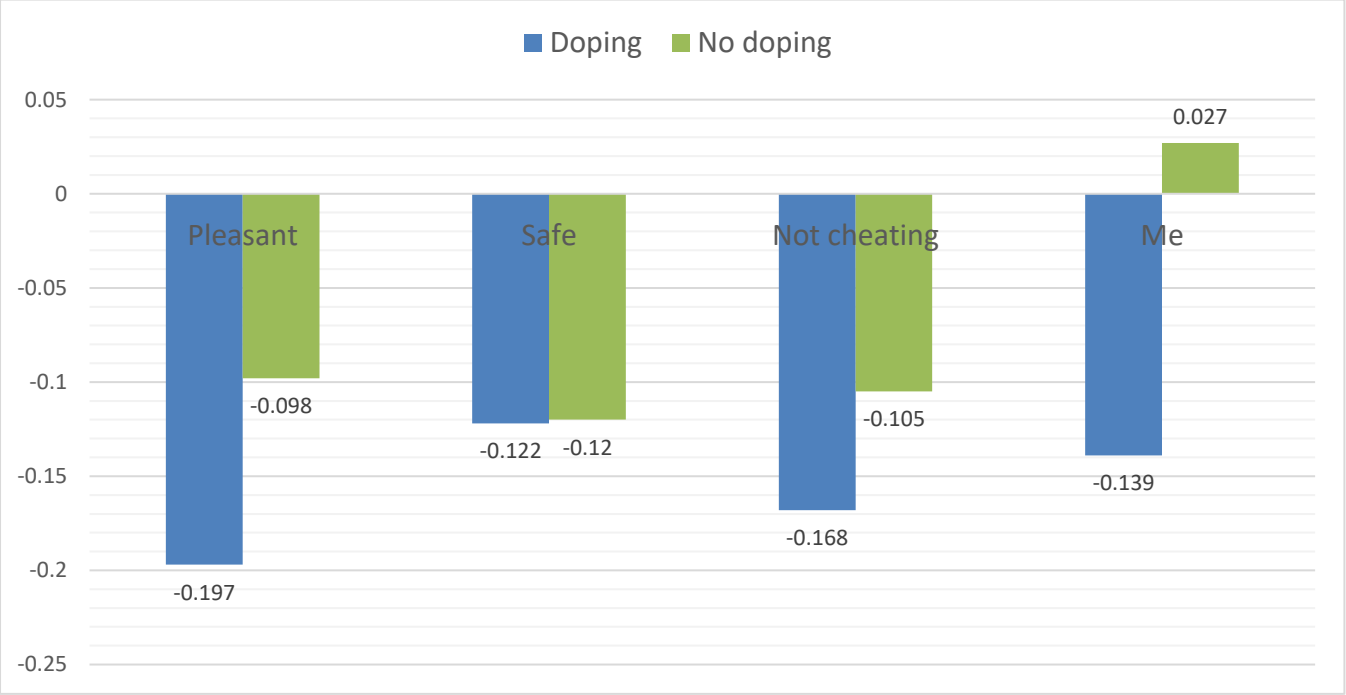


Figure 11: *Mean D-scores by doping user groups of the four BIAT tests*

Table 22: *Explicit Doping Attitude by Self-admitted Doping User vs. Nonusers*

Variable	Scale-score (Mean±SD)[a]		Test statistics
	Doping users	**Non-users**	**Mann-Whitney U (p)**
Explicit attitude (semantic differential statements matching the BIAT)	75.68 ± 13.485	82.59 ± 9.263	3,800 (.001)

Note: [a] reversed scoring: high number represents disapproval/negative attitude (1-10 individually)

Study 4: Piloting the Autobiographical Implicit Association Test (aIAT) and Social Network Analysis

Aims

Based on the incremental model of doping behaviour (IMBD), it is reasonable to assume that social cognitive factors such as attitudes, subjective norms and perceived control toward increasing performance (as goal) predict behavioural intention and doping behaviour over and above social cognitive factors toward doping in doping users and those with intention to use. In nonuser, deterring factors were assumed to be a combination or moral and negative functional (health) reasons.

The aims of this study were:

(1) to obtain preliminary evidence for the functional theory of doping;

(2) to test the framing effect of moral vs. functional on the autobiographical IAT (aIAT) and

(3) to explore the social visibility or the doping practices and the potential influence of social surrounding on the doping related explicit and implicit social cognitive measures.

Furthermore, it was hypothesised that incongruent framing effect weakens the validity of the aIAT, where users expected to exhibit stronger aIAT effect on the functional, non-judgmental frame and nonusers expected to either exhibit a stronger aIAT effect on the moral, negative valence frame.

The project also incorporated a simple social network analysis (SNA) to capture relationships between the players within their team, hence was the focus on collecting data from every member of a single team (defined network). It was expected that subgroups of players (close friends) exhibit similar explicit and implicit views on performance enhancement and doping.

Methods

Participants

Participants of this study were semi-professional UK football players (n = 14), all male with mean age of 26.50 ± 3.39 years. All players were from the same team in order to generate a dataset for a defined network; affording placing the role of the doping-related social cognitive variables into immediate social context.

Measures[4]

Relying on the demonstrated equivalence of the brief IAT to the standard IAT, especially when the self is a focal category (Nosek et al., 2013), the two versions of the aIATs were set using the brief IAT template (Sriram & Greenwald, 2009), identical in format to the cocaine/heroin version used previously (Vargo & Petroczi, 2013c). One version used autobiographical statements phrased within the moral/ethical frame whereas the other version made factual statements without evaluative judgements. The statements for both versions are shown in Table 23.

Implicit measurements

Items were presented in the centre of the screen and followed the original aIAT (Sartori et al., 2008) guidelines of using first-person short statements that represented mutually excluding events. The first block (20 trials) presents only items from target categories while the remaining four blocks constitute the sorting task. The actual test consists of the control task set (false and true) + one target set. The brief aIAT measures response time differences between congruent blocks (Attribute A with Target A) and incongruent blocks (Attribute A with Target B). Following Sartori et al's method (2008), participants were instructed to perform the sorting task according to the statement being 'guilty or innocent' in the moral frame and 'user or non-user' in the functional frame.

Table 23: *Category Labels and Stimuli for the Brief Doping aIAT*

Items for Attribute A 'True':		**Items for Attribute B 'False':**	
1	I'm in London taking a test	**1**	I'm climbing a rocky mountain
2	I'm taking a test with a researcher	**2**	I'm swimming in a very big pool
3	I'm in front of a tablet playing a task	**3**	I'm playing football alone in a field
4	I'm reading the screen of a tablet	**4**	I'm shopping for tables and chairs
Items for Target A 'Guilty':		**Items for Target B 'Innocent':**	
1	I cheated using prohibited drugs	**1**	I don't cheat by using prohibited drugs
2	I violated the anti-doping rules	**2**	I refuse to cheat with doping substances
3	I cheated with doping substances	**3**	I always play fair by not taking drugs
4	I gained unfair advantage using drugs	**4**	I avoid unfair doping substances
Items for Target A 'User'		**Items for Target B 'Not a user'**	
1	I took performance enhancing drugs	**1**	I don't use performance enhancing drugs
2	I enhanced my performance with doping	**2**	I don't use drugs to improve performance
3	I used drugs to improve my performance	**3**	I keep off doping substances
4	I was involved in doping	**4**	I've never used doping substances

[4] The scripts for the two doping aIATs for this study was set up by Julie Vargo (Kingston University), who also contributed to developing the survey tool and helped the data collection with Ricky James (Kingston University) and Jaime Morente-Sanchez (University of Granada) as part of their research training.

Moral/Functional attitudes were assessed with two BIAT tasks. Category labels and stimuli items are shown in Table 24.

Table 24: *Moral/Functional and Self-referential BIAT*

Category	Words
PPD	steroids, drugs, stimulant, hormone
Supplement (Non focal)	vitamin, mineral, protein, superfood
ME	I, myself, mine, my
Not Me	They, their, them, others
Moral	Fair, honourable, honest, right
Immoral	Unfair, deshonorable, dishonest, wrong

Explicit measurements

Attitudes. To assess attitudes toward improving athletic performance by training, doping as functional/rational choice and doping as anti-doping rule breaking/cheating, participants were asked to rate three statements on six 10-point semantic differential scales of good/bad (R), right/wrong (R), worthless/worthwhile, detrimental/beneficial, foolish/wise and safe/risky (R). The three statements were: "Training hard to improve athletic performance is..." (training); "Violating anti-doping rules to improve athletic performance is..." (doping as cheating) and "Taking prohibited performance enhancing substances to improve athletic performance is...." (doping as functional). Scales denoted with 'R' were reversed before analysis so higher scores consistently represents agreement with the positive end of the semantic scale. Owing to ambiguous performance of two semantic scales (good/bad and worthless/worthwhile) across the three domains, these were excluded from the combined scores which is based on the remaining same four semantic differentials for all three attitude measures: attitudes toward improving athletic performance by training (Cronbach α = .703), doping as functional/rational choice (Cronbach α = .713) and doping as anti-doping rule breaking/cheating (Cronbach α = .717).

Self-efficacy. Perceived performance related self-efficacy was measured with four items: "For me, improving my athletic performance is easy", "Making improvement to my performance is beyond my control" (reversed), "I am not sure that my talent and hard work are enough to improve my athletic performance" (reversed) and "I am confident that I can enhance my athletic performance" (Cronbach α = .794). Perceived doping specific self-efficacy, was assessed with two items: "I am confident that I could reach my athletic potential without using prohibited performance enhancing substances" and

"I am certain that I do not need prohibited performance enhancing drugs to be a good player" (Cronbach α = .625).

Perceived control. Perceived personal control over doping and the importance of having an approval of others were measured by a single statement each, rated on a 6-point Likert-type scale: "The decision to use prohibited performance enhancing substances is up to me" and "Having the approval of people important to me is...", respectively.

Norms. Subjective norms about the goal (performance) and behaviour (doping) were assessed with one statement each: "People who are important to me want me to enhance my performance" and "People who are important to me do not want me to use doping substances", respectively.

Social projection. Perceived doping prevalence was assessed by asking participants to estimate the proportion of players (0% - 100%) using doping among teammates, other footballers in their league; and other footballers that play in the league above their current league. The social influence on players' willingness to use doping to enhance athletic performance was assessed on a 10-point scale asking respondents to rate their willingness, separately for each of the potential three social influences, if doping was suggested by their (1) coach, (2) team-mate or (3) family member.

Risks. Perceived risks from doping were measured with two statements, one for health "If I use doping, I will damage my health" and one for testing "If I use doping, I would risk failing the doping test". Unless stated otherwise, items in all measures were rated on a 6-point Likert type scale anchored at 1 (strongly disagree) and 6 (strongly agree).

Intention. To obtain information on doping and doping intention, participants were asked if they have ever knowingly used prohibited performance enhancing substances and whether they intend to use doping in the future (Yes/No/Prefer not to answer). In addition, players were also asked to rate on a 10-point scale how important improving their athletic performance was to them, where 1 represents 'not important at all' and 10 represents being 'extremely important'.

Functional vs. moral doping attitude. Explicit assessments also included the newly proposed and yet to be validated indirect attitude scale that distinguish between the functional and moral aspects of doping (Table 25), along with an indirect scale to measure attitude toward the goal of performance enhancement. Statements about the behaviour were rated on a 6-point scale anchoring strong disagreement (-3) and strong agreement (3). Evaluation of the importance of the expected behaviour outcomes were also recorded on a 6-point Likert-type scale ranging from extremely undesirable (1) to extremely desirable (6). This way, the individual statement scores also carry information on the composite scores because the evaluation scores remained on the unipolar scale.

Table 25: *Items and Scoring of the Functional-focus Doping Attitude (FDA), the Morally-framed Doping Attitude (MDA) and the Performance Enhancement Goal Attitude (PEGA) Scales (R Denotes Reversed Scoring)*

Functional-focus Doping Attitude (FDA)				
		Behaviour: Achieving an athletic goal		**Evaluation of the expected outcome**
FDA1*	a1	Using doping can make my results better.	A1	Making my results better is...
FDA2*	b1	If I use doping, I will remain competitive.	B1	Remaining competitive for me is…
FDA3	c1	If I use doping, I will not know what I am capable of without drugs.	C1	Knowing what I am capable of for me is...
FDA4*	d1	Using doping can help to improve my athletic performance.	D1	Improving my athletic performance is…
FDA5	e1	If I don't use doping, I will not benefit from my hard work and training as much as I want to.	E1	Getting return on my hard work and training for me is...
FDA6*	f1	Using doping will not help me training hard.(R)	F1	Training hard for me is...
FDA7	g1	Using doping after injury will not aid my recovery. (R)	G1	Recovering fully and quickly after injury for me is ...
FDA8	h1	If I refrain from using performance enhancing drugs, I can see the results of my natural ability. (R)	H1	Seeing how far my natural talent can take me is...
FDA9*	i1	If I use doping, I will be a more competitive athlete.	I1	Being a competitive athlete for me is...
FDA10*	k1	If I increase my performance with doping, my income will be higher.	K1	Increasing my income for me is....
Morally-framed Doping Attitude (MDA)				
		Behaviour: Breaking the rule/cheating		**Evaluation of the expected outcome**
MDA1*	a2	Using doping is morally wrong.	A2	Doing what morally right for me is...
MDA2*	b2	Using doping gives unfair advantage.	B2	Gaining unfair advantage for me is…
MDA3*	c2	If I use doping, I will feel I cheat.	C2	Cheating for me is...
MDA4	d2	If I use doping, I will not harm others. (R)	D2	Harming others for me is...
MDA5	e2	Using doping is not against the spirit of sport. (R)	E2	Keeping the sport clean of drugs for me is...
MDA6	f2	Using doping is against fair play.	F2	Fair play for me is...
MDA7*	h2	If I use doping, I will violate the anti-doping rules.	H2	Adhering to the anti-doping rules for me is...

Performance Enhancement Goal Attitude (PEGA)				
		Behaviour: Increased performance		**Evaluation of the expected outcome**
PEGA1[a]	a3	I will be a better athlete if I enhance my performance.	A3	Being a better athlete for me is...
PEGA2[a]	b3	If I improve my performance, I will compete in higher level.	B3	Competing at the higher level for me is...
PEGA3[b]	c3	If I increase my performance, my income will be higher.	C3	Higher income for me is...
PEGA4[b]	d3	I need to increase my performance to reach my personal performance goal.	D3	Reaching my personal performance goals for me is...
PEGA5[b]	e3	Performing to the best of my ability is an important personal goal to me.	E3	Achieving the goals I set to myself is...

Note: * denotes inclusion in the final scale, giving internal consistency values (Cronbach alpha) for FDA (6 items) = .760 and MDA (4 items) = .726. The PEGA items did not form a clear unidimensional scale but split into two, with reliability of subscale (a) = .792 and (b) = .595.

Team cohesion. Team's success is largely dependent on how well the group as a whole fits together (Carron et al., 2002). Group cohesion was assessed with the Group Environment Questionnaire (GEQ) (Brawley et al., 1987; Whitton & Fletcher, 2014). The GEQ produces results on a four factor model, derived from the four subscales; group integration-task (GIT), individual attraction to group-task (ATGT), group integration-social (GIS), individual attraction to group-social (AGTS) (Carron et al., 1985; Whitton & Fletcher, 2014). These four subscales focus upon two main concepts of cohesion, task and social. Task refers to the teams goals, whilst social refers to the inter-member relations. In team sports there is the group (team) and the individual, the GEQ assesses the degree to which the group and individuals share the tasks and social outlines. Items for each of the subscales are scored on 1 to 9 agreement Likert scale with 1 being strongly disagree and 9 being strongly agree. Items which correspond to each subscale are collated and a mean determined, the larger the score the more the respondent is in agreement with the subscale. ATGT & GIS are scored between 4 to 36 and GIT & AGTS are scored between 5 to 45.

Procedure

Owing to the nature of the issues investigated (i.e., use of prohibited performance enhancing drugs) ensuring completely anonymous participation was paramount. To facilitate this, the complete anonymity of the participants was guaranteed by the procedure outlined below. The implicit assessments and the second questionnaire were administered in small groups, time arranged as it was convenient to the players. The two aIATs were administered in randomised order, and always before completing the self-reported questionnaire.

In order to ascertain the social structure of the football team, participants were asked to identify 3 of their team-mates closest to them (i.e., friends) in order to obtain information regarding clusters of friendships within the examined football team. Owing to the nature of the issues investigated (i.e., use of prohibited performance enhancing drugs) ensuring completely anonymous participation was paramount. To facilitate this, the complete anonymity of the participants was guaranteed by the procedure outlined below.

Data collection for the Social Network Analysis (SNA) took place in a single setting, with all participating players present. Individual pre-printed labels with numbers between 1 - 100 were provided. These labels served serve as ID-tags. Each player was asked to pick one ID-tag randomly from the pool of 100. Because the sample size per team is normally between 10 and 15 in any one setting, 100 numbers offered sufficient variation. Players were instructed to use their own ID-tag number where prompted in the self-report questionnaire and the implicit association tests; and in the SNA question, and to refer to the team-mates (as friends close to them) only by using these ID tags and not names, or any other identifiable information when completing the SNA survey. This procedure afforded linking the social network information to the variables measured via the self-report

questionnaire (attitudes, norms, perceived control, self-efficacy, experience with doping and willingness/intention to use doping) and the two aIATs. To ensure that participants used the same 'ID-tag' number throughout the data collection process, participants were asked to log their ID-tag number for subsequent use with the researcher using a unique, self-generated password of something memorable and meaningful only to the participant but meaningless for everyone else. Using the last 4 or 5 digits of a memorable phone number of their choice usually works well as password.

Data analysis

Exploratory factor analyses of the items of each of the three subscales: Functional-focus Doping Attitude (FDA), Morally-framed Doping Attitude (MDA) and Performance Enhancement Goal Attitude (PEGA) were conducted. The limitation to subscales was necessary because of the small sample size. The factoring process, using principal component analysis, was limited to extracting 1 component. Routinely conducted KMO and sphericity tests for sampling adequacy and factorability respectively were applied. Reliability analyses were also conducted to examine internal consistency and item to total correlations. Items with factor loading and item to total correlation > .3 were kept. Based on the combined results, the FDA and MDA scales were shortened to 6 and 4 and items, respectively. The PEGA items did not form a clear unidimensional scale but split into two with unclear factor contents, thus it was excluded from further analysis. Owing to the very small sample size, the scale structures must be considered with caution. The result can only serve as a pilot study, but as such, it is encouraging and suggests that further effort into developing these scales following the standard procedure for scale development could be a worthwhile enterprise.

Attitude scores for each subscale were created by first multiplying each behaviour assessment and its importance to the person individually [FDA= (a1 x A1) + (b1 x B1) + (c1 x C1) + ... (k1 x K1); MDA = (a2 x A2) + (b2 x B2) + (c2 x C2) + ... (j2 x J2) and PEGA = (a3 x A3) + (b3 x B3) + (c3 x C3) + ... (e3 x E3)], then scores were added together for each of the three subscales.

In the present aIAT setup, positive scores indicates a preference for the association with target ‘A’ and attribute ‘A’ categories (i.e., “True” with “as if you were a drug user”) while negative scores indicates faster response times for incongruent blocks (i.e., target A and attribute B; not being a drug user is true). Through a validated algorithmic score incorporated in the software program (Greenwald et al., 2003) raw data were transformed into D-scores. Thus, positive D-scores mean guilty (in moral aIAT) and user (in functional aIAT) and conversely negative D-scores mean innocent and non-user, respectively.

Scale's reliability, where applicable, was expressed as Cronbach alpha coefficients. Group differences were tested using independent samples t-test or ANOVA; and repeated measures ANOVA in case of comparing willingness and projected doping use. Relationships between measured variables were expressed with Pearson's product moment correlation coefficients. Effect

sizes (Cohen's *d* or partial eta squared) were calculated for all comparisons to inform future studies. Significance level was set at $p < .05$ for all analyses.

For social network analysis, a sociogram was created showing individuals as nodes and ties between them representing some sort of connection (e.g., friendships). SNA data were grouped according to the tie preferences expressed by the individuals and the reciprocity of ties, resulting in four possible dyadic configurations (no tie, outdegree only, indegree only and reciprocal), depending on the way in which the relationship is expressed (Pearson, Steglich & Snijders, 2006).

Clusters and bridges were identified by non-weighted fuzzy clustering method (Nepusz et al, 2008) using igraph software version 0.6.5 (http://igraph.sourceforge.net/index.html). Cluster memberships were also confirmed using four traditional weighted hierarhical clustering methods, namely fast greedy modularity optimisation (Clauset et al 2004), the walktrap method (Pons & Latapy, 2006, and edge betweenness based community detection (Girvan & Newman, 2002); along with a non-hierarchical Louvain method (Blondel et al, 2008). Dendograms from the hierarchical methods were cut where modularity was the highest (Clauset et al., 2004). All clustering methods used nondirected graph where reciprocal connections were weighted by adding the edge weights together.

Results

Fourteen players from a football team (FB) in the Isthmian league agreed to participate. The Isthmain league consists of semi-professional football clubs from London, east and south east England. The team had a mean age of 27 ± 3.4 years. The sample consisted of five forward players, four defenders, four midfield players and a goal keeper. Four team members declined taking part.

None of the 14 players in the sample reported using doping (two preferred not to answer). Only two players were unsure whether they intend to use prohibited performance enhancing substances, the remaining 12 players claimed no intention. Interestingly, the same two players were unsure about the future with regard to doping who did not answer the doping use question.

Autobiographical IATs

The aIAT results are displayed in Figure 12. It is notable that although no players reported doping use, the aIAT tests identified eight players as doping user, of which five had positive D-scores on both aIAT tests. One potential explanation is that players did not reveal the truth. The other explanation is that the aIAT test does not measure a concealed life event. In the true absence of the target behaviour (e.g., doping), the aIAT measures a related concept. Such phenomenon has been documented in previous studies using aIAT to identify cocaine users (Vargo & Petroczi, 2013c), where the aIAT incorrectly identified a large proportion of non-users as users.

The strength and direction of the two aIATs (Figure 12A and 12B) were in line with the hypothesis that athletes see using performance enhancements as a choice based on function, not morals. The

negative D-scores on the moral frame aIAT were expected from a group with no doping experience. However, the positive skewness on the functional aIAT, particularly in the context of having mainly negative D-scores on the moral framed aIAT, suggests that if another construct was activated in the absence of the relevant life event, it was related to the functional aspect of performance enhancement, not to a prohibited/illegal activity or cheating.

Clear positive correlation was found between the two aIATs (Figure 12C) reaching statistical significance despite the small sample size ($r(14) = .545$, $p = 0.044$).

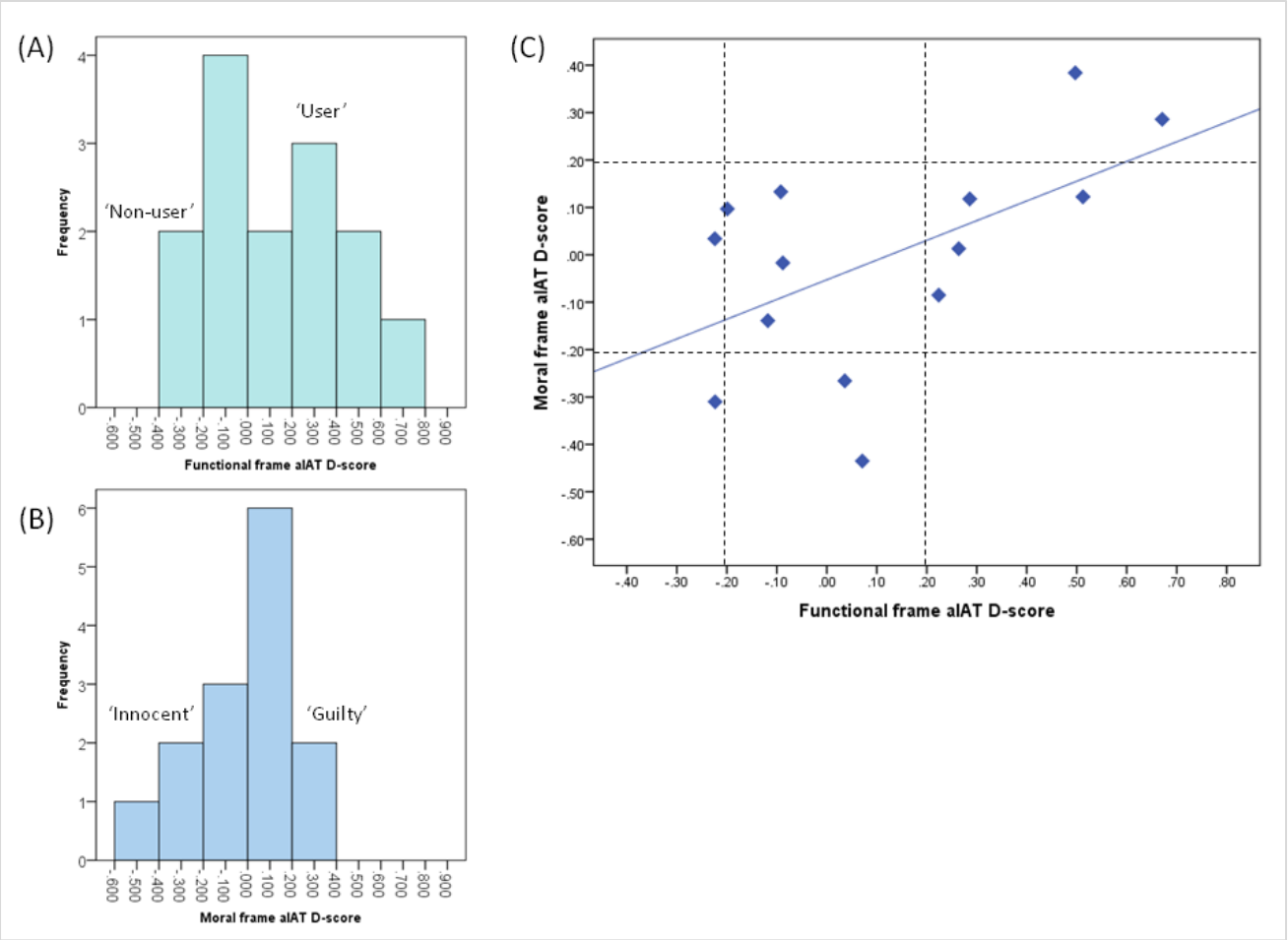


Figure 12: *Results from the aIATs. Distribution of the d-scores from functional frame aIAT (A) and moral frame aIAT (B) and the correlation between the two aIATs (C). Following Agosta, Pezzoli and Sartori (2013), dashed lines in panel (C) represent the more stringent criteria for the 'neutral' range.*

Explicit measures

Players in the sample generally claimed that they would be unwilling to take prohibited performance enhancing substances. There was a slight, but not statistically significant difference in willingness depending on whether the coach (1.54), family member (1.31) or a team mate (1.23) recommends use ($F(2,11) = 1.451$, $p = .276$, partial $\eta^2 = .209$). The largest standard deviation was observed for

coaches' recommendation (1 – 4, with 1 representing no willingness at all). Only 3 players (#16, 40 and 68) indicated some willingness (scores of 3 and 4). One player (#17) did not answer this question but based on the response pattern and qualitative feedback during data collection, doping use is suspected Players #40 and #17 also stated that they were unsure about their doping intentions.

Taking all into consideration, a 'doping prone' group was created with players #16, 17, 40 and 68. In the absence of doping behaviour, this variable will be used for group comparison. As expected, the projected prevalence estimation showed ingroup conservatism with the lowest estimated prevalence at 7.3%, compared to among players in other teams in the same league (15.7%) and in league/division above (21.3%). The differences almost reached statistical significance despite the small sample size ($F(2,12) = 3.416$, $p = .067$, partial $\eta^2 = .363$).

Comparing the 'doping-prone' group to the other, there was a slight difference in the expected direction in the functional aIAT with both mean D-scores in the slightly positive domain (0.098 ± 0.321 and 0.160 ± 0.265 for clean athletes and doping-prone players, respectively), suggesting faster response time for 'being a functional user' ($t(12)= -0.340$, $p = .740$, Cohen's $d = -0.201$). Moral aIAT results were even closer to the neutral range (0.0041 ± 0.217 and -0.027 ± 0.284 for clean athletes and doping-prone players, respectively, $t(12)= 0.220$, $p = .830$; Cohen's $d = 0.130$). Means, standard deviations and effect sizes for the direct and indirect explicit measures are displayed in Table 26.

Table 26: *Means, standard deviations and effect sizes for the direct and indirect explicit measures*

	Theoretical score range	Clean players	Doping-prone players	Cohen's *d*
Importance of athletic performance	1 - 10	8.33 ± 1.94	8.25 ± 1.26	0.046
Self-efficacy ('without doping')	2 - 12	9.1 ± 2.47	9.7 ± 2.63	0.259
Self-efficacy (performance)	4 - 28	17.0 ± 5.73	17.0 ± 4.40	-
Subjective norm (performance)	1 - 6	2.9 ± 1.97	2.5 ± 0.58	0.231
Subjective norm (no dope)	1 - 6	4.7 ± 1.64	4.5 ± 1.91	0.117
Personal control	1 - 6	4.8 ± 1.48	4.5 ± 0.58	0.229
Functional doping attitude/FDA ('works')	-108 - 108	29.9 ± 42.49	27.8 ± 47.42	0.049
Moral doping attitude / MDA ('cheating')	-72 - 72	33.4 ± 18.35	31.25 ± 17.88	0.118
Training hard	4 - 40	37.4 ± 5.66	38.0 ± 3.37	0.116

Violating anti-doping rules	4 - 40	9.2 ± 7.68	10.5 ± 8.06	0.162
Taking doping (projection)	4 - 40	11.1 ± 9.16	10.5 ± 6.45	0.070
Risk (health)	1 - 6	4.6 ± 1.35	5.5 ± 0.58	0.747
Risk (detection)	1 - 6	4.8 ± 1.75	4.0 ± 1.83	0.452
Prevalence in team	1 - 100	6.0 ± 6.78	10.5 ± 11.00	0.559
Prevalence in other teams in the league	1 - 100	13.30 ± 12.85	21.75 ± 26.69	0.486
Prevalence in league above	1 - 100	19.30 ± 21.93	26.25 ± 22.88	0.314

Note: none of the observed differences reached statistical significance at $p < .05$

None of the observed differences reached statistical significance with the current small sample. Therefore, the observed differences below are discussed based on effect sizes (indicating meaningful differences, if and where they exist) to inform future research instead of relying on sample-size sensitive statistical significances. Of course, these observations are to inform future studies and must be replicated in a larger sample to allow generalisation. Generally, doping-prone players perceived doping at higher prevalence rate, stronger belief that doping helps performance coupled with slightly less agreement with the notion that doping is cheating and higher tolerance for violating anti-doping rules. They also estimated the risk of being caught if using doping lower compared to their teammates who were not interested in doping. The largest effect sizes were for social projection and perceived risk with surprisingly small effects noted for the new attitude measures.

Players also made open comments on doping. These are displayed in Table 27. Some of those who exhibited some willingness to dope rationalised doping by the expected outcome (winning) and with a perceived pressure to achieve this outcome. The duality of attributes (i.e., 'cheating but works') has emerged from some of the comments.

Table 27: *Qualitative comments on doping*

ID	Open comment on doping
1	No comment
10	I think doping is wrong
16	No need for it to be honest, unfair advantage
17	I don't really care it's not for me
23	Morally wrong but it works
25	Disadvantage for another team. Brings game into disrepute
40	Doping is cheating but if you don't get caught and you win why not
44	I don't think it is fair to improve your performance with a drug

46	I think doping is wrong
60	I feel like I would need to know more to give a more educated answer but my first thought is that it is wrong and it takes away from the integrity of the specific sport. I do understand the thought process behind it but just think its morally wrong.
67	I think it is wrong. Its cheating to gain an advantage from training
68	I feel doping is wrong, but do understand the different pressures athletes are under, elite sport revolves around the attitude of 'win at all costs' and 'winning is the only option'. I feel this breads a doping culture.
69	Not fair ban everyone that cheats
70	As there is a lot of money involved in football nowadays, there is no place for doping

Explicit – implicit relationship

The relationships between the two aIATs and the explicit measures are expressed as correlation coefficients in Table 28. The strong correlation between functional indirect attitude and moral attitude is notable. As higher scores in each individually indicates stronger agreement with the scale general direction, namely 'doping helps performance' and 'doping is morally wrong', the strong positive correlation between these two measures provides some evidence for the functional use hypothesis and that positive attitude toward functionality of doping could exist along with explicitly endorsing the societal disapproval of doping on moral ground.

Interestingly, the aIATs did not correlate strongly with any form of attitude measures (direct or indirect). The strongest relationship was found between the functional aIAT and direct assessment of functional doping use attitude with semantic differential scales ($r(14) = -.401$), followed by the same assessment format for anti-doping rule violation ($r(14) = -.365$). The directions of both of these relationships were negative, thus those who identified more with being a 'functional doping user' reported more negative attitudes toward the same, and vice versa. However, one or both the aIATs showed strong correlation with self-efficacies and perceived social norms. Specifically, functional doping aIAT correlated strongly with perceived positive performance norm ($r(14) = -.590$), whereas moral doping aIAT correlated strongly with perceived negative doping norm ($r(14) = .749$). The directions of these relationships are surprising: those who identified more with being a functional user of doping on the aIAT showed reported less effect on perceived norm for performance and conversely those who identified more with being guilty of doping (i.e., cheaters) showed stronger effect from perceived negative doping norm. There was also a relationship between functional doping aIAT and perceived negative doping norm ($r(14) = .370$). Such contradictory findings cannot be explained within the associative theory of implicit attitudes, but rather, these can be seen as products of partial retrieval / salience asymmetries (Rothermund & Wentura, 2001; 2004).

Table 28: *Pearson correlation coefficients between explicit and implicit measures; Pearson's r and significance (p)*

		Direction	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Moral aIAT	+ *guilty* - *innocent*	-	.545* (.044)	.274 (.343)	.622* (.017)	.126 (.667)	.749** (.002)	.253 (.383)	.204 (.484)	.192 (.510)	-.117 (.690)	-.059 (.848)	-.004 (.989)	.097 (.741)	.033 (.911)
2	Functional aIAT	+ *user* - *nonuser*		-	.562* (.036)	.654* (.011)	-.590* (.026)	.370 (.194)	-.030 (.918)	.247 (.395)	.162 (.580)	-.181 (.537)	-.365 (.219)	-.401 (.155)	-.098 (.738)	.114 (.698)
3	Self-efficacy (doping)	*"I can do without doping"*			-	-.061 (.837)	-.343 (.230)	-.069 (.816)	.228 (.432)	.017 (.953)	.216 (.458)	-.148 (.614)	.025 (.935)	-.103 (.727)	.374 (.187)	.122 (.678)
4	Self-efficacy (performance)	*"I can enhance my performance"*				-	-.088 (.764)	.833** *	-.023 (.937)	.567* (.035)	.389 (.169)	-.198 (.497)	-.257 (.396)	.004 (.990)	-.084 (.776)	.212 (.468)
5	Subjective norm (performance)	*"People want me to enhance"*					-	.333 (.244)	.150 (.608)	-.053 (.858)	-.055 (.852)	.108 (.713)	.213 (.485)	.708** (.005)	.208 (.323)	-.140 (.634)
6	Subjective norm (doping)	*"People don't want me to take"*						-	.242 (.404)	.433 (.122)	.335 (.241)	-.058 (.845)	-.036 (.908)	.333 (.245)	.125 (.671)	.184 (.529)
7	Personal control over doping	*"Up to me"*							-	.121 (.679)	-.113 (.701)	.673 (.008)	.071 (.817)	.035 (.906)	.514 (.060)	.324 (.259)
8	Functional doping attitude / FDA (I)	*"Doping works"*								-	.788 (.001)	-.274 (.343)	.087 (.778)	.104 (.723)	.433 (.122)	.392 (.185)
9	Moral doping attitude / MDA (I)	*"Doping is cheating"*									-	-.441 (.114)	-.130 (.671)	.172 (.557)	.383 (.177)	.392 (.165)
10	Training hard (S)	+ *attribute is high score*										-	-.371 (.212)	-.297 (.303)	.127 (.665)	.075 (.800)
11	Violating anti-doping rules (S)	+ *attribute is high score*											-	.640 (.019)	.298 (.323)	-.169 (.581)
12	Taking doping (S)	+ *attribute is high score*												-	.280 (.333)	-.174 (.552)
13	Risk (health)	*"Using doping will risk my health"*													-	.328 (.252)
14	Risk (detection)	*"If I use doping I will fail the test"*														-

Note: I = indirect explicit assessment; S = semantic differential; * $p < .05$; ** $p < .01$; *** $p < .001$; exact p is reported for all correlations with $p > .001$.

Discussion

This study was the first application of the newly constructed explicit measure of doping attitude (Functional-Moral Doping Attitude (FMDA) scale) which separated the performance enhancement aspect from the moral aspect. The results provided preliminary evidence for the reliability and validity of two subscales (FDA and MDA) but the factor structure of the third facet, attitude toward performance enhancement goals (PEGA), was unclear with this small sample. The observed strong correlation between FDA and MDA requires further investigation to ascertain whether the correlation shows a *bona fide* relationship or caused by the same measurement format.

Following the previous work by Vargo and Petroczi (2013), the study utilised the aIAT concept and tested two variants of the doping aIAT, one containing neutral and non-judgmental statements representing the functionality of doping, whereas the other version used morally loaded statements focusing on the cheating aspect. The two brief doping aIATs were administered to each participant simultaneously. The correlation patterns between explicit and implicit measures offer reassurance for the validity of the newly constructed aIATs. Similarly to the explicit measures, the observed relatively strong correlation between the functional and moral aIATs requires further investigations. If the self-reported abstinence from doping is accepted as 'truth', then the study provided further support to Vargo and Petroczi (2013) questioning the validity of the aIAT as 'lie detector'. Accepting that in the absence of the target behaviour (doping), the aIAT measures some related concept, the results can be interpreted as the dominant mental representation of doping in team players. The results suggest that 'functionality' (i.e., performance enhancement) vs. 'morality' (i.e., cheating) is likely to be the dominant feature which could produced false positives if the 'prohibited' information of each stimuli statements are not processed. The underlying cognitive mechanism should be further explored, but the preliminary results indicate that the dominant mental representation of doping aligned with functionality in this small sample. Because the moral-framed doping aIAT is in line with the social knowledge (i.e., doping is cheating), it can be concluded that the functional-frame doping aIAT - when the outcomes are different from the moral-frame aIAT - most likely measures the individuals' mental representation of doping and not some environmental effect.

Owing to the small sample size and the lack of positive cases for doping among the participants, the study was not able to fully meeting the aim of comparing doping users/'contemplators' to non-users in the aIAT performance. For the same reasons, whether social cognitions about the *goal [performance enhancement]* predict doping over and above the social cognitions about the *method [doping]* cannot be tested. Furthermore, it was hypothesised that incongruent framing effect weakens the validity of the aIAT, where users expected to exhibit stronger aIAT effect on the functional, non-judgmental frame and nonusers expected to either exhibit a stronger aIAT effect on the moral, negative valence frame. Again, in the absence of positive cases, this hypothesis was not yet tested.

Future studies should focus on developing and establishing validity and reliability of the FMDA scale. Both explicit and implicit measures should be tested again with a larger sample size, and incorporate an objective behavioural measure whenever possible. Having accurate information about doping use is critical to fully understand the mechanism behind the different outcomes produced by the functional vs. moral aIAT. Given the length of the statements (and thus time required for processing), the automaticity in the test performance is debatable. Further research is warranted to explore the potential influence of propositional thinking on aIAT performance.

Social Network Analysis

The small sample size, however, benefitted the Social Network Analysis, which required a 'defined' population where every individual (node) had an equal chance of forming a relationship (path).

In order to investigate whether friends 'think alike', first friendship nominations were converted to into a social network diagram (Figure 13) and sub-groups (clusters) were identified within the football team (Table 29). Non-weighted fuzzy clustering method (Nepusz et al, 2008) identified 3 clusters and 3 bridges. The network diagram (Figure 13) does not show obvious clusters within the team.

Confirming the cluster memberships by traditional clustering methods, a considerable agreement was achieved: there was a complete agreement between fast greedy modularity optimisation (Clauset et al., 2004) and the Louvain method (Blondel, et al, 2008); and complete agreement between the walktrap method (Pons & Latapy, 2006) and the edge betweenness based community detection (Girvan & Newman, 2002). The disagreement was due to the strongest 'bridge' (with 0.85 'bridgeness' score, Table 30), hence the need for the fuzzy clustering methods.

Relevant cluster is the number of relevant clusters in which the node participates. A node is a bridge if it is ≥ 1.5. Bridgeness score measures the degree by which a node (vertex) is 'shared' among the clusters.[5]. Traditional clustering methods shown in Table 23 are: 1: Fast greedy modularity optimisation; 2: Walktrap method; 3: Edge betweenness based community detection; 4: Louvain method.

[5] In traditional graph clustering, clusters are 'crisp' sets: a node (vertex) is either included in the cluster or it is not. Each node belongs to exactly one of the clusters. Fuzzy approach to graph clustering allows a node to be partially included and thus shared between clusters. Because of this, fuzzy clustering based networks model real life scenarios better.

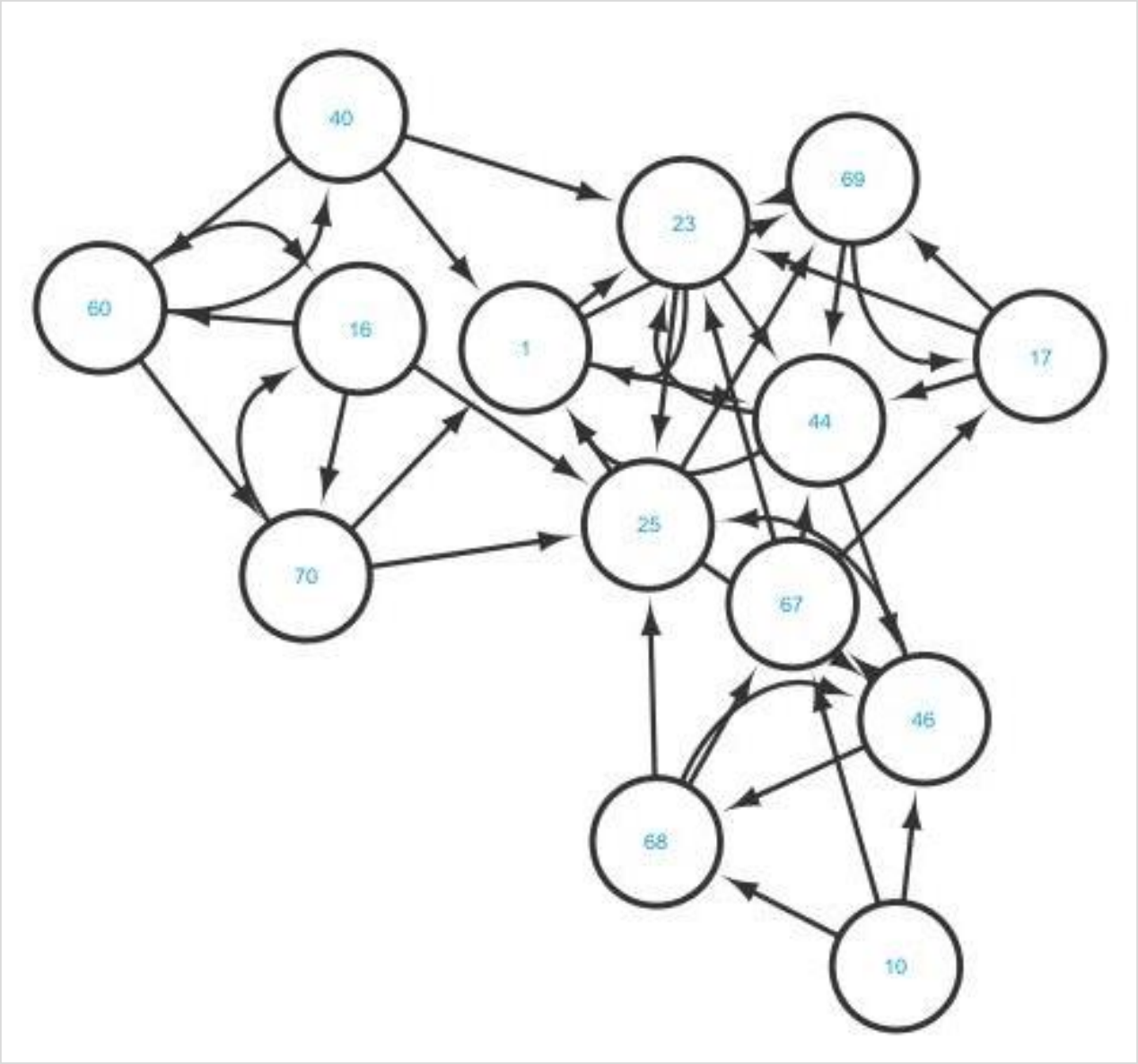


Figure 13: *Directed unweighted social network diagram of the football team, based on the top 3 nominated friends (Network diagram was created using Cytoscape 3.0.2). Node numbers correspond to numbers on Table 18.*

Table 29: *Cluster formation using unweighted fuzzy clustering compared to traditional clustering methods*

	Fuzzy clustering			Hierarchical clustering			
Node	**Cluster**	**Relevant cluster**	**Bridgeness**	**1**	**2**	**3**	**4**
1	A	1.6227	0.2644	A	A	A	A
10	B	1	0	B	B	B	B
16	C	1	0	C	C	C	C
17	A	1.4963	0.1993	A	A	A	A
23	A	1	0	A	A	A	A
25	A / B / **C***	2.9388	0.8577	C	C	A	A
40	**A** / C*	1.9993	0.4995	A	A	A	A
44	A	1.5258	0.2141	A	A	A	A
46	B	1.2465	0.085	B	B	B	B
60	C	1	0	C	C	C	C
67	A / **B***	1.8091	0.3712	B	B	B	B
68	B	1	0	B	B	B	B
69	A	1	0	A	A	A	A
70	C	1.2856	0.1016	C	C	C	C

Note: * denotes bridges; clustering methods: 1: Fast greedy modularity optimisation; 2: Walktrap method; 3: Edge betweenness based community detection; 4: Louvain method

Team Cohesion

AGTS is a 5-item scale which refers to an individual's feelings about personal involvement, acceptance and social interaction in the team. The scale mean ranges from 1 to 9 with high scores referring to a high sense of social personal involvement. The team score AGTS mean score was 4.77 ± 0.67, suggesting an average sense of social involvement. Yet when broken down into the individual positions, forwards had the lowest mean score of 4.64 ± 0.83, followed by midfielders 4.60 ± 0.16, defender 5.05 ± 0.91 and goal keeper scored the largest with a score of 5.00.

ATGT is a 4-item scale which refers to an individual's feelings about personal involvement with group tasks productivity, goals and objectives within the team. The scale mean ranges from 1 to 9 with high scores referring to a high sense of task personal involvement. The team ATGT mean score was 5.02 ± 0.96 suggesting a slightly larger than average sense of task involvement. Yet when broken down into the individual positions the goalkeeper scored the highest with a score of 6.25, followed by midfielders 4.88 ± 0.92, forwards 4.50 ± 1.00 and finally defenders scored the lowest 4.76 ± 0.47.

GIS is a 4-item scale which refers to an individual's feelings about the similarity, closeness and bonding within the team which revolve around the team as a social unit. The scale mean ranges from 1 to 9 with high scores referring to a high sense of similarity and bonding within the team. The team GIS mean score was 4.52 ± 0.97, suggesting an average sense of similarity within the team in social situations. Yet when broken down into the individual positions the goal keeper scored the highest with

a score of 5.75, followed by forwards with a score of 4.60 ± 1.38, defender 4.56 ± 0.75 and midfielder 4.06 ± 0.43 scored the lowest.

GIT is a 5-item scale which refers to an individual's feelings about the similarity, closeness and bonding within the team the team which revolve around the team tasks. The GIT team mean score was 4.76 ± 0.47, suggesting a larger than average sense of similarity and bonding whilst conducting tasks. When broken down into the individual position again the goal keeper scored the highest with a score of 5.40, closely followed by forwards with a score of 4.80 ± 0.42, midfielder with 4.75 ± 0.53 and defenders had the lowest score of 4.55 ± 0.50.

Significant relationships were observed between the cohesion measures and the PPD attitude measures. AGTS positively correlated with FPU scale $r = 0.737$, $n = 14$, $p < 0.01$ and with the RBG scale $r = 0.617$, $n = 14$, $p = 0.03$. GIS negatively correlated with FDA scale $r = -0.636$, $n = 14$, $p = 0.01$ and PEGA $r = -0.672$, $n = 14$, $p = 0.01$ and positively correlated with FPU $r = 0.543$, $n = 14$, $p = 0.05$. GIT also negatively correlated with the FDA scale $r = -0.713$, $n = 14$, $p < 0.01$ and PEGA $r = -0.753$, $n = 14$, $p < 0.01$ and positively correlated with FPU $r = 0.627$, $n = 14$, $p = 0.02$.

Study 5: Social Network Analysis with a team of American football players – shared views and values about doping in close friendship groups[6]

Background

In social network analysis, a sociogram is created showing points (nodes) which represent the individuals belonging to the network and ties between these subjects representing some sort of connection (e.g., friendships). Through statistical analyses, correlations are explored between the nodes' characteristics and typology of ties between participants. Social network analysis will provide us with a dynamic approach to the interpretation of attitudes towards goal attainment and attitudes towards doping behaviour through the exploration and categorization of selective processes and social influence (Steglich et al., 2010).

Aims

After a successful pilot study of the data collection and analysis with data from football players in a single team, this research embarked on repeating the study with a larger sample, American football team to further explore the usefulness of combining Social Network Analysis with doping research. The overarching aim of the study was to explore how social groups (immediate athlete environment) influences explicit and implicit social cognition about doping.

Methods

Participants

The sample consisted of 40 university level American football players based in the United Kingdom.

Due to incomplete data, the final sample for some analysis was reduced to 31. The mean age was 21 ± 1.8 years. Of the 31 players, 2 were running backs (RB), 5 played offensive line (OL), 4 played tight ends (TE), 4 were wide receivers (WR), 5 played defensive line (DL), 2 were line backers (LB), 4 were corner backs (CB) and 5 were safety (S). Twenty-four of the players competed at university level, five at a regional level, and two for the UK National team. The whole team had average training time of 9 ± 2.63 hours per week.

Procedure

All participants were randomly assigned a number in order to maintain anonymity when providing responses. Numbers were used to link data together and was used during the social network analysis. Players were provided with a self-administered paper-based questionnaire.

[6] This study formed a section in Ricky James' PhD dissertation (submitted in April 2017). The study is included with minor edits.

Measures

Social network

The technique used was a modified version of McCallister & Fisher (1978) tool used in Kiuru et al (2010). This modified procedure required the team members to identify their top three friends from the whole team using the numbers from the anonymity procedure. This information was used to observe sub groups within the team. Group analysis was conducted using a fuzzy method as individuals are known to belong to multiple groups simultaneously (Davis & Carley, 2008).[7]

Cohesion

Because a team's success is largely dependent on how well the group as a whole fits together (Carron et al., 2002) the first section consisted of a common tool used to assess cohesion, the Group Environment Questionnaire (GEQ) (Brawley *et al.*, 1987; Whitton & Fletcher, 2014). The GEQ produces results on a four factor model, derived from the four subscales; group integration-task (GIT), individual attraction to group-task (ATGT), group integration-social (GIS), individual attraction to group-social (AGTS) (Carron *et al.*, 1985; Whitton & Fletcher, 2014). These four subscales focus upon two main concepts of cohesion, task and social. Task refers to the teams goals, whilst social refers to the inter-member relations. In team sports there is the group (team) and the individual, the GEQ assesses the degree to which the group and individuals share the tasks and social outlines. Items for each of the subscales are scored on 1 to 9 agreement Likert scale with 1 being strongly disagree and 9 being strongly agree. Items which correspond to each subscale are collated and a mean determined, the larger the score the more the respondent is in agreement with the subscale. ATGT & GIS are scored between 4 to 36 and GIT & AGTS are scored between 5 to 45.

Attitudes

The study used three types of attitude measures: Direct (report directly on sematic differential spectrum), Indirect (assessed through agreement with attitude items) and Implicit (based on response times)

Direct assessment of attitude measure

Direct attitude measures were created following guidelines for creating attitude measure for the Theory of Planned Behaviour model (Francis et al, 2004). For the '*moralistic approach*', respondents were asked to rate achievement through rule breaking in general (RBG) various positive to negative continuums. The continuums were good/bad, right/wrong, worthwhile/worthless, beneficial/detrimental, wise/foolish and safe/risky all scored on a 10-point scale. In the AMF study three items (wise/foolish, safe/risky and worthwhile/worthless) were combined to create a scale (α =

[7] Network Analysis was conduct by Dr Tamas Nepusz, Sixdegrees Consulting, Budapest, Hungary.

0.65). In the FB study five items were selected (right/wrong, worthwhile/worthless, beneficial/detrimental, wise/foolish and safe/risky) and combined to create a scale (α = 0.73).

When measuring PPD use with a '*functional approach to use'* (FPU) a similar approach was used. Respondents were asked to rate PPD use to achieve objectives on various positive to negative continuums. The continuums were good/bad, right/wrong, wise/foolish, worthwhile/worthless, beneficial/detrimental, and safe/risky all scored on a 10-point scale. In the AMF study four items were selected (right/wrong, good/bad, worthwhile/worthless, wise/foolish) for a scale (α = 0.77). In the FB study five items (good/bad, right/wrong, beneficial/detrimental, wise/foolish, safe/risky) were selected to create the scale (α = 0.78).

Indirect assessment of doping attitude

Indirect attitude measures were created following guidelines for constructing attitude measures for testing Theory of Planned behaviour (Francis et al, 2004). The formation of the indirect attitude scale involved a combination of behavioural beliefs and outcome evaluations. Each behavioural belief had a linking outcome evaluations (Tables 30-32). Items were categorised into three subgroups for scale development, functional focus doping attitude (FDA, Table 30), morally framed doping attitude (MDA, Table 31)) and performance enhancement goal attitude (PEGA, Table 32).

Table 30: *Morally framed doping attitude items (MDA). AMF - 3 ITEMS (α=0.75). FB – 3 ITEMS (α=0.62).*

Study	Behaviour: Breaking the rule/cheating	Evaluation of the expected outcome
	Using doping is morally wrong	Doing what morally right for me is…
AMF/FB	Using doping gives unfair advantage	Gaining unfair advantage for me is…
FB	If I use doping, I will feel I cheat	Cheating for me is...
	If I use doping, I will not harm others	Harming others for me is...
	Using doping is not against the spirit of sport	Keeping the sport clean of drugs for me is...
AMF	Using doping is against fair play	Fair play for me is...
AMF/FB	If I use doping, I will violate the anti-doping rules	Adhering to the anti-doping rules for me is…

When constructing the MDA scale for AMF 3 items were selected;

- *'Using doping gives unfair advantage',*
- *'Using doping is against fair play'*
- *'If I use doping, 'I will violate the anti-doping rules'*

The scales Cronbach alpha was well above threshold (α = 0.75) so was used in the study. Yet the highest Cronbach alpha for the FB study was (α = 0.62).

Table 31. *Functional focus doping attitude items (FDA). FB – 9 ITEMS (α=0.91). AMF – 4 ITEMS (α = 0.59). R signifies scores were reversed*

Study	Behaviour: Achieving an athletic goal	Evaluation of the expected outcome
FB	Using doping can make my results better.	Making my results better is...
FB	If I use doping, I will remain competitive.	Remaining competitive for me is…
FB	If I use doping, I will not know what I am capable of without drugs.	Knowing what I am capable of for me is...
	Using doping can help to improve my athletic performance.	Improving my athletic performance is…
FB/AMF	If I don't use doping, I will not benefit from my hard work and training as much as I want to.	Getting return on my hard work and training for me is...
FB/AMF	Using doping will not help me training hard.(R)	Training hard for me is...
FB	Using doping after injury will not aid my recovery. (R)	Recovering fully and quickly after injury for me is ..
FB	If I refrain from using performance enhancing drugs, I can see the results of my natural ability. (R)	Seeing how far my natural talent can take me is.
FB/AMF	If I use doping, I will be a more competitive athlete.	Being a competitive athlete for me is..
FB/AMF	If I increase my performance with doping, my income will be higher.	Increasing my income for me is...

When constructing the FDA scale for FB study 9 items were selected;

- *Using doping can make my results better.*
- *If I use doping, I will remain competitive.*
- *If I use doping, I will not know what I am capable of without drugs.*
- *If I don't use doping, I will not benefit from my hard work and training as much as I want to.*
- *Using doping will not help me training hard.(Reverse scoring)*
- *Using doping after injury will not aid my recovery. (Reverse scoring)*
- *If I refrain from using performance enhancing drugs, I can see the results of my natural ability. (Reverse scoring)*
- *If I use doping, I will be a more competitive athlete.*

- *If I increase my performance with doping, my income will be higher.*

The scales Cronbach alpha was well above threshold (α = 0.91) so was used in the study. Yet the highest Cronbach alpha with 4 items for the AMF study was (α = 0.59).

Table 32. *Performance enhancement goal attitude items (PEGA). AMF – 4 ITEMS (α=0.67), FB PEGA – 4 ITEMS (α = 0.81)***.**

Study	Behaviour: Increased performance	Evaluation of the expected outcome
AMF	I will be a better athlete if I enhance my performance.	Being a better athlete for me is..
AMF/FB	If I improve my performance, I will compete in higher level.	Competing at the higher level for me is...
AMF/FB	If I increase my performance, my income will be higher	Higher income for me is..
FB	I need to increase my performance to reach my personal performance goal.	Reaching my personal performance goals for me is.
AMF/FB	Performing to the best of my ability is an important personal goal to me.	Achieving the goals I set to myself is...

When constructing the PEGA scale for FB study 4 items were selected:

- If I improve my performance, I will compete in higher level.
- If I increase my performance, my income will be higher
- I need to increase my performance to reach my personal performance goal.
- Performing to the best of my ability is an important personal goal to me.

The scales Cronbach alpha was well above threshold (α = 0.81) so was used in the study. When constructing the PEGA scale for AMF study 4 items were also selected:

- I *will be a better athlete if I enhance my performance.*
- *If I improve my performance, I will compete in higher level.*
- *If I increase my performance, my income will be higher*
- *Performing to the best of my ability is an important personal goal to me.*

The scales Cronbach alpha was just above threshold (α = 0.67) so was used in the study.

When scoring the PEGA, MDA and FDA scales, each behaviour item (scored on a 1 to 6 agreement scale) was multiplied by its corresponding expected outcome (scored on a -3 to +3 desirability scale). All items in the scale where added together, positive scores indicate a preference towards the behaviour and negative scores indicate an aversion.

Implicit assessment of doping attitude

Two Brief Implicit Association Tests (BIAT) were used. The tests required the respondents to sort PPD related words into categories; the first BIAT required respondents to sort "PPD" and "supplement" category words into "me", "not me" categories (Supplements were non focal) the second BIAT required respondents to sort "PPD" and "supplement" category words into "moral", "immoral" categories. Supplements were non focal (Table 33). These were used to ascertain whether the respondents associated PPD's with themselves and an advantage. The BIAT is scored using D scores ranging from 1+ to -1, the closer to 1 in either direction signifies the strength of the association (Sriram & Greenwald, 2009).

Table 33: *BIAT categories and corresponding words*

Category	Words
PPD	Steroids, drugs, Stimulant, Hormone
Supplement (Non focal)	Vitamin, mineral, protein, superfood
ME	I, myself, mine, my
Not Me	They, their, them, others
Moral	Fair, honourable, honest, right
Immoral	Unfair, deshonorable, dishonest, wrong

Doping Prevalence and pressure

The false consensus effect is when individuals assume that others share attitudes and partake in similar behaviour to a larger extent to what the reality is (Ross et al, 1977). Respondents were asked to estimate the percentage of PPD users in their current team, in their league and in the league above. Respondents were required to report what their reaction would be to a teammate doping. Respondents were also required to give a percentage of pressure felt to use PPD's.

Team Norms

Various aspects of teams norms were assessed using a Likert scale, these include: abiding by team social norms, team situational expectations, agreement on appropriate and inappropriate behaviour, sense of behavioural freedom, behavioural disapproval, complying with norms, achievement

comparison, experience exchange and learning from the experience from others. Responses were scored on a 6-point Likert-type agreement scale ranging from strongly disagree to strongly agree.

Demographics

Demographical information collected were: age, playing position, level of competition, hours of training per week and play time.

Results

The sample comprised of 45 American (male) football players in the UK (mean age = 22.58 ± 3.56), playing at university club level. The average play time in the season was 4.33 (± 3.7), and ranged between 1 and 20. Typically, participants trained 9 hours (± 2.66; range: 5-14).

The players' positions in the team were as follows (in decreasing order of frequency): defensive line (5), offensive line (5), safety (5), tight end (4), wide receiver (4), cornerback (4), running back (2), linebacker (2), not identified (14).

Based on the identified 'friends' within the team, a social network map was constructed (Table 34 and Figure 14). Thirty-one players completed the social network questions.

Table 34: *Network Analysis clustering results*

Node (players)	Fuzzy clustering	Bridgeness	1	2	3	4
1	0	0	1	1	1	2
2	5	0	4	0	0	0
3	0	0.0959	1	1	1	2
4	4	0	0	0	4	0
5	1	0	2	4	3	3
6	6	0	0	2	0	0
7	5	0.2289	4	2	0	0
8	6	0.2405	0	0	0	0
9	6	0.0833	0	2	0	0
10	4	0.5663	0	0	0	0
11	1	0.5085	2	2	0	3
12	1	0	2	4	3	3
13	0	0.3243	1	1	1	2
14	1	0	2	4	3	3
15	5	0.3903	4	2	0	1
16	3	0	0	0	5	4
17	2	0	3	3	2	1
18	2	0.3217	3	3	2	1
19	4	0.0981	0	0	4	0
20	2	0	3	3	2	1

21	0	0.4292	1	1	1	2
22	0	0.2947	1	1	1	2
23	1	0	2	4	3	3
24	4	0.2126	0	0	4	0
25	3	0.3667	0	0	0	0
26	3	0.2934	1	1	5	4
27	5	0.1734	4	2	0	0
30	2	0	3	3	2	1
31	2	0.3981	3	3	2	1
37	3	0.1271	0	0	5	4
40	0	0.086	1	1	1	2

Clustering: 1: Fast greedy modularity optimisation; 2: Walktrap method; 3: Edge betweenness based community detection; 4: Louvain method

Social network analysis highlighted seven clusters (Groups) within the team, mainly bridged by eight members (Figure 14). Group A & C had the most number of members with six in the group and group F and G had the least amount of members with 3 (Table 34). All groups consisted of players from a variety of offensive and defensive positions. Group A had the most amount of bridges in their group with five and Group B had the least with one (Table 35). Group B had the player (Figure 14) with the highest bridgeness with a score of 0.57, this indicates that this team member may have the largest influence over attitudes.

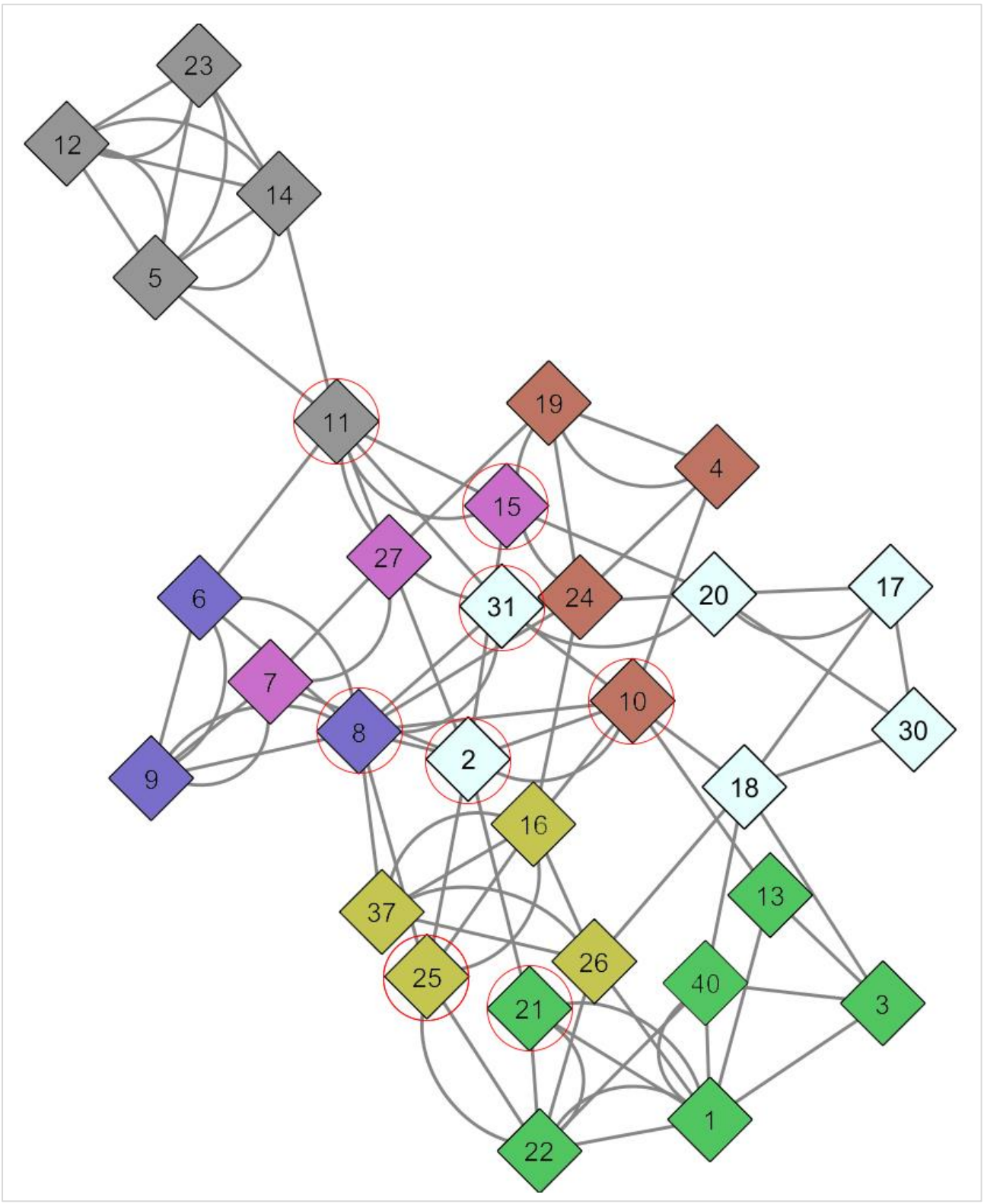


Figure 14: *Social network diagram for AMF. Green (Group A), Grey (Group B), Light Blue (Group C), Yellow (Group D), Red (Group E), Purple (Group F) and Pink (Group G). Red circles indicate the strongest bridges in each subgroup***.**

Table 35: *Number, age, position and bridges in each group*

Cluster	Size	Age (years)	Positions	No of Bridges
Group A	6	20.33 ± 1.51	RB/OL/TE/LB/CB/CB	5
Group B	5	21.00 ± 1.58	RB/OL/TE/WR/DL	1
Group C	6	20.33 ± 2.01	TE/WR/DL/SF/SF/SF	2
Group D	4	21.00 ± 1.63	OL/WR/CB/SF	3
Group E	4	20.50 ± 2.65	OL/OL/LB/CB	3
Group F	3	20.67 ± 1.53	TE/WR/DL	3
Group G	3	22.67 ± 1.16	DL/DL/SF	2

Team cohesion

AGTS is a 5-item scale which refers to an individual's feelings about personal involvement, acceptance and social interaction in the team. The scale mean ranges from 1 to 9 with high scores referring to a high sense of social personal involvement. The team score AGTS mean score was 3.55 ± 0.92, suggesting a lower than average sense of social involvement. Yet when broken down into the individual groups, group A had the largest mean score of 4.00 ± 1.40 and group C had the significantly lowest score 3.13 ± 0.45 ($t(5) = -2.87$, $p = 0.04$) when separated and compared to the remaining group mean (Table 36).

ATGT is a 4-item scale which refers to an individual's feelings about personal involvement with group tasks productivity, goals and objectives within the team. The scale mean ranges from 1 to 9 with high scores referring to a high sense of task personal involvement. The team ATGT mean score was 6.90 ± 0.88 suggesting a larger than average sense of task involvement. Yet when broken down into the individual groups, group D had the lowest mean score of 6.13 ± 0.97 and group C had the significantly highest score of 7.45 ± 0.34 ($t(5) = 4.64$, $p = 0.01$) when separated and compared to the remaining group mean (Table 36).

GIS is a 4-item scale which refers to an individual's feelings about the similarity, closeness and bonding within the team which revolve around the team as a social unit. The scale mean ranges from 1 to 9 with high scores referring to a high sense of similarity and bonding within the team. The team GIS mean score was 4.89 ± 0.72, suggesting a lower than average sense of similarity within the team in social situations. Yet when broken down into the individual groups the highest and lowest groups were around the mean, group F had the largest mean score of 5.50 ± 0.50 and group B had the significantly lowest score 3.95 ± 0.48 ($t(4) = -5.21$, $p = 0.01$) when separated and compared to the remaining group mean (Table 36).

Finally GIT is a 5 item scale which refers to an individual's feelings about the similarity, closeness and bonding within the team the team which revolve around the team tasks. The GIT team mean score was 5.65 ± 1.01, suggesting a larger than average sense of similarity and bonding whilst conducting tasks. When broken down into the individual groups the highest and lowest groups were around the mean, group B had the lowest mean score of 5.16 ± 0.77 and group A had the significantly highest score of 6.47 ± 0.47 ($t(5) = 5.27$, $p < 0.01$) when separated and compared to the remaining group mean (Table 36).

Table 36: *GEQ subscales, group means compared against the combined means of the other groups.* ^{H} *Indicates the group with the highest group mean,* ^{L} *indicates the group with the lowest mean and * indicates groups with a significant difference.*

	AGTS		ATGT		GIS		GIT	
	G mean	**Other G Means**	**G mean**	**Other G Means**	**G mean**	**Other G Means**	**G mean**	**Other G Means**
Group A	4.00 ± 1.40^{H}	3.45 ± 0.77	6.92 ± 0.72	6.89 ± 0.93	5.13 ± 0.86	4.83 ± 0.69	6.47 ± 0.47^{H}	5.46 ± 1.01*
Group B	3.88 ± 1.06	3.49 ± 0.90	6.25 ± 1.12	7.02 ± 0.80	3.95 ± 0.48^{L}	5.07 ± 0.61*	5.16 ± 0.77^{L}	5.75 ± 1.04
Group C	3.13 ± 0.45^{L}	3.66 ± 0.98*	7.45 ± 0.34^{H}	6.77 ± 0.93*	5.04 ± 0.73	4.85 ± 0.73	5.47 ± 1.01	5.70 ± 1.03
Group D	3.20 ± 0.49	3.61 ± 0.96	6.13 ± 0.97^{L}	7.01 ± 0.83	4.94 ± 0.24	4.88 ± 0.77	5.80 ± 1.32	5.63 ± 0.99
Group E	3.85 ± 1.17	3.51 ± 0.90	7.13 ± 0.97	6.86 ± 0.88	4.81 ± 0.63	4.90 ± 0.74	5.30 ± 1.47	5.70 ± 0.95
Group F	3.47 ± 0.42	3.56 ± 0.96	7.25 ± 0.90	6.86 ± 0.89	5.50 ± 0.50^{H}	4.82 ± 0.71	5.93 ± 0.31	5.62 ± 1.06
Group G	3.13 ± 0.61	3.60 ± 0.94	7.25 ± 0.66	6.86 ± 0.90	5.08 ± 0.29	4.87 ± 0.75	5.20 ± 1.31	5.70 ± 0.99
TEAM	**3.55 ± 0.92**		**6.90 ± 0.88**		**4.89 ± 0.72**		**5.65 ± 1.01**	

Prevalence perception and pressure

On average the team perceived that the 7.81% ± 18.68% of the team was using PPD's (Table 37). When broken down into their individual groups D scored the highest perception at 25.00% ± 37.86% which was not significantly different from the other group means. Groups C and F both scored the lowest with a perception of 0.00% ± 0.00%. Group A 2.50 ± 4.18 ($t(5) = -3.85$, $p = 0.01$) and group E 0.50 ± 1.00 ($t(3)$ -16.78, $p < 0.01$) were all significantly larger than the mean of the remaining groups yet group C and F were without *t* values due to their lack of standard deviation.

The team perception of PPD use in the league was higher than the team level at 20.97% ± 22.42%. When broken down into their individual groups, group D again scored the highest with a score of 35.50% ± 28.07%, Group G scored the lowest with a score of 3.67% ± 5.51% which was significantly lower than the separated means $t(2) = -6.02$, $p = 0.03$. Group F was also scored significantly lower ($t(2) = -4.75$, $p = 0.04$) with a score of 6.67% ± 5.77%.

Finally the team perception of PPD use in the league above was again higher than the perception of the league with a score of 35.58% ± 21.40%. When broken down into the groups, group D again scored the highest with a score of 47.50% ± 22.17%. Group G scored the lowest with a mean score of 15.00% ± 13.23%. None of the groups were significantly different. All groups showed a perceptual increase as the level of competition increased from there team, to the league and the league above.

As a whole the team felt relative low pressure to dope with a mean score of 18.36% ± 28.88%. When broken down into individual groups, group B felt the highest pressure with a score of 44.00% ± 37.82%. Groups C and G felt the least pressures with scores of 0.00% ± 0.00%, *t* values were not calculated by SPSS due to the low standard deviation but it is assumed the difference would be significant.

Table 37: *Perceptions of pressure and doping in the team, in the division and the division above. [H] Indicates the group with the highest group mean, [L] indicates the group with the lowest mean, * indicates groups with a significant difference and ?* indicates significant differences between the group and the other means but SPSS didn't produce data as the standard deviation was 0.*

	Pressure		Team doping		Division doping		Division above	
	G mean	Other G Means	G mean	Other G Means	G mean	Other G Means	G mean	Other G Means
Group A	10.00 ± 20.00	20.40 ± 30.62	2.50 ± 4.18	9.08 ± 20.58*	26.67 ± 35.17	19.60 ± 18.98	35.00 ± 21.68	32.00 ± 21.75
Group B	44.00 ± 37.82[H]	13.46 ± 24.81	15.00 ± 21.21	6.42 ± 18.28	33.00 ± 17.89	18.65 ± 22.74	42.00 ± 21.68	30.77 ± 21.29
Group C	0.00 ± 0.00[L]	28.80 ± 30.62*	0.00 ± 0.00[L]	9.68 ± 20.42*	15.00 ± 13.78	22.40 ± 24.03	26.67 ± 25.03	34.00 ± 20.70
Group D	30.00 ± 46.90	16.67 ± 26.17	25.00 ± 37.86[H]	5.26 ± 13.60	35.50 ± 28.07[H]	18.81 ± 21.25	47.50 ± 22.17[H]	30.37 ± 20.80
Group E	25.00 ± 25.17	17.41 ± 29.69	0.50 ± 1.00	8.89 ± 19.82*	15.50 ± 13.70	21.78 ± 23.51	23.75 ± 12.50	33.89 ± 22.29
Group F	23.33 ± 25.17	17.86 ± 29.61	0.00 ± 0.00[L]	8.64 ± 19.50*	6.67 ± 5.77	22.50 ± 23.04*	33.33 ± 25.17	32.50 ± 21.50
Group G	0.00 ± 0.00[L]	20.36 ± 29.75*	16.67 ± 28.87	6.86 ± 17.78	3.67 ± 5.51[L]	22.82 ± 22.79*	15.00 ± 13.23[L]	34.46 ± 21.40
TEAM	18.36 ± 28.88		7.81 ± 18.68		20.97 ± 22.42		35.58 ± 21.40	

Game time

Group D had members with the most amount of game time with all of them playing 100% of the games. Members of group C played predominantly only 25% of the games. The rest of the groups had a mixture of 25%, 75% and 100% playing time (Figure 15).

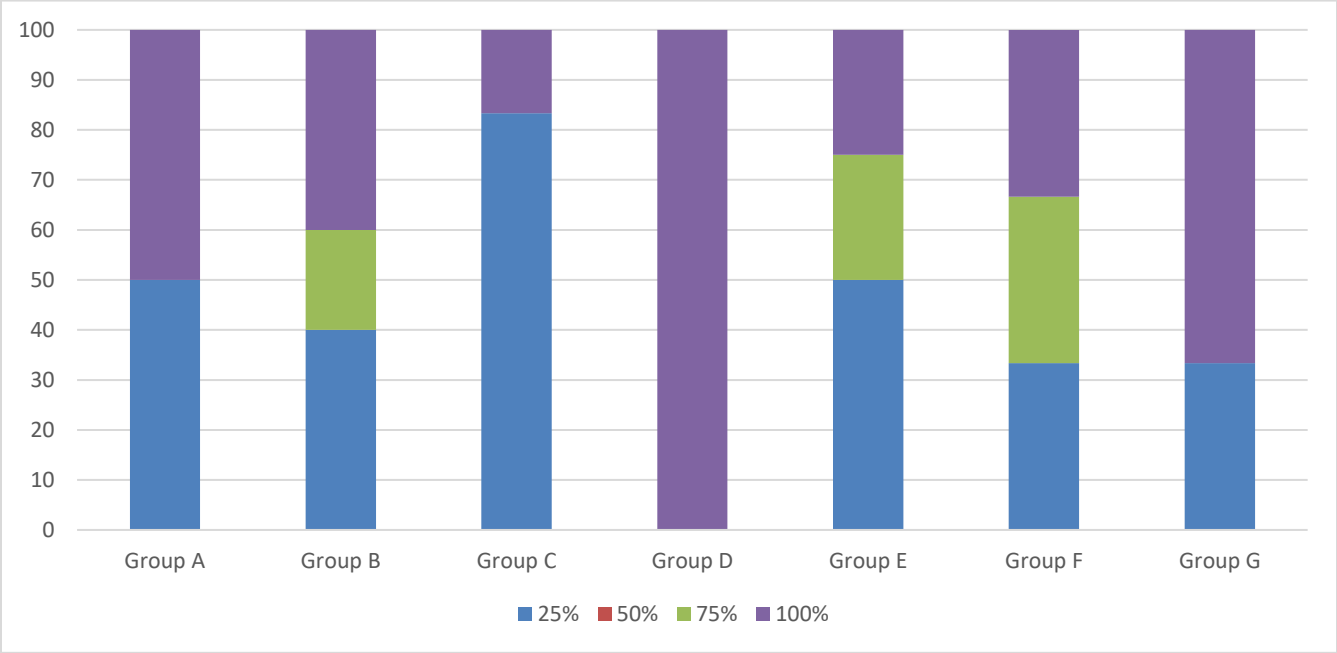


Figure 15: *Percentage of game time by group*

Reported use of doping

All team members expressed that they were not currently using prohibited performance enhancing drugs (PPDs). When asked if they had knowingly used PPD's in the past, as a team 3.2% answered yes, the majority answered no with 90.3% and 6.5% said that they would prefer not to answer. When broken down into individual groups, groups B, C, D and F all answered no they had not used before. Groups E and G had members who preferred not to say and group A had one person who had (Figure 16).

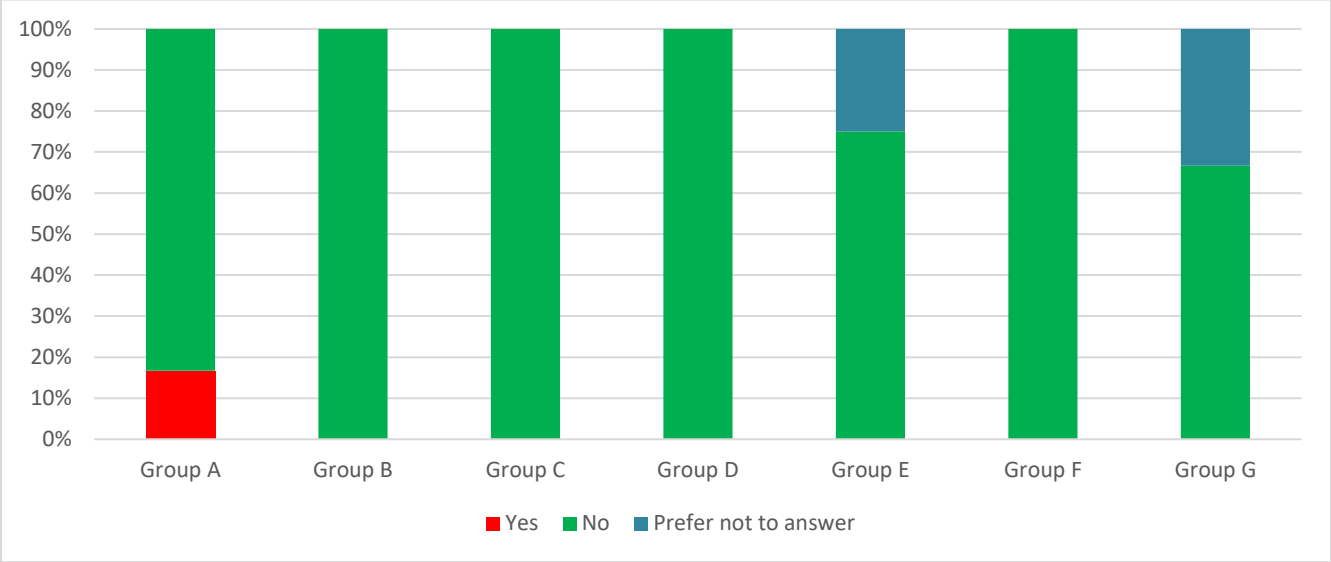


Figure 16: *Reported past use of prohibited performance-enhancing drugs*

When the team were asked if they would use and PPD substances in the future none said yes, 77.4% said no and 22.6% said that they weren't sure. When broken down into individual groups, groups C, E and F all answered 100% no and groups A, B, D and G had members who weren't sure with group G having the largest amount of members (Figure 17).

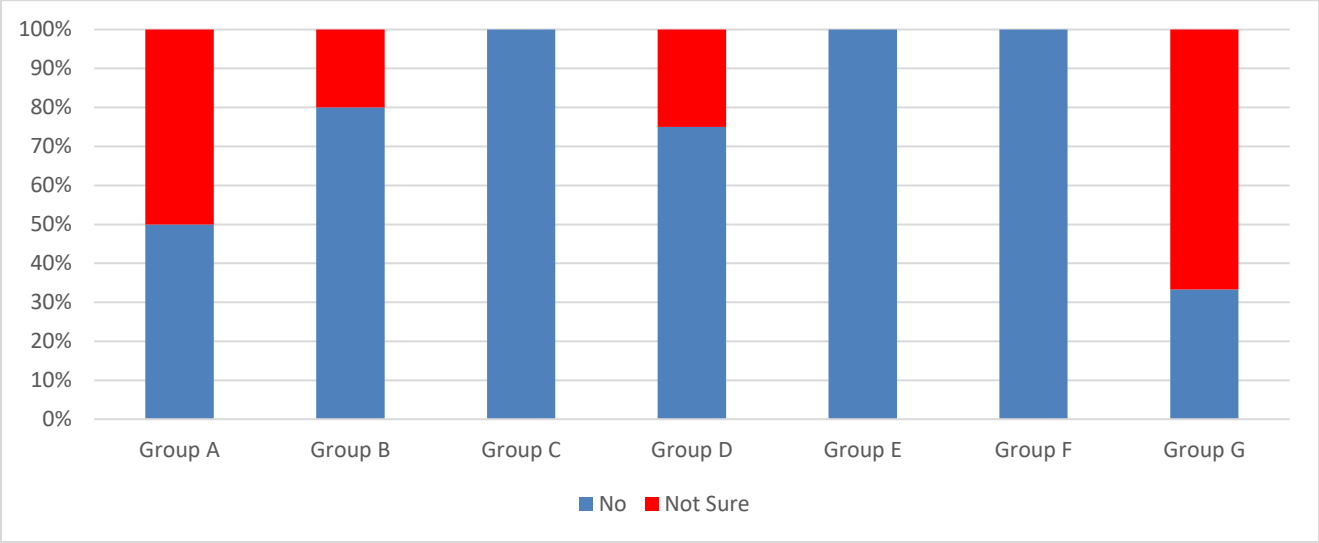


Figure 17: *Reported intention to use prohibited performance-enhancing drugs in the future*

When asked what the team would do if they found out a team member was partaking in PPD behaviour, 64.5% indicated that they would ignore it, 22.6% of the team said they would understand without making judgement, 9.7% indicated they would report it to the coach and 3.2% would follow the example not wanting to get left behind. When broken down into the sub-groups, groups F and G would 100% ignore PPD use. Group E and C would predominately ignore it but had members that would also understand. Groups A and B had a mix between ignore, understand and report, group A predominately would ignore and group B would evenly ignore or report with a few members who would understand (Figure 18).

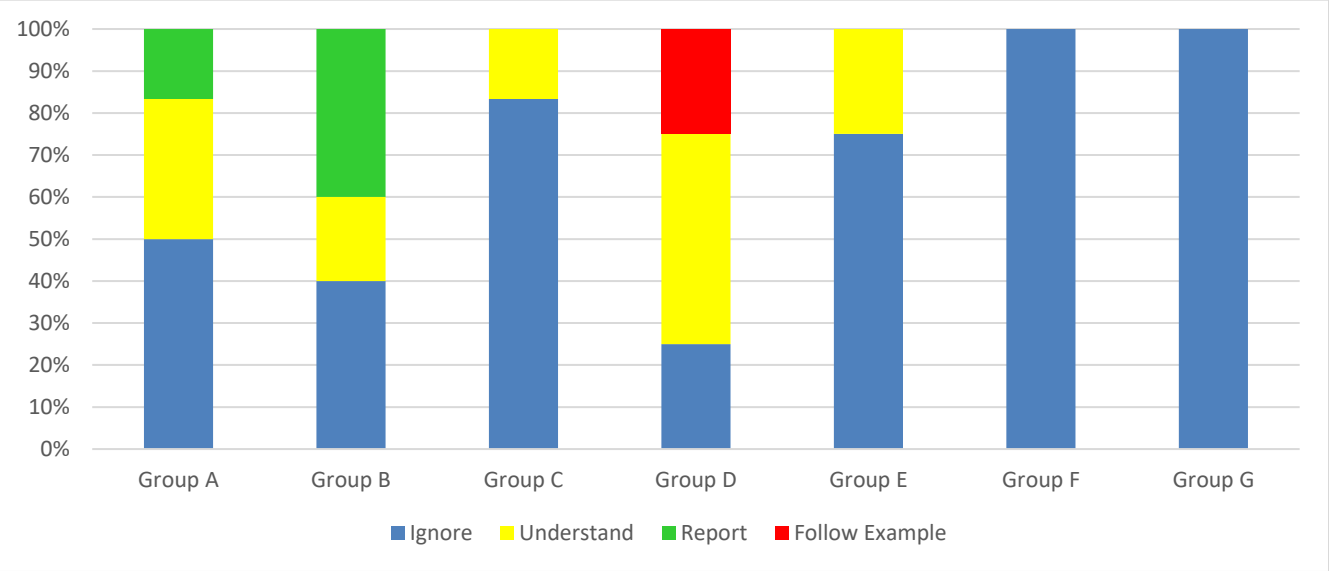


Figure 18: *Reaction to team PPD use*

Team norm profile

Social norms are rules of behaviour by which members of the group must follow or risk being shunned by the group. All groups scored exhibited similar profile patterns (Figure 19). All groups apart from group G exhibited mid to low scores in abiding to the norms of the group, this can have negative connotations if the norm of the team is not to use PPD's. Similarly the team disagreed with the statement 'people often compare their achievements with those of others', this is surprising considering there is large internal competition within the team.

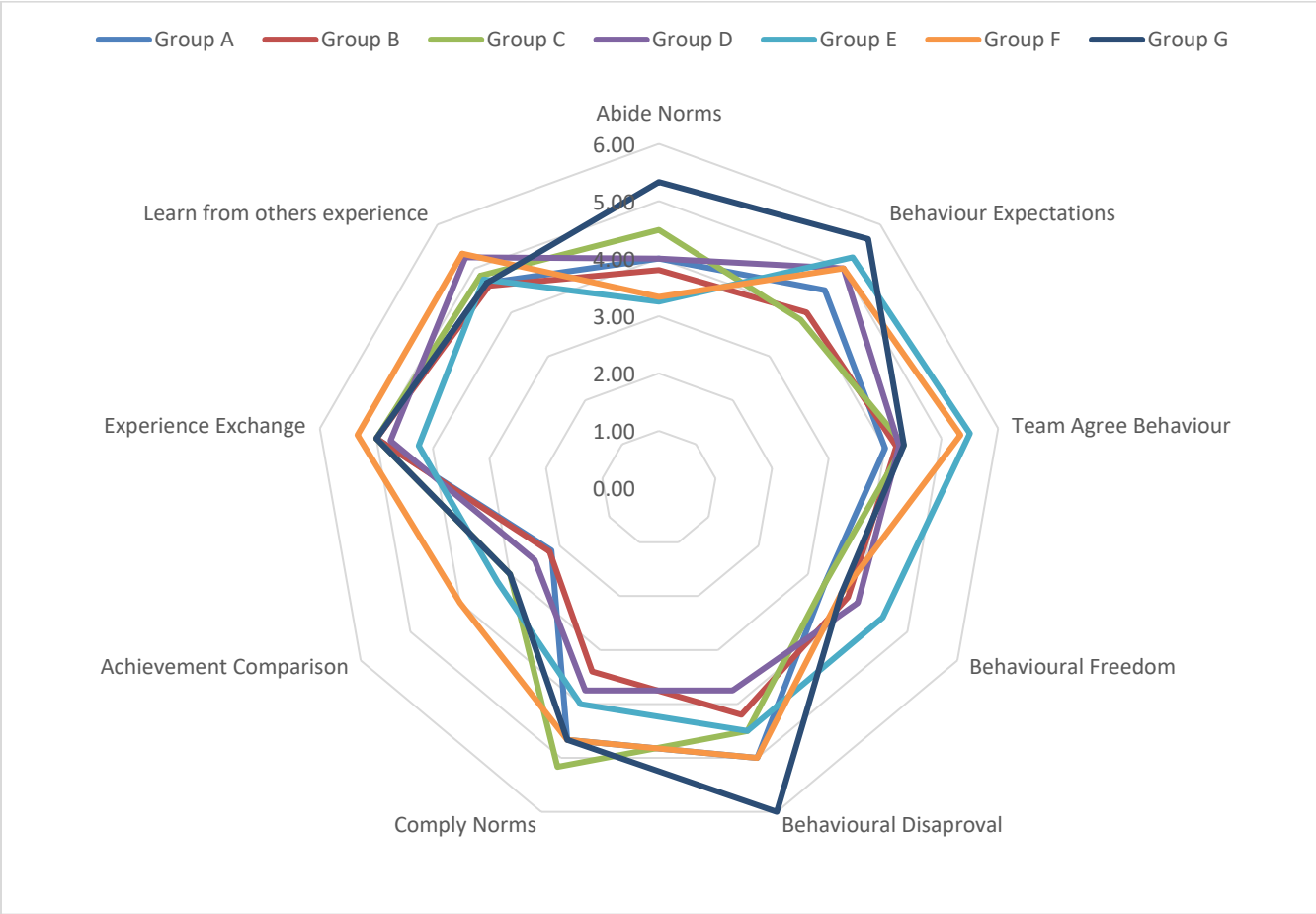


Figure 19: *Norm profile of each social group within the team*

Implicit assessment of doping attitude

The first brief implicit association test conducted was to ascertain whether the respondent associated PPD use with themselves or with others. Positive scores suggest that the respondent's associate PPD use with others and negative scores indicate an association with PPD use with themselves. As a team the results indicate an overall slight association of PPD use with themselves with a score of -0.04 ± 0.26 (Table 38). When broken down into individual groups (Figure 20), group A was significantly lower than the group mean with a score of -0.33 ± 0.18 ($t(5)$-4.97, $p < 0.01$). Group G's score of 0.20 ± 0.11 was significantly higher than the mean of the rest of the groups ($t(2)$ 4.16, $p = 0.05$).

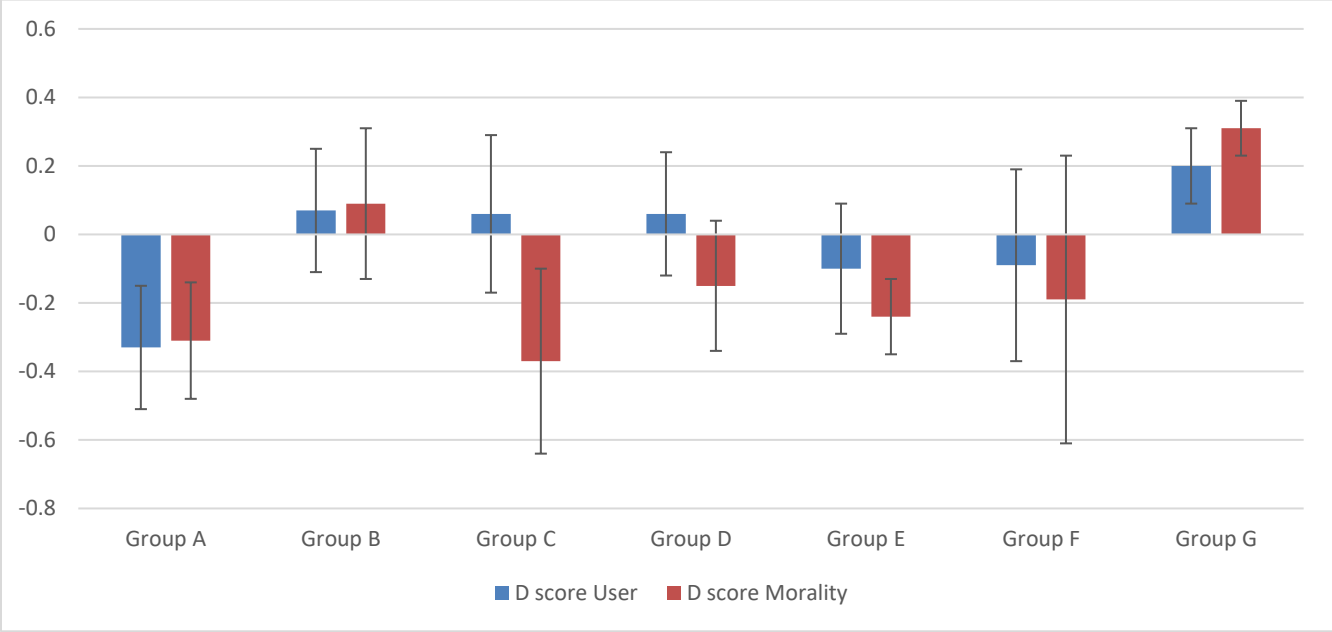


Figure 20: *Morality and user Implicit association D scores by social group*

The second brief implicit association test conducted was to ascertain whether the respondent associated PPD use as a moralistic action or not. Positive scores suggest that the respondent's associate PPD use as not morally acceptable and negative values indicate PPD use is morally acceptable. As a team the results indicate an overall slight association of PPD use as morally acceptable with a score of -0.12 ± 0.31 (Table 38). When broken down into individual groups (Figure 20), group C was significantly lower than the group mean with a score of -0.37 ± 0.27 ($t(5) = -2.70$, $p = 0.04$). Group G's score of 0.31 ± 0.08 was significantly higher than the mean of the rest of the groups ($t(2) = 10.00$, $p = 0.01$). Not only groups C and G had significant differences from the mean of the rest of the team, groups D ($t(3) = 3.09$, p = 0.05) and A ($t(5) = -3.34$, $p = 0.02$) also.

Table 38: *User and morality D score differences.* [H] *Indicates the group with the highest group mean,* [L] *indicates the group with the lowest mean,* * *indicates groups with a significant difference*

	D score User		D score Morality	
	G mean	Other G Means	G mean	Other G Means
Group A	-0.33 ± 0.18[L]	0.03 ± 0.23*	-0.31 ± 0.17	-0.07 ± 0.32*
Group B	0.07 ± 0.18	-0.06 ± 0.28	0.09 ± 0.22	-0.16 ± 0.32

Group C	0.06 ± 0.23	-0.06 ± 0.27	-0.37 ± 0.27 [L]	-0.06 ± 0.29*
Group D	0.06 ± 0.18	-0.05 ± 0.25	-0.15 ± 0.19	-0.15 ± 0.31*
Group E	-0.10 ± 0.19	-0.03 ± 0.27	-0.24 ± 0.11	-0.10 ± 0.33
Group F	-0.09 ± 0.28	-0.03 ± 0.27	-0.19 ± 0.42	-0.11 ± 0.31
Group G	0.20 ± 0.11 [H]	-0.06 ± 0.26*	0.31 ± 0.08 [H]	-0.16 ± 0.29*
TEAM MEAN	-0.04 ± 0.26		-0.12 ± 0.31	

Discussion

To date very little research has been conducted in regards to social networking analysis in team sports (Lusher et al, 2010). Cohesive subgroups are subgroups with individuals who have ties to one another. Within these subgroups norms and behaviour may be different than that of the rest of the team.

The AMF team exhibited 7 subgroups varying in number of members and positions played. These results suggest that these groupings did not occur via positional similarities. This also means that grouping analysing positional subgroups similarly to the FB study may neglect to identify true interactions within a team. Social network analysis can be used to identify key characteristics of social subgroups within a team which may pose a risk of PPD use as well as subgroups which may be against it. Analysing aspects of PPD use from a team view may neglect to identify rogue factions, which could influence the whole team over time. Multiple significant differences were observed for a variety of different PPD aspects in this study but only attitude measures (Petróczi, 2007), D scores (Brand et al, 2014) and social projection measures (Petróczi et al, 2008) have predictive value.

Direct and indirect assessments of doping attitude

No significant differences were found between the groups for the RBG, FPU and the PEGA scales yet group E was found to score significantly higher on the MDA scale suggesting a significantly more positive attitude towards PPD use when it is morally framed. On the RBG scale group E scored below the mean of the group suggesting that this group was more towards rule breaking than the rest of the team average. Whereas group E's FPU score was above the team mean suggesting they were against PPD functional use more than the rest of the team average. Group E scored the highest in the PEGA scale suggesting they were more towards PPD use to achieve goals than the rest of the team.

On a whole, this provides a picture of a group who are the rule breakers of the team with an attitude towards using PPDs to achieve goals, the D scores support this by associating PPD's with themselves and moral. Group E consisted of two offensive linemen, a linebacker and a cornerback. Offensive linemen are required to block the opposing team from getting to the quarter back, they require explosive power in their arms (bench press) and their legs (squat) and large amounts of mass. Linebackers are required to back up the defensive lineman, they require they fill in the gaps that the defensive line leave open, agility is the overriding physical attribute. Corner backs primary role is to defend the receivers, the position requires speed and agility. In this group the offensive line would benefit from PPD use the most as their physical requirements involve explosive power and size, a study on 2552 retired AMF players found 95 (16.3%) had previously used steroids (Horn et al, 2009). This was the highest prevalence out of all of the positions. Group E had members who would prefer not to answer when asked if they had used in the past, though they did not say yes not saying no suggests a level of admission. This may explain why this groups would predominantly ignore but also understand if a teammate was found to be using PPDs.

In sports where PPD use is engrained into the culture of the sport, previous PPD users can educate potential users on how to use within their sport (Lentillon-Kaestner et al, 2012). Providing this information can ease concerns thus increase the likelihood of future use. Research has shown that teams and peers as a source of information regarding PPD's can act as a mediator to future PPD use (MacKinnon et al, 2001). The group's perception of doping within the team was significantly lower than the mean of the rest of the team but shows progression in estimation from the team level to the league. Young players have been shown to be more likely to use PPDs if they perceive the opposing team was using PPDs (Stilger & Yesalis, 1999). The results from this study also shown that there was a perceptual increase as the level of competition increased. The incremental model of doping behaviour posits that the path towards PPD use is incremental in this case the progression of performance intensity (Petroczi, 2013). The view that others may be using PPDs and that PPD's may be required to progress to a higher competition level may explain the amount of pressure felt by members in the group to use personally. An aspiring player wishing to progress in the sport may feel PPD use is a necessity in order reach the top.

In the GEQ Group E scored higher than the team mean for AGTS, ATGT and GIT and slightly below the mean for GIS. Out of all four subscales group E scored the highest on the ATGT scale, which represents the group's attraction to personal involvement in the team's tasks (Carron et al, 2002). PPD use is an individualistic endeavour in that it is the individual who administers the PPD's yet the motivation to use can stem from team dynamics. Doping as an individual rather than as a collective has its benefits, article 11 of the WADA code highlights that if two or more members of a team are caught using PPDs the whole

team may face consequences: "*If more than two members of a team in a Team Sport are found to have committed an anti-doping rule violation during an Event Period, the ruling body of the Event shall impose an appropriate sanction on the team (e.g., loss of points, Disqualification from a Competition or Event, or other sanction) in addition to any Consequences imposed upon the individual athletes committing the anti-doping rule violation."* (Dimeo et al, 2014)

Conversely, this also means that if more than one individual is using PPD's within a team, use by other members will not incur further repercussions to the team thus reducing the perception of risk. It should also be noted that the internal competition felt between players may also play a part. The elevated individual attraction to involvement in task can refer to the need to be involved in actual game time, the item 'I'm not happy with the amount of playing time I get' highlights this notion. A study on 27 US high school AMF players found that PPD users had more playing times than non-users did (Stilger & Yesalis, 1999). In this group, there was a fairly even mix of game time with players playing 100%, 75% and predominantly 25% of the season.

Bridgeness is a measure of connectivity between networks this group exhibited thee bridges within the group of four players. This group also exhibited the second highest level of bridgeness suggesting multiple links to other groups within the team.

Standout group for implicit assessment of doping attitude (BIAT measures)

Both D scores were the only other significant PPD attitude difference between the groups, group A associated PPDs with themselves and as a moral action significantly more that all of the other groups. This group was made up of players from various positions and was the only group who had a member admit to previously using a PPD. Research has shown that team members who have previously used PPDs can inform potential users within the team on various aspects of use (Lentillon-Kaestner et al, 2012). In the GEQ group A scored the highest mean above the team mean on the AGTS and GIT scores and the second highest on the second highest in the GIS measures. This group was one of two with the highest number of members suggesting a highly social group, this may justify the attraction and group social subscales (AGTS & GIS). This may pose a risk if the player who had previously used PPDs is perceived to have social capital within the team (Maycock & Howat, 2007). This group was also one of two groups who had members who would report if team members were using PPD's, yet this group scored the highest of all the groups on the RBG scale suggesting that they have more of a rule breaking attitude than the rest of the team yet they associate PPDs as a moral action. It has been said that morality can be rationalised to justify immoral behaviour (Tsang, 2002), the model of moral rationalisation and evil

behaviour (the author interchanges evil, immoral and unethical behaviour to refer to one who violates moral principles) posits that moral rationalisation can occur when motivations compete with morality, this can cause the individual to reconstrue the moral behaviour as moral. Reconstructing immoral behaviour as moral reduces the cost of being immoral, this behaviour can also be progressive in nature thus further supporting the incremental model of doping behaviour (Petróczi, 2013a). The MDA scale also supports this moral rationalisation. As the scale interlinks behaviour with outcome expectancy, someone who has a positive attitude towards immoral behaviour should show a positive score but the extent to how positive it is suggests how much the respondents behaviour will match their expectancy. Although group A showed a positive score it was relatively low suggesting a positive attitude towards immoral use but this attitude didn't exactly match the outcome expectancy.

Interestingly enough this groups attitude towards PPD use as a functional process was the most positive out of all of the groups (FPU). It has been suggested that some athletes see PPD use as a functional process and not a moralistic one (Petróczi et al, 2011). The study suggests that PPD use may exist in the domain of supplement use and not moralistic behaviour. A conceptual paper by Petróczi (2013) highlighted the functional use of PPDs, the behaviour is said to be derived from previous patterns exhibited prior to PPDs being an issue. For instance, athletes use supplementation as a means to support their training, the issue is that PPD's can be perceived to exist in this domain. The continual use of legal supplements provide a blueprint for behaviour to be learned, this is dependent on positive feedback for progression which can eventually may lead to PPD use. Goal achievement whether they be performance enhancement and career goals tends to the driving force as capacity increase is required. In this study group A exhibited a more goal-orientated attitude towards PPD use as the PEGA score was the highest of all of the indirect measures score nearly double the MDA scale and nearly triple the FPU scale. Social projection has been utilised to observe functional motivations (Petróczi et al, 2011), individuals who have positive attitudes towards PPD use are more likely to inflate their projection of use. The premise is that users internally justify their own use with the belief that others are partaking in the same behaviour and in order to remain competitive one must also partake. In this study group A estimated doping in the division above the mean of the team, whereas estimation of team doping was below the team mean. Similarly to the other groups as the perceived competition increased as did the perceptual prevalence of PPD use.

This group exhibited 5 bridges within the group of 6. This group also exhibited the highest level of bridgeness.

Study 6: Social Projection and prevalence

False Consensus Effect and domain specificity of the[8]

The aim of this study was testing an indirect approach to identify dopers, which relies on social projection (Allport, 1924). Specifically, we relied on the so called 'False Consensus Effect' (FCE) which arose from psychology's efforts to explain discrepancies in social judgement. FCE describes the frequently observed phenomenon by which individuals tend to overestimate the extent to which others behave the same way as they do, especially if the behaviour in question is deemed to be socially questionable or unacceptable. (Ross et al., 1977). This phenomenon is explained by a part motivational, part cognitive process resulting in people believing that their own action is a relatively common behaviour. The effect appears to be present even when objective statistics and information on the bias effect are provided, indicating the intractable and egocentric nature of this biased social perception (Krueger & Clement, 1994).

Applying the False Consensus Effect (FCE) concept to performance enhancing drugs (PEDs) in a sport context, we hypothesised that athletes who use PEDs overestimate prevalence of doping in their sport and in sport more broadly, compared to non-users. The measurement tool we propose to develop for doping prevalence estimation is based on the FCE, assuming that the effect is present for illicit or banned drug use. What differentiates the proposed approach from reported projected use is how the estimation made by respondents is used. Typically estimates are reported at face value and discussed as prevalence in the population. We propose to use estimates to gain information about the *individual* who makes the estimates and *not the population* for which the estimates are made. While there are no reliable epidemiology data for drugs in sport against which to compare athlete responses, it is the magnitude of over- or underestimation that may provide the indicator. The indirect nature of asking athletes about prevalence may yield an indicator suitable for epidemiological and social science based research to begin cross-sectional descriptive or prospective causal models of athlete PED use.

Determining the level of over- or underestimation will be conducted by calculating deviation from the publicly established prevalence rate of 2% (WADA, 2006) and the prevalence rate calculated from the presence of doping in the sample (users/non-users). Estimates can be solicited in various forms ranging from direct questions (i.e., 'In your opinion, what percentage of others in your sport use PEDs?' or 'To your knowledge, what proportion (%) of your fellow athletes use PEDs?') to hypothetical scenarios (i.e.,

[8] The work was supported by a previous World Anti-Doping Agency social science grant and results published in Petróczi et al, 2008; Uvacsek et al, 2011. This is a shorter version of the published manuscripts.

'Under circumstances X, what percentage of the athletes would use PEDs?'), where depending on the research question, using different hypothetical situations can be used as experimental manipulation. Estimates made by user and non-user groups will be compared and the differences tested for statistical significance:

$$H1: \mu_1 > \mu_2,$$

$$H2: (\mu_1 - P) > (\mu_2 - P)$$

where μ_1 and μ_2 denote population estimate for users and non-users, respectively and P is the doping prevalence in the population.

Significantly higher estimates made by the user group will provide empirical evidence for the FCE. Part of this test for association includes developing an estimate for confidence in the level of overestimation and their corresponding odds ratios (OR). OR is defined as the ratio of the odds of doping use occurring in one group (high prevalence estimators) to the odds of it occurring in another group (lower prevalence estimators), or to a sample-based estimate of that ratio. The calculation of the odds ratio will be based on Fisher's Exact Test (FET). The advantage of the FET over a simple calculation of the odds ratio is that FET provides a confidence interval for the odds ratio.

An OR of 1 indicates that doping use is equally likely in both high- and low estimating groups. An OR greater than 1 indicates that doping is more likely (may be many times) in the high estimators group, whereas an OR below 1 indicates that doping is less likely in this group in comparison to the other, low estimators group. Owing to the phenomenon that OR sometimes overstates relative positions, it is proposed that the log OR value was be used.

Pilot study to establish the presence of the FCE in relation to doping

The primary aim of this pilot study was to provide proof that the FCE is present in the perception of doping behaviour. In addition, the study also served as validation of the measurement tool (questionnaire) designed to obtain self-reported information from the athletes.

Methods

To investigate whether a relationship exists between doping use and potential doping use and estimation of others' use and potential use, a questionnaire was developed containing questions of the following: i) self-reported doping use (recorded as Y/N), ii) estimated doping use of others (as %) and eight

hypothetical scenarios of doping use forming the Hypothetical Doping Scenarios (HDS). For estimating potential doping behaviour of others, respondents were asked to estimate the proportion (as %) of others who would use doping. Respondents were also asked to report whether or not they would use doping in a prescribed situation (HDS-Self, recorded as Y/N). The questions were preceded by a classification and brief definition of the drugs. In line with the WADA regulation, no distintction was made between social drugs and other substances if they were used for performance enhancing purposes.

Self-reports were used to establish the user categories. The HDS-Self score was used to group participants as users vs. non-users, where athletes with HDS-Self ≥ 1 were classified as potential user. Direct self-report had binary values (No = 0, Yes = 1). For the purpose of the analyses, only those athletes were considered doping users who were classified 'user' in both categories (direct report and hypothetical use). Similarly, non-user athletes were those who were classified as 'non-users' in both categories. Owing to the ambiguity in the other two categories that will require further investigation, 39 athletes who fell in these two categories were excluded from the comparison of population estimates. Categorisation for nutritional supplement users was conducted in the same manner. Population estimates for doping and nutritional supplement use were obtained in two forms. Athletes were asked in a straightforward manner to estimate the percentage of athletes, in general, who use doping or nutritional supplements. Hypothetical situations identical to the self-reported hypothetical situations (HDS-Self) were also used. Estimates given as percentages were used as reported for the direct general estimates and were averaged for the eight scenarios. Comparisons of group means were performed with Mann-Whitney non-parametric statistics using SPSS 15.0, and R statistical software was used for Fisher's Exact Test for Count Data.

Participants

Data were collected among UK sports science students and student athletes (n = 142) using a web-based anonymous questionnaire. 124 participants met the criteria of taking part in sport at the designated competitive level. Competitive level was defined as regular participation in organised sports competition. Given the nature of the present sample (sports science students and student athletes), competition equates club level competition here. The sample consisted of 46 (37.1%) female and 78 (62.9%) male athletes with mean age of 21.47 ± 5.53. User vs. non-user groups were established using self-reported information on doping use and intention to use PEDs in hypothetical situations. Based on the self-reported doping use and potential use, respondents were categorised into four groups: users with current and potential use (n = 9), potential users with no current use (n = 31), 'ambiguous' users with current use but denied potential use (n = 8) and non-users (n = 76).

Results and discussion

Scale reliability coefficients for HDS scales were reassuringly above the customary cut-off value (α = .886 for PED and α = .917 for NS), suggesting good internal consistency. Observed differences in the mean estimation of PED use made by the user group exceeded the estimation made by the non-users (35.11% vs. 15.34% for general doping and 34.25% vs. 26.30% in hypothetical situations, respectively) providing evidence in support of the FCE concept (Figure 21).

The difference, however, was only statistically significant for the general estimation (U = 143.00, p = .004) but not for the summarised hypothetical situations (U = 247.00, p = .175, d = .476). The other two groups (potential users and the ambiguous group) showed considerable inconsistency, suggesting that these answers (as well as the self-reported information on which group membership was established) have most likely been influenced by the perceived need for socially desirable responding. Notably, the variance in estimations was considerably less among the self-declared clean athletes.

Following the methods used in previous research (Lai et al., 2007; Wolson, 2000), the accuracy of estimates were calculated as the difference between the estimate given by the participants (X) and the actual population figure (P). The population figures we used were i) the official rate of positive doping tests reported yearly by the WADA (2%) and ii) self-reported doping behaviour in the sample (13.7%, 95%CI = .08, 20.0). The accuracy of an estimate is the degree to which responses reflect reality. Accuracy of the estimates for our sample using i) self-reported information for population prevalence and ii) official rate of positive tests showed significant difference between users and non-users (U = 143.00, p = .004 and U = 143.00, p = .004, respectively). However, the problem with this method arises from the uncertainty regarding population prevalence. The prevalence rate calculated from self-reports (which itself may be under-reported owing to the social desirability effect) suggests a considerably higher prevalence rate compared to the official yearly reports of the World Anti-Doping Agency (13.7% vs. 2%).

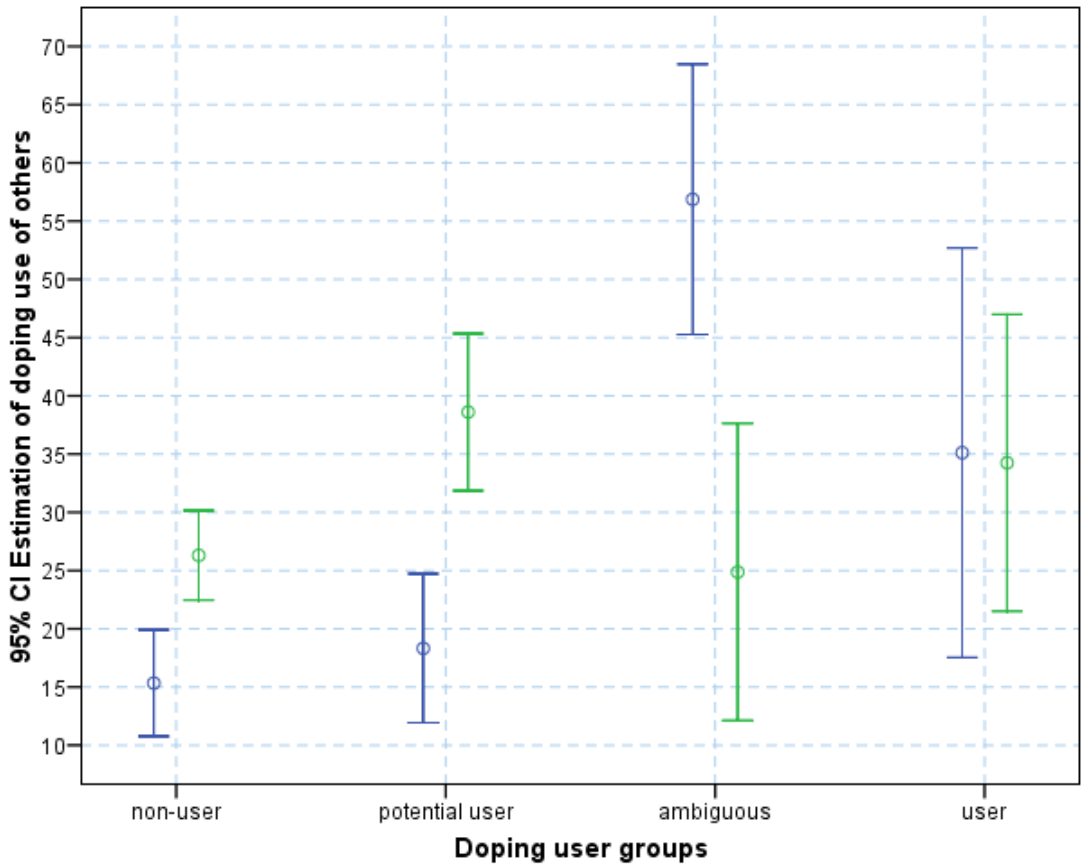


Figure 21: *Estimation of doping use (blue) and hypothetical doping use (green) among others (displayed as means and 95% confidence intervals)*

The odds ratio is 6.025, *95%CI*=1.365, 31.186 (*ln* = 1.82), suggesting that doping use is more likely among those who estimate doping use in others beyond the sample prevalence upper *95%CI* (20%). Notably, the lower bound of the 95% CI is above 1, suggesting that the difference is significant at the 95% confidence level. The *p* value of .007 provides further reassurance that the true OR is > 1.

Results regarding nutritional supplements suggest that social projection is influenced by the social judgement of the behaviour. For nutritional supplements (NS), 57 athletes (46%) reported current use with a further 61 who would consider using NS and 6 athletes rejected NS use under any circumstances. Unlike PED, the 'ambiguous' cell (current use with denied hypothetical use) was empty for NS. The comparison using estimated NS prevalence as outcome revealed similar but less marked patterns than the same analyses with projected PED use. Doping users' estimation of NS use of others were higher than the estimation made by non-users for both general estimation (54.15 ± 30.19 vs.46.72 ± 27.34%) and hypothetical situations (74.79 ± 22.90% vs. 59.68 ± 20.40%), but the differences were not or close

not non-significant (U = 295.00, p = .500 and U = 203.50, p = .048, respectively). The mean direct prevalence estimations (54% and 47%) were close to the actual sample prevalence of 46%. The estimates of hypothetical NS use by others (73% vs. 60%) were actually below the actual self-reports of the same behaviour (95%).

It is evident from the literature that categorisation (involved vs. not involved in an act) was typically based on self-reports, which are known to be susceptible to response bias. Results from this pilot study, in addition to providing important evidence for the presence of the FCE, have flagged this problem as well. Social projection appears to be dependent on the social judgement of the behaviour. Therefore, it is suggested that FCE-based assessment, coupled with using objective indicators of behaviour (i.e., biochemical analyses) should be used in prevalence studies on socially sensitive issues (such as using PEDs), instead of relying on the dubious results of self-reports.

Predictive Power and Domain Specificity

The aim of this follow-up study was to test the FCE using a sample of competitive athletes in relation to doping and recreational/social drug use behaviour. Following the assessment of whether the FCE works, the capacity of the FCE-induced estimation and explicit attitude towards doping to predict PED use can be assessed. The study therefore investigates the following hypotheses (Hs):

H_1: Athletes who self-report doping overestimate the prevalence of doping compared to athletes who self-report abstaining.

H_2: Athletes who self-report recreational/social drug use overestimate the prevalence rate of use by others, compared to athletes who self-report abstinence.

H_3: Athletes who use one type of drug (recreational vs. performance-enhancing) tend to overestimate the use of the other types of drug.

H_4: Athletes admitting doping exhibit a more lenient attitude toward doping than those who abstain.

H_5: Doping use is more accurately predicted by a combination of the estimate of prevalence of doping and attitudes than either one alone.

Methods

Participants were recruited via personal and professional contacts with competitive athletes. Power analysis, based on effect size established in a pilot study using UK student athletes (Petroczi, Mazanov, Nepusz & et al., 2008), indicated that the minimum combined sample size required for comparing two independent groups at α = 0.05 and 1 - β = 0.95 is n = 40. Participation was completely anonymous and

voluntary. The testing protocol and data handling were approved by the Faculty Research Ethics Committee, Kingston University.

Participants

Competitive Hungarian athletes (*n* = 82) with a mean age of the respondents being 21.43±2.82 years participated in the study. User vs. non-user groups were established using self-reports for PED use. The gender distribution was 45% males (*n* = 37) and 55% female (*n* = 45).

Measurements

To investigate whether a relationship exists between self-admitted doping use, estimation of use by others, social drug use and doping attitude, data were collected on the following: i) self-reported use of PEDs (Y/N), ii) estimated doping use of others (expressed as %), iii) general doping attitude using the Performance Enhancement Attitude Scale (PEAS, Petroczi & Aidman, 2009). As a control measure, athletes were also asked about their habits of using social drugs and estimated use of social drugs by others.

Data on behaviour and projected use were obtained with the following questions: i) Have you ever used a social drug? (Yes / No); ii) What % of the general population do you think has used a social drug?; iii) Have you ever used a banned substance? (Yes/No); iv) What % of others in your sport has used a banned substance? Questions about the athletes' own behaviour preceded the projected use questions.

For the purpose of this project, 'doping' or 'banned substances' were those substances that are prohibited by the World Anti-Doping Agency or other governing body in training and/or competition. 'Social or 'recreational' drugs were defined as psychoactive drugs (e.g., stimulants, opiates, cannabis, cocaine, etc.) used for recreational purposes rather than for work, medical or spiritual reasons. Although caffeine, alcohol and tobacco are also social drugs, they were excluded from the definition in this survey. Athletes were presented with these definitions at the beginning of the questionnaire.

Procedure

The anonymous questionnaire was self-administered. At most two participants were present in a separated room. There was no time limit for completing the questionnaire. A uniform coding system was used by the research assistant and the data were submitted in Excel files.

Data analysis

Associations in the 2x2 frequency tables (gender – doping use and doping – recreational drug use) were tested by using Fisher's Exact Tests, whereas known-group differences were shown by using t-tests and

Mann-Whitney U-tests in case of non-normal distribution with α set to .05. Owing to non-normality of the distribution in one of the variables, the relationship between doping prevalence and recreational drug use prevalence was tested using Kendall's tau correlation coefficient. Cronbach alpha coefficient was calculated for the PEAS to evidence the internal consistency of the scale.

Logistic regression is used for the prediction of the probability of an event (i.e., whether an athlete uses banned substances regularly) by fitting a logistic curve to one or several predictor variables (i.e., PEAS score or the athlete's estimation of doping prevalence in others). The curve being fitted can be described by the logistic function:

$$f(z) = \frac{1}{1 + e^{-z}}$$

where

$$z = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k$$

assuming *k* predictors. β_0 is called the intercept and all other β_k's are the coefficients of the corresponding predictor variables. The output of the logistic function is confined to values between zero and one for any input, which makes it more suitable to predicting binary outcomes than a simple linear model, as simple linear models will occasionally produce values less than zero or greater than one. Moreover, the significance testing of the coefficients in a linear model rely on the assumption that the prediction errors are normally distributed, which is hard to justify in the case of a binary dependent variable. Statistical analyses were performed using SPSS 16.0 and the R Project for Statistical Computing. Power analysis was conducted using G*Power 3.0.10.

Results

Of the 82 athletes, 12 admitted using banned PEDs and 26 reported using recreational drugs giving prevalence rates in the sample for doping above the relative low levels (typically between 1.5% - 3.0%) reported in the literature (for details, see Backhouse et al., 2007). Eight athletes (5 males and 3 females) admitted using both (Table 2). Transforming the information from Table 2 into a contingency table, the odds ratio was 5.632 (Fisher's exact test estimates being at *95%CI*: [1.321, 28.781]), $p = .015$, suggesting that PED and RD use, based on self-reports, were not independent. The correlation between PED and RD use estimates was weak and statistically non-significant (Kendall's tau = 0.142, $p = .78$).

Table 39: *Projected use of doping and recreational drugs by user categories (expressed as mean percentage and standard deviation for the groups). Effect sizes (Cohen's d) are shown in Italics*

	Behaviour: Doping		Behaviour: Recreational drug	
	User	Non-user	User	Non-user
	n = 12	n = 70	n = 26	n = 56
Doping use estimation (%)	34.58±26.32	16.86±19.20	23.70±4.65	20.10±2.68
	d = 0.769		*d = 0.887*	
Recreational drug use estimation (%)	52.41±21.09	41.33±21.72	50.69±21.54	39.42±21.28
	d = 0.518		*d = 0.526*	

Note: Of the 82 athletes, 9.8% used both PED and RD; 4.9% used PED but no RD, 21.9% used RD but no PED, and 63.4% used neither.

Although more male athlete admitted using PEDs than females (18.9% vs. 11.1%,), Fisher's exact tests for 2x2 associations provided reassurance that gender was independent of doping (odds ratio = 1.852 (95% CI: [0.454, 8.177]), p = .361). There was practically no gender difference in RD use (32.4% vs. 31.1% for males and females, respectively, odds ratio = 1.062 (95% CI: [0.374, 2.987]), p = 1).

Of the three outcome variables, doping attitude scores were normally distributed (Kolmogorov-Smirnov Z = 0.098, p = 0.081). The distribution of the RD and PED prevalence estimates failed the normality test (Z = 0.128, p = .005 and Z = 0.209, p < .001, respectively). All estimates were made with Lilliefors significance correction.

The mean estimations of PED and RD by self-admitted users and non-users are summarised in Table 3. In comparison with the doping prevalence in the sample (14.46%), non-users' mean estimation was fairly close to the actual prevalence, whereas doping users significantly overestimated the proportion of users (Mann-Whitney U = -241.0, p = .016). Congruently, with regard to RD, estimates made by non-users was fairly close to the sample prevalence (31.7%) whilst users, again, significantly overestimated the proportion of other users (Mann-Whitney U = 518.00, p = .028).

The results showed that those who admitted to the use of PEDs overestimated the prevalence of doping in their sport (Mann-Whitney U = -299.0, p = .098) compared to those who abstain from doping but not RD use but no statistical significance was established. Conversely, RD users overestimated the prevalence of RD but not PED use (Mann-Whitney U = 737.00, p = .968). The trend holds even after eliminating the overlap between the two user groups by separating those athletes who admitted using both. Not surprisingly, those who admitted using recreational drug and doping shared the opinion that many others are doing the same. The mean estimations made by this subgroup (59.38 ± 18.60 for recreational drug and 35.00 ± 28.91 for doping) were at the high end and well above the estimation made by the non-overlapping user groups (Table 40).

Table 40: *Projected upe of doping and recreational drugs by exclusive recreational drug or doping user groups (expressed as mean Percentage and SD for the groups)*

	Behaviour: Doping		Behaviour: Recreational drug	
	User	Non-user	User	Non-user
Doping use estimation (%)	33.75±24.28	16.76±19.08	14.50±18.58	18.56±19.93
Recreational drug use estimation (%)	39.38±21.64	41.45±21.59	46.83±22.12	39.61±21.16

Comparing the means displayed in Tables 39 and 40, it is notable that the unique FCE effect remained present but the non-significant differences in the non-congruent cells (bottom left and top right quarters) have reversed. In the exclusive user groups, recreational drug users actually estimated the doping prevalence below the figure made by non-users (14.50% vs. 18.56%, respectively). Similarly, doping users underestimated the use of recreational drugs in others compared to non-users (39.38% vs. 41.45%). The differences were small but still in the opposite direction to those comparable estimates shown in Table 39 where, regardless of the type of drugs, drug users always gave a higher estimate compared to non-users with only the magnitude of the estimates being domain specific (Figure 22).

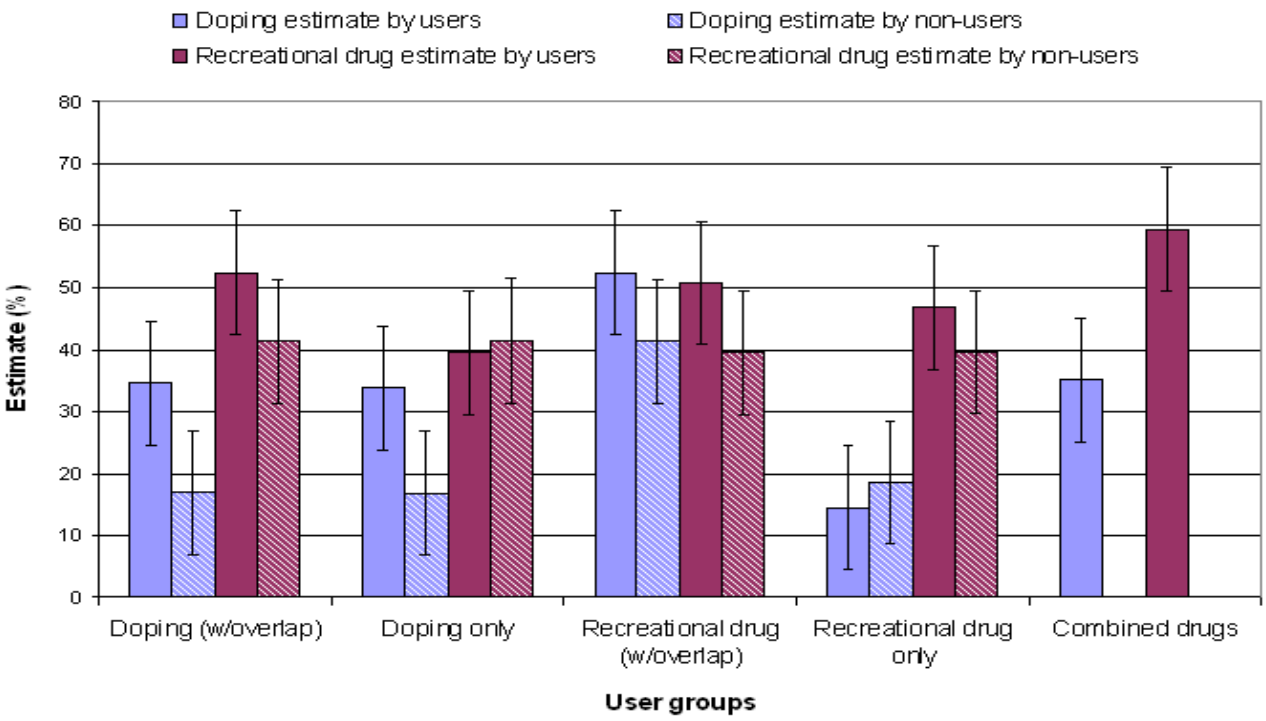


Figure 22: *Summary of estimated doping and recreational drug use in others by user categories.*

The pilot FCE results reported by Petroczi, Mazanov, Nepusz and et al (2008) were confirmed with a sample of competitive athletes; overestimation of doping prevalence correlated with self-reported doping (H1). The FCE was repeated in relation to RD use in the present same sample (H2). Of interest, however, was the specificity of the FCE within drug categories rather than being a generalisation that is PED use failed to affect RD use estimates, and *vice versa* (H3). The specificity of PED and RD use was corroborated by the result that attitudes to performance enhancement were related to PED use and unrelated to RD use (H4). This suggested that athletes think about doping very differently to RD use, possibly around the functionality of drug use in athlete populations (see Dunn et al., 2009; Petroczi & Aidman, 2008). The model that predicted doping use based on the magnitude of overestimation of doping and attitude to doping demonstrated the potential for an algorithm to be developed that provides a probability that an athlete is using PED (H5). The results are caveat to the small sample size and the implications that follow in terms of generalisability. While the results can be taken as indicative, they provide a sound basis for pursuing the FCE as a potential basis for developing an indirect self-report measure of PED use that can be used for future survey research.

The effect of incentives on accuracy of social projection

Previous work on doping prevalence estimations (Petróczi et al, 2008; Uvacsek et al, 2011)[9] concluded that:

(1) False Consensus Effect is present in doping prevalence estimations; those who admitted doping give higher estimation of doping prevalence compared to those who reported no doping.

(2) False Consensus Effect only occurs in ostracized/undesirable behaviour. For example nutritional supplement use does not produce different (higher) estimate compared to non-users, but FCE is present for doping use as well as social drug use.

(3) False Consensus Effect is domain specific: higher estimation is only given for the directly linked behaviour. For example, doping users give higher estimation of doping users but not social drug users, and vice versa.

Studies in experimental economy have shown that incentives increase accuracy in estimations. The current project provides an excellent opportunity for testing this assumption outside the business domain. This small study supplements these findings by exploring if projection (perceived prevalence) is influenced by instructed social conformity or incentives for accuracy.

The aim of this study was twofold: i) to investigate the stability of the estimation over time (Time 0 – Time 1); and ii) to ascertain whether incentives decrease the overestimation (Time 2).

Methods

Participants

Competitive Hungarian athletes (n = 82) with a mean age of the respondents being 21.43±2.82 years participated in the study. User vs. non-user groups were established using self-reports for PED use. The gender distribution was 45% males (n = 37) and 55% female (n = 45).

Measures

In study 1, the perceived prevalence question was part of a larger study.

The extended study used only three questions:

(1) What % of the general population you think has used a social drug?

(2) What % of others in your sport is using nutritional supplements?

(3) What % of others in your sport has used a banned substance?

[9] See previous WADA research report, or published papers for details.

Procedure

Athletes participating in the study were re-invited to complete a brief questionnaire on social projection of nutritional supplement and doping use among fellow athletes; and social drug use in general under two different conditions (Time 1 and Time 2). The research process is depicted in Figure 29.

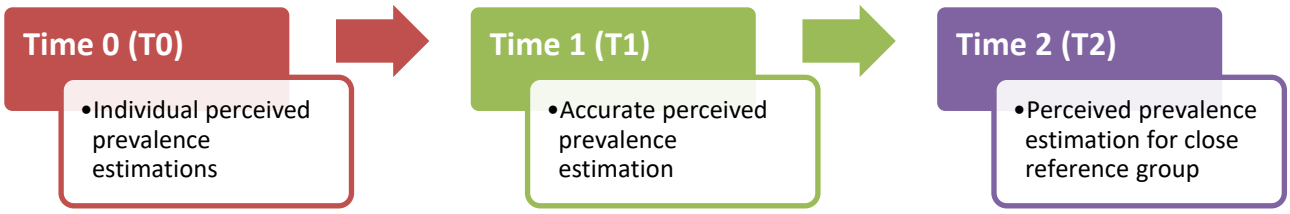


Figure 23: *Research process to test the potential sources of projection bias*

At Time 1, a payment of a small amount (300 Hungarian Forint = approximately £1) was offered for answering the 3 questions. Once the questionnaire was completed, participants were offered to move to the next part, where they can 'earn' more money in exchange for completing a similar task. Those who agreed were presented with the same questions and offered 400 Hungarian Forints for each question (totalling approximately £4 maximum for the second set of answers). This time, the instruction was included that said that the estimates must be made for their group (all participants in the first round) as accurately as possible. The prevalence rate from the first round was not known to the participants. If they got the percentage right with ± 0.99% accuracy, they received the full amount. For each percentage by which they under or overestimate the prevalence will result in a loss of 30 Forints. Information regarding the athletes' own relevant behaviour, and hair sample validation for doping was available from the first set of data. The Information Sheet and the link to the test site were emailed to athletes who took part in the first study. The participation is voluntary and anonymous. Only the athletes' emails (private email accounts) are known to the Principal Investigator (PI). A unique alphanumerical code was created from the email addresses to identify participants and allow for them to claim their prize (if any) from the Hungarian collaborating partner, using the email address as ID. The Hungarian collaborative partners did not have access to the answers athletes had given and the PI did not have information about the athletes' identity beyond a personal email address.

Results

Overall, the difference was negligible between the estimates of any of the three substance categories, regardless of the financial incentives to try to conform to the group's average. Looking at the repeated estimates in the context of objective behavioural data however, the results were more perceptive.

Although statistical significance were not reached between the repeats ($F(2,60) = 2.132$, $p = .128$, partial $\eta^2 = 0.066$) nor for the interaction between groups and time ($F(2,60) = 1.077$, $p = .371$, partial $\eta^2 = 0.034$), Figure 24 shows that contrary to the literature evidence in economics, incentives did not change estimation; but there was a notable drop between the first and the second timepoints. The change between the first and second timepoints could be explained by the different context in which the estimation was made. At first, the projection questions were embedded at various points of a large survey asking about explicit attitudes, norms and belief about nutritional supplements, social drugs and doping; along with requesting self-reports for the same. The projections always preceded the self-reports. Second and third time, the projections were made without context, although the instructions referred to the previously completed survey. A consensus with 16% was achieved in the last time timepoints, which is in line with the upper end of the self-reported figures but well above the official statistics.

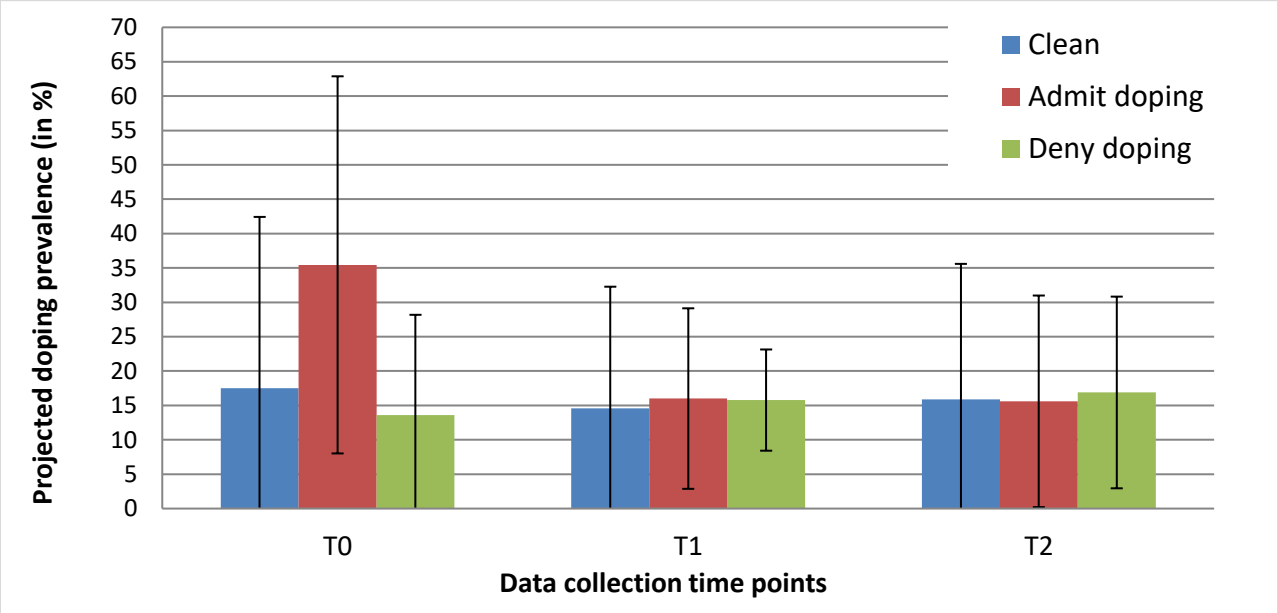


Figure 24: *Repeated estimations of doping, social drugs and supplement use by doping user categories. Groups are based on self-reports and hair analysis. Error bars are SDs.*

The only group where increase, albeit a small one, occurred in projected doping prevalence was those who denied doping use. This result is in line with the previous results showing that those athletes who hide their actual discriminating behaviour underreport in variables where a low score is anticipated from a 'clean athlete'. Financial incentives could have had a counterbalance this to a degree, resulting in an estimate closer to those who admitted doping. These results can be interpreted in the anchoring and adjustment heuristic framework, which may help brings us closer to answer the question whether 'overestimation' is a reflection of an existing behaviour ('finding comfort in large numbers') or a normative motivation ('if most people do, I should too'). Defining anchoring as an iterative cognitive process by which people attempt to answer factual questions to which they do not know the answer (e.g. what percentage of athletes use doping or when doping became first prohibited [most people do not know this unless they are doping researchers or sport historians]) by self-generating anchors and using these to adjust their estimates under uncertainty (Chapman & Johnson, 2002; Epley & Gilovich, 2001; 2005) opens up the question of the origins of these self-generated anchors.

In this experiment, participants did not know the answer to the original question (as nobody does), nor the estimate given by the group, thus they had to generate an anchor for themselves to be able to make an estimate. In the absence of contextual information or cues, these anchors were unique to each individual in the sample yet resulted in a higher initial estimation among those who admitted doping behaviour, which is in line with the theory that anchoring bias manifests in overestimation of the frequency of events that are easy to recall (Kahneman, 2003). In other words, athletes who use and admit using doping are more likely to have the knowledge of others doing the same than those who are either genuinely clean athletes or pretend to be one.

The notable reduction in the second and third estimate by the self-confessed doping users could be explained by the adjustment process. The repeated request for giving the same estimate, coupled with some incentives for the third round, could have made respondents to re-evaluate their initial estimate by calling up alternative anchors. Of the three groups, alternative anchors were less likely to be available in the clean athlete group, resulting in no change in estimation. In contrast, doping users and deniers had alternative anchors (e.g., own behaviour and perceived proportion of those who are clean of doping in their environment) to use and make adjustments. The presence and direction of these adjustments support the notion by Epley & Gilovich (2001) advocating for the importance of both anchoring and adjustment. In conclusion, it is unlikely that clean and doping user athletes share the same perception of doping prevalence, and by default, the perception of the clean athletes must result in a genuinely lower estimate, which is in turn reinforced by the process of cognitive bias. Although these cross-sectional

results do not appear to support the assumption that a distorted perception (i.e., believing that most athletes use doping) could lead to doping behaviour among the 'clean', the question needs further investigation, ideally using longitudinal study design.

Study 7: Ingroup – outgroup bias in perceived prevalence estimations

Perceived prevalence estimations in own country vs. in other countries

In the first study, 136 competitive level Turkish wrestlers (89.7% male; mean age = 18.21 ± 2.38 years) were asked to estimate what percentage of athletes use doping. The estimations were solicited in 2 x 2 categories: own sport vs. other sport and own country vs. country. The estimations were significantly above the official statistics (~ 2%) and demonstrated relative conservative ingroup bias / liberal outgroup bias (Table 39). The difference for both pairs were statistically significant ($t(114) = -3.365$, $p = .001$ for sport and $t(116) = -8.101$, $p < .001$ for country), with strong positive correlation within the pairs ($r(115) = .746$, $p < .001$ and $r(117) = .739$, $p < .001$, respectively).

Table 41: *Perceived Prevalence of Doping (Sport and Country)*

	Sport (%)	Country (%)
Own country	30.57 ± 28.47	30.07 ± 24.79
Other country	36.09 ± 25.11	47.04 ± 29.63

Perceived prevalence estimations across sport

In the second study, two-hundred and eighteen university level UK athletes (72.6% male; mean age = 21.31 ± 2.22 years, mean time in training = 5.88 ± 2.11), representing 7 sports: Athletics ($n = 17$); Basketball ($n = 35$); Boxing ($n = 9$); Football ($n = 99$); Rowing ($n = 14$); Rugby ($n = 25$) and Taekwondo ($n = 19$). Participants were asked to estimate doping prevalence in their own sport and in all of the other six sports. Similarly to the previous study, the results evidenced relative ingroup conservativism.

In all cases but one (basketball prediction by boxers), the lowest projection for a sport was made by athletes from the same sport (Table 42). The 'odd' pattern might be explained by basketball not commonly associated with doping. In fact, the overall doping prevalence estimation was the lowest for basketball (11.07%). Statistically significant difference was not found for the following pairs (using Šidak adjustment): 1-2, 1-5, 1-7, 2-7, 2-5, 4-6, 5-7 (overall repeated measure ANOVA: $F(6,212) = 65.335$, $p <$ .00).

Notably, the correlation coefficients between doping prevalence estimation for own sport and estimations given for different sports ranged between zero and |.38|; with the exception of the boxing where the highest correlation reached |.65|. The correlation coefficients between 'other sports' varied widely up to |.70|.

Table 42: *Perceived Prevalence of Doping by Sport*

	Projected prevalence in sports						
Respondent's sport	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1. Athletics (n = 17)	***9.94 ± 4.90***	10.00 ± 4.47	18.82 ± 5.63	16.12 ± 6.77	11.29 ± 4.47	11.82 ± 5.22	22.59 ± 4.87
2. Basketball (n = 35)	20.83 ± 6.18	***6.74 ± 3.85***	24.34 ± 3.88	20.43 ± 6.18	15.60 ± 6.49	17.89 ± 5.67	20.06 ± 4.99
3. Boxing (n = 9)	21.56 ± 2.74	***3.56 ± 1.33***	**7.11 ± 4.37**	15.22 ± 8.88	5.44 ± 1.67	9.89 ± 8.69	12.44 ± 8.26
4. Football (n = 99)	20.66 ± 6.20	13.56 ± 5.28	18.97 ± 4.93	***6.59 ± 3.77***	13.30 ± 5.72	12.72 ± 4.31	17.00 ± 4.93
5. Rowing (n = 14)	18.79 ± 5.38	7.93 ± 3.17	17.93 ± 7.39	13.00 ± 8.46	***4.14 ± 1.87***	10.50 ± 4.70	18.21 ± 3.40
6. Rugby (n = 25)	18.52 ± 4.27	15.20 ± 5.41	21.00 ± 5.77	17.84 ± 4.37	13.48 ± 5.24	***5.88 ± 4.03***	19.32 ± 4.78
7. Taekwondo (n = 19)	15.21 ± 5.70	14.74 ± 7.47	17.63 ± 6.45	16.00 ± 6.21	12.89 ± 3.43	15.47 ± 4.83	***6.63 ± 3.04***
Sport average (n = 218)	19.05 ± 6.25	**11.70 ± 6.05**	19.38 ± 6.15	12.43 ± 7.75	12.59 ± 5.99	12.67 ± 5.86	17.18 ± 6.17

Note: bold denotes the lowest predictions for each sport (regardless of the source); italics denote the lowest prediction given by each sport. Diagonal shaded cells represent prediction within own sport.

Perceived prevalence estimations across expanding social groups and levels

This study is part of a larger project with ongoing data collection. Data to date consist of 81 competitive UK athletes (51.9% % male, mean age = 21.78 ± 4.92 years), recruited through one UK university, representing over 30 sports. In this part of the project, participants were asked to estimate doping prevalence for their own sport in three independent conditions: their own team, their own league/division and the league/division above.

Table 43 shows that ingroup estimation for teammates was significantly lower than the estimation for others in the same league ($p < .001$; overall repeated measure ANOVA: $F(1.42, 113.93) = 42.983$, $p < .001$). The perceived doping prevalence in the higher league/division was significantly higher than any of the estimations made for the same league ($p < .001$). All three estimates correlated significantly with strong positive correlations for each pair. Stronger correlation was found between estimates for others in the same league and league above ($r(81) = .923$, $p < .001$) than within the same league ($r(81) = .768$, $p < .001$). The smallest, but still strong positive correlation was noted between the ingroup estimation and the league above ($r(81) = .720$, $p < .001$).

Table 43: *Perceived Ingroup and outgroup Prevalence of Doping within the Same Sport*

Group	Estimated prevalence (%)
Among teammates	2.67 ± 9.75
Among other players/athletes in the same league/division:	7.20 ± 12.72
Among other players/athletes that play in the league/division above:	11.73 ± 15.89

The ingroup conservative – outgroup liberal bias was also observed in a 3rd study among young Hungarian weightlifters (n = 104, 80.8% male, mean age = 15.52 ± 1.09 years, range 13 – 17). As Figure 25 shows, the estimated prevalence of nutritional supplement (NS) use in their own team vs. in opponent team differed, with statistically significance difference ($t(103) = -2.783$, $p = .006$). The projected estimation on prohibited performance-enhancing drugs (PED) however, showed significant difference ($t(103) = -5.232$, $p < .001$). The same patterns were observed for perceptions about recreation drug (RD) use, but with a smaller but still significant difference ($t(103) = -5.971$, $p < .001$). Large standard deviation was observed in all estimations.

Young athletes in this sample were exposed to doping in their environment: 17.3% reported knowing more than one doping user and 11.5% reported knowing one.

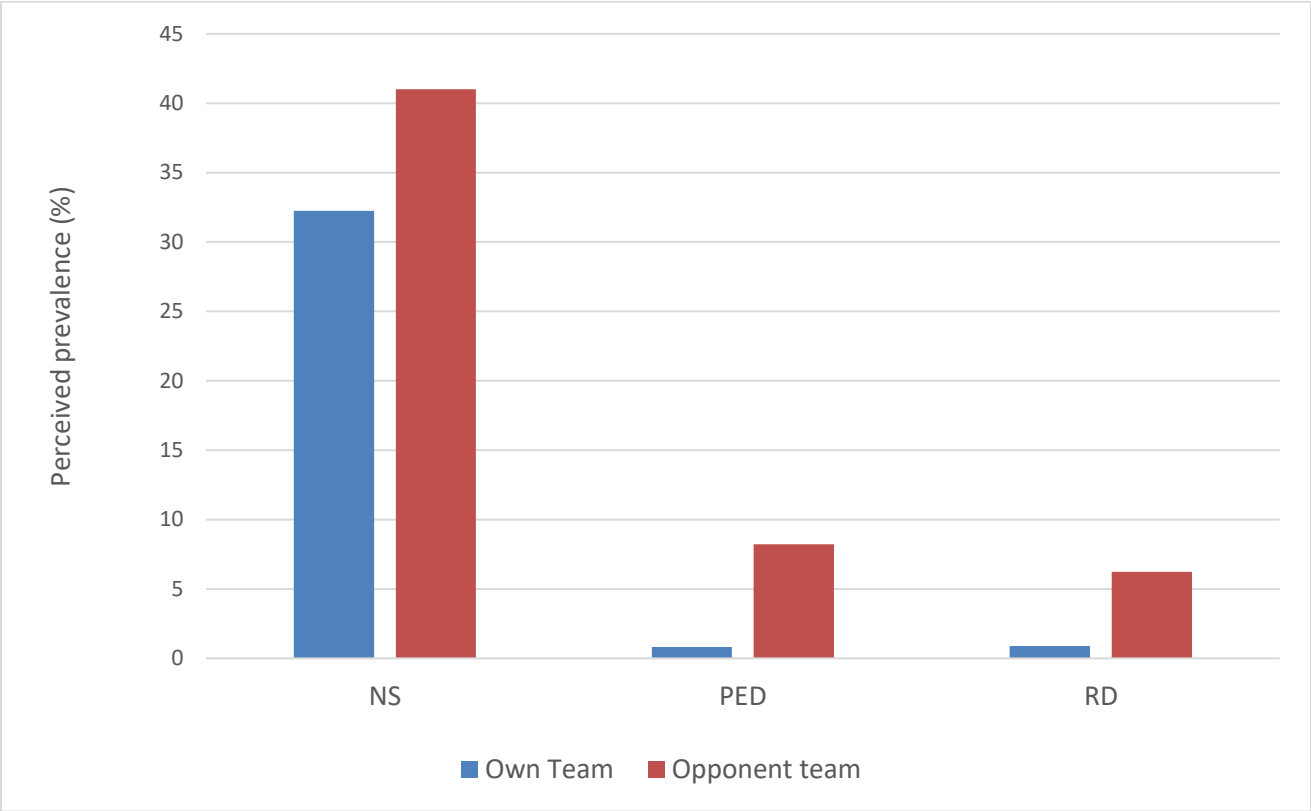


Figure 25: *Projected prevalence estimations for nutritional supplements (NS), prohibited performance enhancing drugs (PED) and recreational drug use (RD) for own team vs. other team*

Study 8: Explicit and implicit normative prevalence of doping, drug and supplement use with honesty goal priming

Given the practical implications of self-reported methodology, researchers using questionnaires or surveys have been concerned over the validity of the responses and made several attempts to counterbalance this distortion effect. Incorporating implicit goal priming to be honest was proposed to improve the quality of self-report data (Rasinski et al., 2005). In brief, *priming* here refers to the unintended, or automatic process aimed at increasing the accessibility of mental concepts in the presence of subtle cues (primes) related to those concepts, whilst the respondents are not made aware the relationship between the priming cue and the dependent variables being measured (Bargh & Chartrand, 2000). Rasinski et al (2005) posit that being exposed to words related to honesty increases the respondents' motivation to respond truthfully, hence reduces the distortion effect arising from strategic responding.

This pilot project aimed to compare and contrast explicit and implicit measures of social cognitive processes relating to performance enhancing drug (doping) and supplement use under an experimental condition. The experimental condition consisted of two parts: i) a simple priming task to be honest and ii) a target and control task (Doping vs. Altitude training, Supplements vs. Altitude training, Legal vs. Illegal substances, respectively). It was hypothesised that the discrepancy between explicit and implicit measures will indicate strategic responding on the explicit measures (i.e., participants will give answers that they assumed to be appropriate) in the target task, whereas the control task will remain unaffected.

The experiment was designed to provide evidence that the degree of distortion by strategic responding aiming to give a socially desirable response in self-reported information can be reduced with the inclusion of a simple priming task to be honest. If the hypothesis is correct, the findings can be employed to improve social science research methodology where data on socially sensitive cognitive processed is gathered by self-reports. The testing protocol is depicted in Figure 26. Both explicit and implicit measures of social projection will include the target task and the control task.

It was expected that:

1. The discrepancy between implicit and explicit assessment of social projection (descriptive norms) will be less in the experimental condition group in comparison to the control group;
2. Social desirability will correlate with the explicit test results more in the control group (stronger negative correlation is expected);

3. The false consensus effect will only manifest in the socially sensitive domain (doping), but not in the nutritional supplements or altitude training (both are being accepted methods);
4. (1) and (2) will only manifest in the target task (Doping vs. Altitude training), but in the control task (Supplement vs. Altitude training).

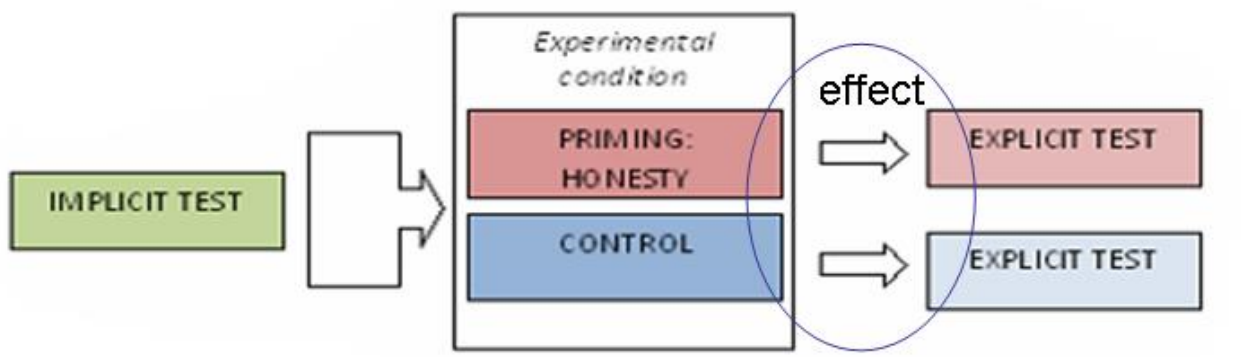


Figure 26: *Research protocol*

Forty young emerging female athletes took part of this study, producing 32 usable datasets. The mean age of the sample was 17.13 ± 3.06. The implicit measures included three brief IAT tests, administered in randomised order. Category labels and stimuli are shown in Table 44. The doping prevalence IAT effect was calculated as the difference time difference between the two focal test blocks.

In an honestly completed questionnaire, these results should correspond well to the prevalence estimate of doping (i.e. those who give high estimate should perform the Widespread + doping task with ease, registering fast average response time on this task. The computerised test application also included explicit measures of relevant behaviour (self-reports), descriptive norms, athletic specific self-efficacy, social desirability and behavioural intention. The implicit test preceded the questionnaire for all respondents. The order of the IAT tests (target and control) was randomised.

It was hypothesized that how respondents subconsciously associate doping with being rare or widespread should correspond well to the prevalence estimate of doping (i.e. those who give high estimate should perform the Widespread + doping task with ease, registering fast average response time on this task) in an honestly completed questionnaire.

Table 44: *Category Labels and Stimuli of the Brief Implicit Prevalence Tests (Implicit Descriptive Norms)*

Test	Category	Stimuli
Attribute 1	Widespread	common, usual, everyone, prevalent
Attribute 2	Rare	uncommon, unusual, nobody, scarce
Doping prevalence	Focal target: Doping	steroid, drug, stimulant, hormone
	Non-focal target: Altitude training	oxygen, mountain, acclimatisation, elevation
Supplement prevalence	Focal target: Supplements	vitamin, ginseng, mineral, calcium
	Non-focal target: Altitude training	Same as above
Illicit drug prevalence	Focal target: Illegal substance	cocaine, marijuana, speed, ecstasy
	Non-focal target: Legal substance	coffee, beer, Red Bull, cigarettes

IAT effects were calculated for the three BIATs as difference/D-score as follows: (1) [*Doping+Rare*] - [*Doping+Widespread*], thus positive D score indicates stronger association of doping with widespread; and negative D-score indicates stronger association with rare; (2) Difference/D-score: [*Supplement+Widespread*] - [*Supplement+Rare*], thus positive D score indicates stronger association of supplements being rare; and negative D-score indicates stronger association with widespread.and (3) difference/D-score: [*Illegal+Rare*] - [*Illegal+Widespread*]; thus positive D score indicates stronger association of illegal drugs with widespread; and negative D-score indicates stronger association with rare.

Under the experimental condition, following Rasinski et al (2005) protocol, six words were selected that relate to the goal of being honest, whereas the control task consisted of words related to positive personal characteristics (Table 45). Participants were instructed to read the word carefully and select the one from the three listed that was the most similar to the word shown in the question. Participants were ensured that there was no right or wrong answer to this question.

Table 45: *Priming and control task words*

Honesty		Control	
Word	**Alternatives**	**Word**	**Alternatives**
honest	open, sincere, truthful	considerate	appreciative, understanding, compassionate
genuine	authentic, real, frank	alturistic	unselfish, charitable, generous
accurate	valid, righteous, candid	compassionate	kind, benevolent, responsive
veracious	credible, honest, trustworthy	sympathetic	understanding, empathic, affectionate
ingenuous	honest, trustful, frank	generous	charitable, kind, alturistic,
frank	outspoken, honest, true	affectionate	warmhearted, caring, tender

The questionnaire also contained questions for projected prevalence of regular use of nutritional supplements, doping, illicit drugs, high altitude training (including simulated conditions). Behavioural intention was measured with a single question for each target categories: "*I would use acceptable nutritional supplements if they help my athletic performance*"; *I would use a prohibited substance if it would help my athletic performance*"; "*I would use high altitude training if it helps my athletic performance*"; and "*I would try an illicit drug at least once if offered to me*". The statements were rated on a 7-point scale ranging anchored as very unlikely and very likely.

To assess willingness to use doping, participants were asked to assess three scenarios under which they may be willing to use a prohibited substance that increases your athletic performance. These were: little chance to get caught, success or prize depends on winning, a person liked very much and have trust in offered a performance enhancing substance. Participants were also asked if they would try an illicit drug if offered by a trusted friend.

Self-esteem was measured by two independent questions. One question was tapping into implicit global self-esteem "How much do you like your own name?"(Gebauer et al, 2008), rated on a 9-point scale ranging from not at all to very much. Explicit single item self-esteem "I have high self-esteem" (Robins et al, 2001) was also used. This question was rated on a 5-point scale ranging from not very true of me to very true of me.

Athletic specific self-efficacy with regard to using/refusing performance enhancing substances (Bandura, 2006) was assessed with three questions: "avoid using prohibited performance enhancing substances", "reach athletic potential without using performance enhancing substances" and "achieve athletic goals

without doping; with the instruction of rating confidence (1-100%). Scale reliability for the 3 items was 0.653.

Respondents were asked to rank 10 reasons in order of importance for avoiding doping. These were: *damage to health, disapprove of drugs, no access, being against the rules, being against fair play, can't afford, fear of being caught, don't feel the need, being illegal behaviour; and it would upset people who are important*.

Social perception questions for the target performance-enhancing methods (doping, supplement and altitude training) and illegal drug use were reported as percentages where 0% represents nobody and 100% represents everybody.

One question was included to directly explore the mental anchoring of doping between functionality (represented by supplements) and legality (illegal drug). Athletes were asked to place 'doping' on a scale where one end represented supplements and the other end represented illegal drugs. No middle point was offered.

Finally, athletes were asked about lifetime use of doping, supplement and illicit drug use, along with alcohol and tobacco (Table 46). Demographic data included age, current sport level and aspirational target level.

Table 46: *Prevalence of Target and Control Behaviour in the Sample*

	Honesty priming	Control	All
Doping	0	0	0
Illicit drugs	2 (10%)	0	2 (6.25%)
Nutritional supplements	14 (70%)	9 (75%)	23 (71.87%)
Alcohol	13 (65%)	6 (50%)	19 (59.37%)
Tobacco	4 (20%)	2 (16%)	6 (18.75%)
High altitude training	3 (15%)	3 (25%)	6 (18.75%)

D-scores from the three prevalence IATs are shown in Figure 27. Generally, athletes implicitly associated doping with rare, nutritional supplements being prevalent and illicit drugs being rare.

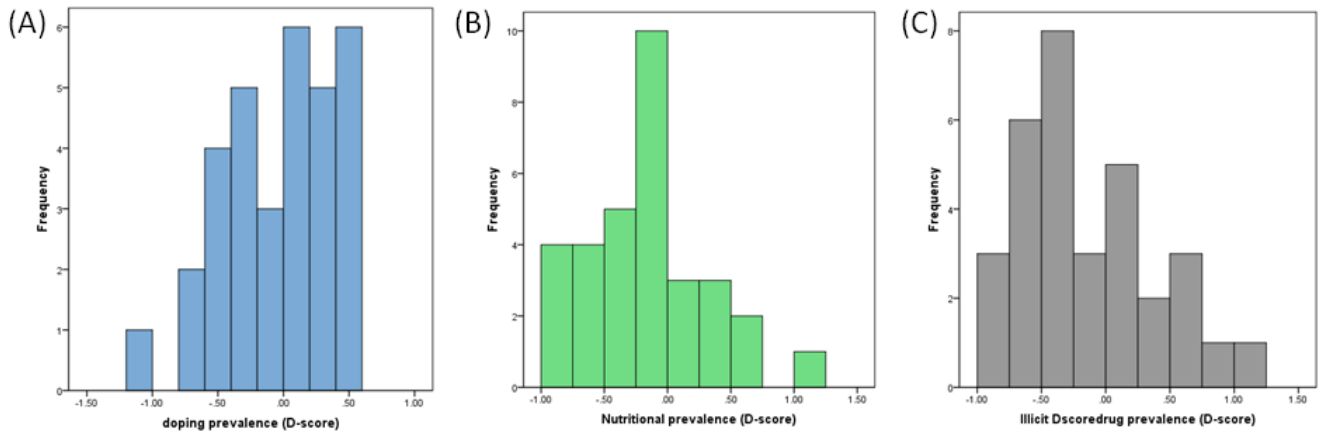


Figure 27: *Distribution of the IAT Scores*

The correlation coefficients between implicit and explicit prevalence estimations are shown in Table 47. There was a notable correlation between implicit doping and illicit drug prevalence as well as explicit estimations of the same pair, suggesting some shared mental representations between illicit drugs and doping. This was not observed in other samples that typically consisted of older adults, but consistent with the outcome of the explicit mapping of doping shown in Figure 28.

Table 47: *Correlation coefficients between implicit and explicit prevalence estimations (Pearson's r and p)*

		1	2	3	4	5
1	Doping IAT	-				
2	Supplement IAT	.334 (.061)	-			
3	Illegal IAT	.205 (.259)	.201 (.248)	-		
4	Doping explicit	.125 (.495)	.107 (.561)	.006 (.975)	-	
5	Supplement explicit	.080 (.665)	.171 (.350)	-.176 (.336)	-.015 (.935)	-
6	Illegal drug explicit	.371 (.037)	.209 (.241)	.023 (.900)	.843 (<.001)	.193 (.231)

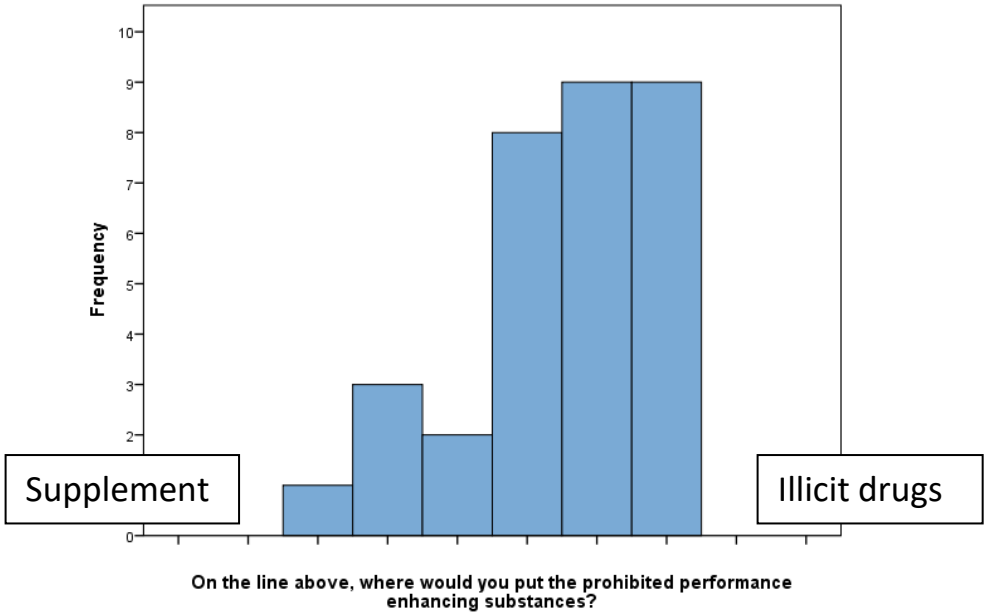


Figure 28: *Explicit mapping of doping*

Perceived prevalence of doping was much higher (33.0 ± 27.0%) then the official statistics at 2% but lower than the perceived prevalence for altitude training (including simulated conditions) at 45.03 ± 26.87%. The estimation of illicit drug use was the lowest at 28.31 ± 23.74%. The projected supplement use prevalence (80.19 ± 18.41%) was in par with the perception about the proportion of athletes being conscious about their diet (89.53 ± 13.88%), suggesting that nutritional supplements in this [young] athlete group is more linked to diet than performance. This also seems to fit the pattern about the observed mental anchoring in this group. Those who used supplements gave a slightly higher but not statistically significant estimation for supplement use compared to those who reported no supplement use (82.47 ± 15.89 and 74.33 ± 23.77%, respectively; $t(30) = 1.130$, $p = .267$).

The most important reason for avoiding doping was the fear that it damages to the health, followed by disapproval of drugs, against the rules/fair play, no need, upsetting people important, being illegal and fear of being caught. Access and affordability do not seem to play a protective role.

Willingness of using prohibited performance enhancing substances and implicit self-esteem correlated negatively and significantly ($r = -.405$, $p = .029$); but there was no correlation between explicit self-esteem and willingness ($r = -.168$, $p = .382$).

In a small sample of young elite female hockey players (n = 32, mean age = 17.13 ± 3.06 years), normative brief IATs were tested. Participants completed three normative IATs for doping, supplement

use and illicit drug prevalence in randomised order. Athletes' D-scores from the normative IATs showed that doping was implicitly associated with rare, whereas nutritional supplements were associated with being prevalent, mirroring the explicit reports on projected doping prevalence observed in previous studies and in the doping literature. The observed strong positive correlation between explicit estimation of doping and illicit drug prevalence stood out in the projected prevalence comparisons. One possible explanation is the age difference between this sample and the previous studies. This also raises a question on age effect on doping mental representations for future studies.

Study 9: Honesty goal priming

This study concerns with two forms of honesty goal priming and explore the impact of honesty goal priming on admission of socially sensitive behaviour. It is expected that in primed condition, admission of social drug use is higher than in the control condition group.

Synonym test

In experiment 1, Rasinki et al.'s (2005) goal priming task was employed. It is also identical to the priming test we used in Study 8. Control condition priming task was identical format and equal difficulty, but the words were random words, not honesty.

The survey comprised an honesty priming or control task and a question about social drug use in the past 12 months.

Data were collected via amazon Turk crowdsourcing platform and UK students. Participants were randomly allocated to different indirect estimations models (Forced Response, Single Sample Count, Crosswise Model) and direct questions with experimental vs. control priming condition.

The raw data are shown in Table 48 and the results are summarised in Table 49.

Table 48: *Raw data from testing different estimation models*

	Combined set	AMT only
FR	632 yes / 1,610	357 yes / 918
CW	306 yes / 873	145 yes / 472
SSC (4+1)	Sum 1590 / 737	Sum 966 / 446
Primed Direct SR	90 yes / 426	37 yes / 232
Control Direct SR	87 yes / 426	26 yes / 246

Table 49: *Estimations of social drug use with different methods (summary of the results)*

	Combined sample (N = 2,462)	Amazon Mechanical Turk (N = 1,396)
Direct self-report	(n = 852) Control: 20.423% Primed: 21.127%	(n = 478) Control (26/246): 10.57% Primed (37/232): 15.95%
SSC	(n = 737) d = (1,590/737) – 2 = 0.15739 (0.08056, 0.23423)	d = (966/446)-2 = 0.16592 (0.0669, 0.26494): 16.6%
FR	(n = 1,610) 0.30117 (0.2833, 0.3191)	p = 0.2963 (0.2726, 0.3199) : 29.6%
CW	(n = 873) 0.7989	p = 0.8856: 88.6%

With regards to priming effect, the results showed some increase in the self-reported prevalence rate of illicit drug use (10.6% vs. 15.9% for control and honesty-primed, respectively) but without reaching statistical significance (Fisher Exact test p = 0.1040).

Note: Rasinski et al.'s (2005) synonym task was also used in a Hungarian sample of adult athletes (n = 180, see Study 12 for demographic details), but without a control condition for comparison. The admitted use of doping, social drugs and nutritional supplements (which were asked in this order to ensure that if there is a priming effect, it impacts on the doping question). The admitted use was as follows:

- Doping: 1.7% are regular user and 7.2% tried;
- Social drug: 1.1% are regular user, 13.3% are occasional user and 26.7% tried;
- Nutritional supplements: 39.4% used for health and performance enhancements, 38.9% used for health reasons only.

Wordsearch puzzle

To further investigate the potential of using priming effect to increase honest responding, an alternative priming task was designed. The priming was presented as a brief vocabulary test to test the level of English and appeared in the form of a word-search puzzle of an 8 x 8 letter matrix, where 9 words were placed (6 were prime). The word-search puzzle was created using a free online programme (Figure 29).

In this task, answer options were not offered in a multiple choice style (which can be completed without actually doing the task) but asked respondents to fill in the blank. The first letter of each word was given. The survey was set so respondents had to complete at least 2/3 of the task to progress. This approach also afforded the option of filtering out respondents with incorrect answers from the dataset retrospectively

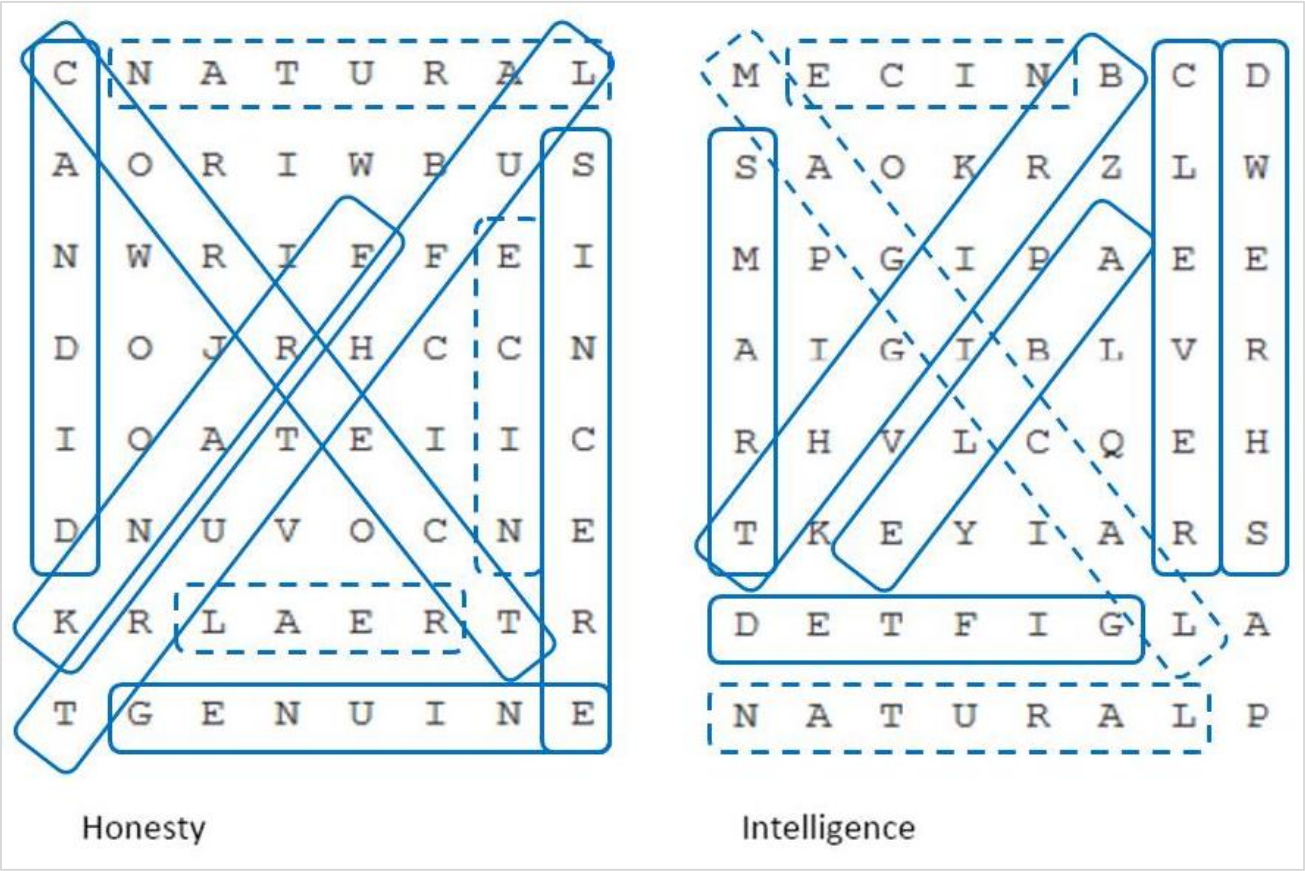


Figure 29: *Word-search puzzle for (A) honesty goal priming and (B) control task*

The target question was about drug use in the past 12 months. The question was asked in an indirect estimation model format called the Single Sample Count (SSC)(Petroczi et al., 2011).

1. My birthday is in the first half (January - June) of the year.
2. My mother's birthday is in the second half (July - December) of the year.
3**. I used drugs, at least once, in the last 12 months.**
4. The day of my birthday is an even number.
5. The last digit of my phone number is an odd number.

Respondents were instructed to report the total number of affirmative answers without revealing which ones are. This way, both the participant and the researcher are protected.

Participants

The survey was posted on the Amazon Mechanical Turk website with HIT rate set as > 85% for compensation of US$0.10. Allocation to the two experimental groups was based on whether respondent's lucky or favourite number was odd or even number. In total, 661 survey was completed (57.4% male). Respondents with an even favourite numbers receiving the honesty priming (n = 321) and respondents with an odd favourite number were allocated to the control task condition (n = 343).

The mean age of the participants was 29.50 ± 9.27 (range 18 – 81 years of age). Due to the nature of mechanical Turks, the sample was international with Asian (India, Pakistan, Bangladesh) dominance (58.6%), followed by North America (26.8%) and Europe (11.0%). Among the participants, English was second language to 37.8% of the participants, followed by native speakers (33.9%) and fluent English speakers (28.3%). Three-quarters of the respondents (72.2%) had at least an undergraduate degree or higher.

Ethnicity distribution was as follows (in decreasing order): Asian (India, Pakistan, Bangladesh)(55.7%), White (33.3%), Black (2.4%), Oriental (2.0%), Hispanic (1.4%), Other (2.7%), Mixed (1.1%), not wish to answer (1.5%).

Results

Of the 664 completed surveys, 31(11 from the primed and 20 from the control group) were deleted owing to incorrect answers to the prime talk control questions. The mean age of the group was 29.5±9.3 years with no significant difference between the two groups ($t(629) = -1.504$, $p = 0.133$).

No gender, language skills or education level effect was observed, but there was a high proportion of white ethnic background in the control group (DQC: 141/323 vs. DQP: 78/310), resulting in a reversed but less pronounced pattern for Asians (DQC: 155/323 vs. DQP: 188/310; Fisher exact $p < 0.001$). The possible effect of this could have resulted in a higher estimate of drug use in the control group, having drug use less prevalent among Asians compared to people from white background. Notably, there was no difference between the two groups in knowing a drug user (DQ: 132 yes/191 no; PDQ: 105 yes/205 no; Fisher's Exact test $p = 0.071$).

In the experimental group (n = 321), 727 'yes' answers were recorded, which gives $d = 0.26479$ (0.14522, 0.38437) compared to the control group ($n = 343$) where $d = 0.14286$ (0.03074, 0.2550). The prevalence of illicit drug use in the experimental group was significantly higher than the same estimate in the control group ($z = 3.912$, $p < 0.001$) (Figure 30).

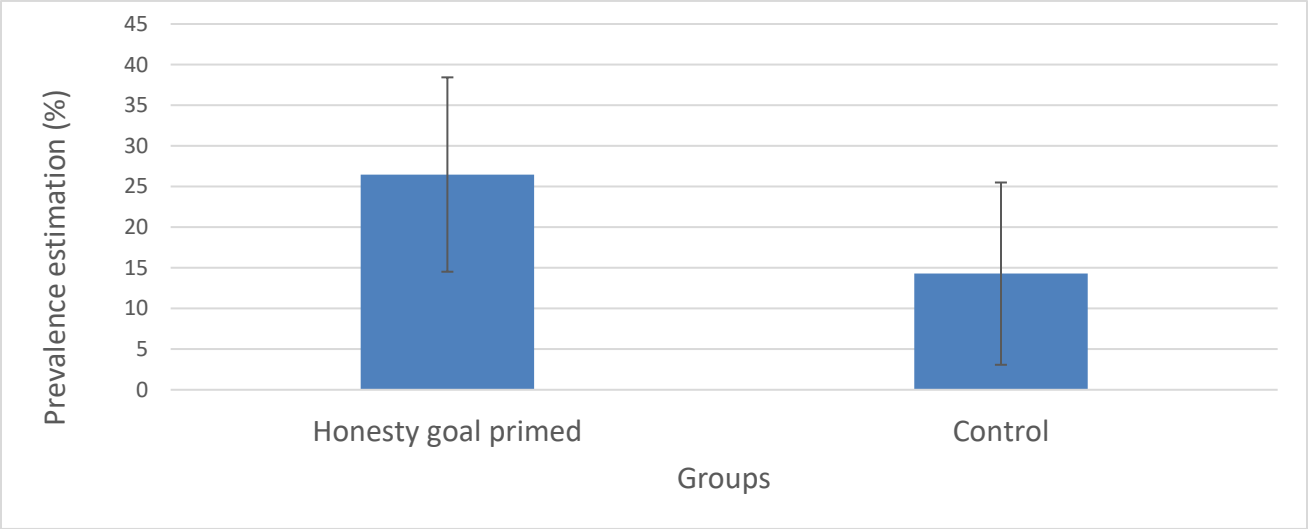


Figure 30: *Estimation of admitted social drug use in primed and control conditions*

Overall the results suggests that honesty goal priming can have a desired impact on admitting socially sensitive behaviour but the priming task must be set in a way that forces participants to make cognitive effort, 'to think'. Task that can be passed by random responding that requires no cognitive effort do not evoke the desired priming effect. This could explain why Rasinki's synonym priming task – without 'marking or other consequences - was less successful.

Study 10: Single question measurements

Self-esteem

In Study 9, self-esteem was measured by two independent questions. One question was tapping into implicit global self-esteem "How much do you like your own name?" (Gebauer et al, 2008), rated on a 9-point scale ranging from not at all to very much. Explicit single item self-esteem "I have high self-esteem" (Robins et al, 2001) was also used. This question was rated on a 5-point scale ranging from not very true of me to very true of me.

There was a statistically significant and positive correlation between the two single question self-esteem measures, but the correlation was not very strong (r = 0.371; p = 0.36). Further study is required where the single question assessment of self-esteem is administered alongside an established measure such as the Rosenberg self-esteem scale (Rosenberg, M. (1979):

1. On the whole, I am satisfied with myself.
2. At times I think I am no good at all.
3. I feel that I have a number of good qualities.
4. I am able to do things as well as most other people.
5. I feel 1do not have much to be proud of.
6. I certainly feel useless at times.
7. I feel that I'm a person of worth.
8. I wish I could have more respect for myself.
9. All in all, I am inclined to think that I am a failure.
10. I take a positive attitude toward myself.

Rated on a Likert-scale or Likert-type scale ranging from Strongly agree to Strongly disagree.

In a separate study with amazon Mechanical Turk participants (n = 1,353), stronger correlation was observed for a different, direct single item self-esteem measure where participants were asked to rate their own self-esteem directly on a 9-point scale (1 = very low and 9 = very high). Increments were marked but not qualified (i.e., just noted with numbers between 2 – 8).

The correlation coefficients are displayed in Table 50.

Table 50: *Correlation coefficient for self-esteem measures (r, p and N)*

	Rosenberg' self esteem	Single question Direct	Single question Indirect
Single-item Direct Question (My self-esteem is...)	.561**	1	
	.000		
	1292	1353	
Single-item Indirect Question (Mark on the scale below how much you like your name)	.240**	.343**	1
	.000	.000	
	1293	1344	1353

In a 3rd study among young Hungarian weightlifters (n = 104, 80.8% male, mean age = 15.52 ± 1.09 years, range 13 – 17) also tested a direct (my self-esteem is high) and indirect self-esteem (liking name) measures. Both were measured on a 9-point scale.

The correlation between the two measures were moderate and positive, and statistically significant (r = .294, p = .002).

Using the same questions, a stronger correlation was observed among 180 Hungarian adult athletes (r = .384, p < .001). See study 12 for demographic details.

Socially desirable responding

Measures of socially desirable responding tend to be multi-item scales which can add considerable length to a survey.

Using a sample of amazon Mechanical Turks (n = 1,353)

A single-item impression management measure ("I am willing to do things just to avoid looking bad") was administered alongside an established scale of social desirability (Marlow Crowne short scale). The correlation between the two measures were statistically significant but small (r = -.102, p < .001). The statical significance is the function of the large sample size.

In a separate study, we tested several single item measures that could capture a tendency for socially desirable responding.

The following statements are what most people do. Please rate how much each of these statements is true for you.

- *When expecting company, I make sure my home is clean*
- *I keep up to date with present fashion trends*
- *I am more polite to strangers than to my friends*
- *I always speak my mind*
- *I always do what I want to do, not what others want me to do*
- *I always wear clothes similar to what my friends wear*
- *I am willing to do things just to avoid looking bad*

Rating: 1 = Not true at all ... 5 = Very true

These were administered alongside an established measure: 20-item impression management subscale of Paulhus' 40-item Balanced Inventory of Desirable Responding (BIDR 6) scale (1991).

The survey also included seven statements of what most people do to some degree (B):

1. I have high self-esteem.
2. I have high desire to present myself in the best possible light.
3. I tend to hide my true feelings.
4. I tend to show off when I am among strangers.
5. I buy designer clothes or accessories I can't really afford.
6. I prefer to keep my thoughts to myself.
7. I don't care what people think of me.

We also added English proverbs (PV) about 'deception', 'lies' and 'impression management':

1. The true hypocrite is the one who ceases to perceive his deception, the one who lies with sincerity.

2. Be who you are and say what you feel because those who mind don't matter and those who matter don't mind.
3. An honest answer is the sign of true friendship.
4. No man, for any considerable period, can wear one face to himself, and another to the multitude, without finally getting bewildered as to which may be true.
5. It is hard to believe that a man is telling the truth when you know that you would lie if you were in his place.
6. Lies that build are better than truths that destroy.

Rating: 1 = Most likely (1st choice) … 6 = Least likely (last choice) for putting it on an office wall.

It was expected that a single question measure of social desirability show correlations with these statements.

Data comprised an international sample of 190 (31.1% male, mean age = 30.6 ± 9.80, range 18 – 69 years of age). The survey language was English. More than two-thirds of the respondents lived in the UK (67.4%), followed by 12.1% in the EU and 15.8% overseas, 76.3% had university degree level education. Most of the participants were native English speakers (64.2%) or bilingual (9.5%). Participants religious beliefs were reported as follows: 32.1% belonged to an established religion but they were non-practitioners, 28.4% were non-believers, 25.3% followed their 'own belief' and 13.7% followed an established religion.

Among the tested items, item "*I am willing to do things just to avoid looking bad*" showed the highest correlation with Paulhus' impression management scale (r = - .299, p < 0.001). The negative correlation suggests that the more one denies this common behaviour, the higher is his/her tendency for impression management.

The correlations between this item and the common behaviour, along with Paulhus' impression management scale is shown in Table 51).

Table 51: *Correlation coefficients between the single item impression management measure, Paulhus' impression management scale and common behaviours and English proverbs. Statistical significance ($p < 0.05$) is marked in bold.*

	SQ-IM	P-IM	B1	B2	B3	B4	B5	B6	B7	PV1	PV2	PV3	PV4	PV5	PV6
SQ-IM	1.00														
P-IM	**-.272**	1.00													
B1	.111	**-.159**	1.00												
B2	**.266**	-.130	**.304**	1.00											
B3	**.149**	-.063	-.106	.107	1.00										
B4	.131	-.141	**-.168**	-.041	**.188**	1.00									
B5	.121	.072	.052	.116	**.535**	.006	1.00								
B6	**.146**	**-.323**	**.252**	.075	-.042	**.322**	-.197	1.00							
B7	-.020	-.089	**.339**	-.110	.120	-.003	**.267**	.154	1.00						
PV1	.073	**-.179**	.045	-.099	-.126	.085	**-.150**	.117	.098	1.00					
PV2	.018	.107	-.018	.071	-.028	-.077	.051	**-.155**	.078	-.320	1.00				
PV3	-.002	0.97	.030	.079	0.043	-.127	.009	-.028	-.002	**-.179**	**-.207**	1.00			
PV4	.084	.002	.140	-.007	-.040	-.053	-.050	.044	.001	-.030	-.086	**-.315**	1.00		
PV5	-.147	-.059	-.023	.020	0.95	.138	**.183**	-.089	-.076	**-.151**	-.137	**-.317**	-.103	1.00	
PV6	-.082	-.055	-.041	-.104	.003	.034	-.033	.104	-.017	**-.162**	**-.234**	-.025	**-.328**	**-.204**	1.00

Tendency for socially desirable responding and impression management are notoriously hard to capture in surveys. Yet, the relatively small correlations coefficients came as a surprise. Further exploration of the cognitive processing of the different constructs is warranted to understand the underlying reasons for this. On the face validity level, one would expect higher correlation. The observed small and non-existent correlation was not limited to the single item measure but also characterized Paulhus' impression management scale.

Study 11: Short form of the Performance enhancement Attitude Scale (PEAS-8)

The aim of this study was to test the short (3-item) legitimacy perception scale. As part of this study, the shortened version of the PEAS was used, which allowed to test for its psychometric properties.[10]

This study involved 158 competitive athletes in the UK (51.3% male, 31.6% female, 13.3% rather not say). The level of competition varied between university club level and national/international. Fifty-six athletes declared professional athlete status.

The short version internal consistency reliability (Cronbach's α) in this sample was 0.828. Item means and standard deviations are presented in Table 52, along with item-Total correlations and change in internal consistency reliability if the item is removed from the scale. The results show that removing item 1 would improve the internal consistency further (from 0.828 to 0.853). However, removing the item would result in losing an aspect of performance enhancement via technology, apparel, and substances.

Table 52: *PEAS-8 items and item levels statistics*

	Mean	SD	Corrected Item-Total corr.	α if item deleted
There is no difference between drugs, fibreglass poles, and speedy swimsuits that are all used to enhance performance.	2.73	1.452	.229	.853
The risks related to doping are exaggerated.	2.80	1.230	.536	.810
Legalising performance enhancements would be beneficial for sports.	2.45	1.426	.604	.800
Doping is not cheating, since everyone does it.	1.78	1.090	.737	.788
Athletes should not feel guilty about breaking the rules and taking performance-enhancing drugs.	1.99	1.309	.547	.808
Only the quality of performance should matter, not the way athletes achieved it.	2.12	1.342	.611	.799
Doping is necessary to be competitive.	2.04	1.281	.678	.791
Doping is an unavoidable part of the competitive sport.	2.65	1.476	.563	.806

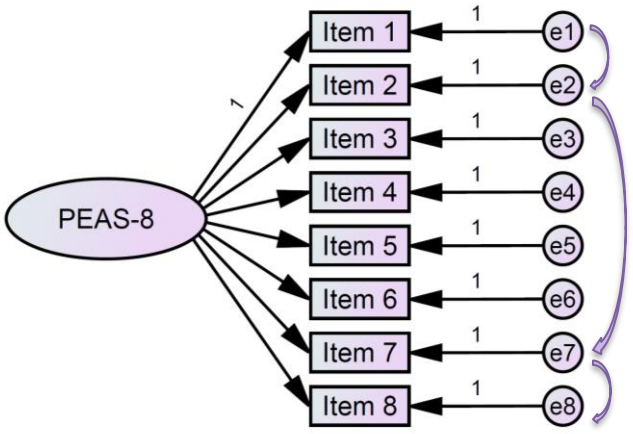
[10] This study was conducted by Dirk Folkerts during his internship at Kingston University, as partial fulfilment of his coursework.

Confirmatory factor analysis (CFA) was also performed. The results are summarised in Table 53. PEAS measurement model and standardised regression weights are shown in Figure 31.

Table 53: *Model fit indices of the short form of PEAS*

Fit indices	Model 1	Model 1 (modified to allow correlation between the errors)	Model 2 (PEAS-7)
Chi-square	77.078	33.757	44.915
Chi-square/df	3.854	1.986	3.208
TLI	0.832	.942	0.896
CFI	0.880	.965	0.931
RMSEA	0.135 (0.104, 0.167)	0.079 (0.039, 0.118)	0.119 (0.081, 0.158)
AIC	109.078	71.757	72.915
BIC	158.080	129.946	115.791

The results in Table 53 shows that more significant improvement to the model fit is done by allowing correlation between the measurement errors, than by removing the first item. Whilst the correlation between measurement errors is not ideal, it is informative because it often signals the presence of an underlying factor.



Item	PEAS8	PEAS7
Item 1	0.180	
Item 2	0.517	0.509
Item 3	0.686	0.686
Item 4	0.862	0.867
Item 5	0.640	0.639
Item 6	0.689	0.688
Item 7	0.779	0.779
Item 8	0.604	0.600

Figure 31: *Measurement model of the short PEAS*

Other measure in this study included normative obedience (expectation of others to follow the WADA Code), perceived normative and procedural legitimacy of anti-doping (Woolway et al, 2020), morality (expressed as a degree of acceptability of using doping), trustworthiness of anti-doping organisations (Dreiskaemper et al, 2016). The correlation coefficients between these constructs and PEAS-8 are shown in Table 54.

Table 54: *Correlation coefficients between doping attitude (PEAS short) and related constructs*

	Obedience	Legitimacy	Morality	Trust-worthiness
Legitimacy	.329**	1		
	p < .001			
Morality	-.170*	-.159*	1	
	p = .033	p = .047		
Trustworthiness	.330**	.584**	-.158*	1
	p < .001	p < .001	p = .048	
Attitude	-.298**	-.270**	.660**	-.336**
	p < .001	p = .001	p < .001	p < .001

The high correlation between PEAS-8 and morality (r = .660, p < .001) suggests that PEAS-8 taps into a moral aspect of doping. The strength and direction (negative) of the other pairwise correlations offer support for the validity of PEAS-8 as a general (or moral) attitude toward doping.

Study 12: Reasons & Deterrence

In this research programme, reasons for doping and reasons for not doping were asked in multiple studies. Specifically, the two questions were phrased as follows:

- REASON FOR: *If I would use performance enhancing substances I would do it to... (list of reasons)*
- REASON AGAINST: *Please rank the following reasons for NOT using prohibited performance enhancing substances according to their importance to you. If you have been or are using such substances, answer the question as what was the most difficult vs. easiest barrier to overcome.* Note: you are only allowed to have one response per column.

In a study with Hungarian weightlifters (n = 104, 80.8% male, mean age = 15.52 ± 1.09 years, range 13 – 17), reasons for and against were identified as shown in Figure 32 and Figure 33, respectively. The same question was also used in a larger sample of young elite Hungarian athletes from various sports (n = 363). For demographic details, see Study 3.

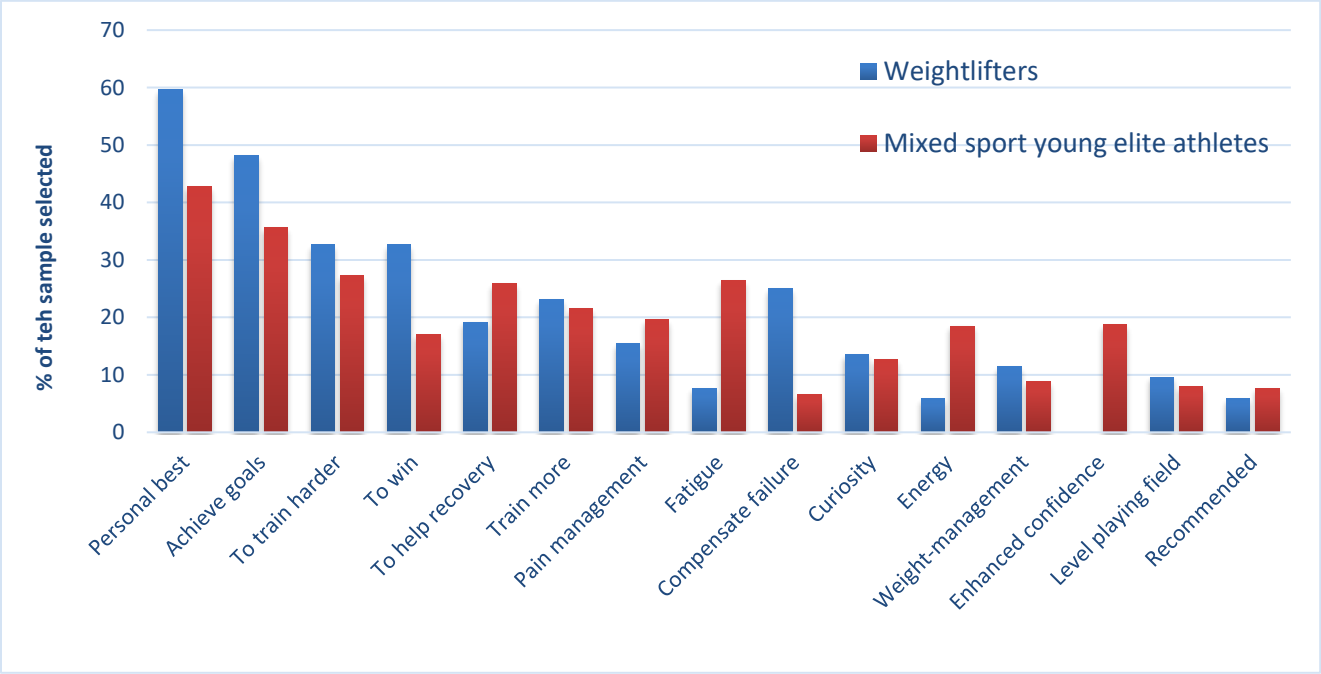


Figure 32: *Reasons for doping among young Hungarian weightlifters and young talented athletes (select all)*

Although the survey used closed response options, it is notable that the dominant reasons for doping tend to be functional (i.e., to train harder or more, to manage pain, help recovery and to win). In contrast, reasons for not doping varied more widely between health concerns, moral reasons (i.e., rule breaking, illegal), access and affordability and fear of consequences.

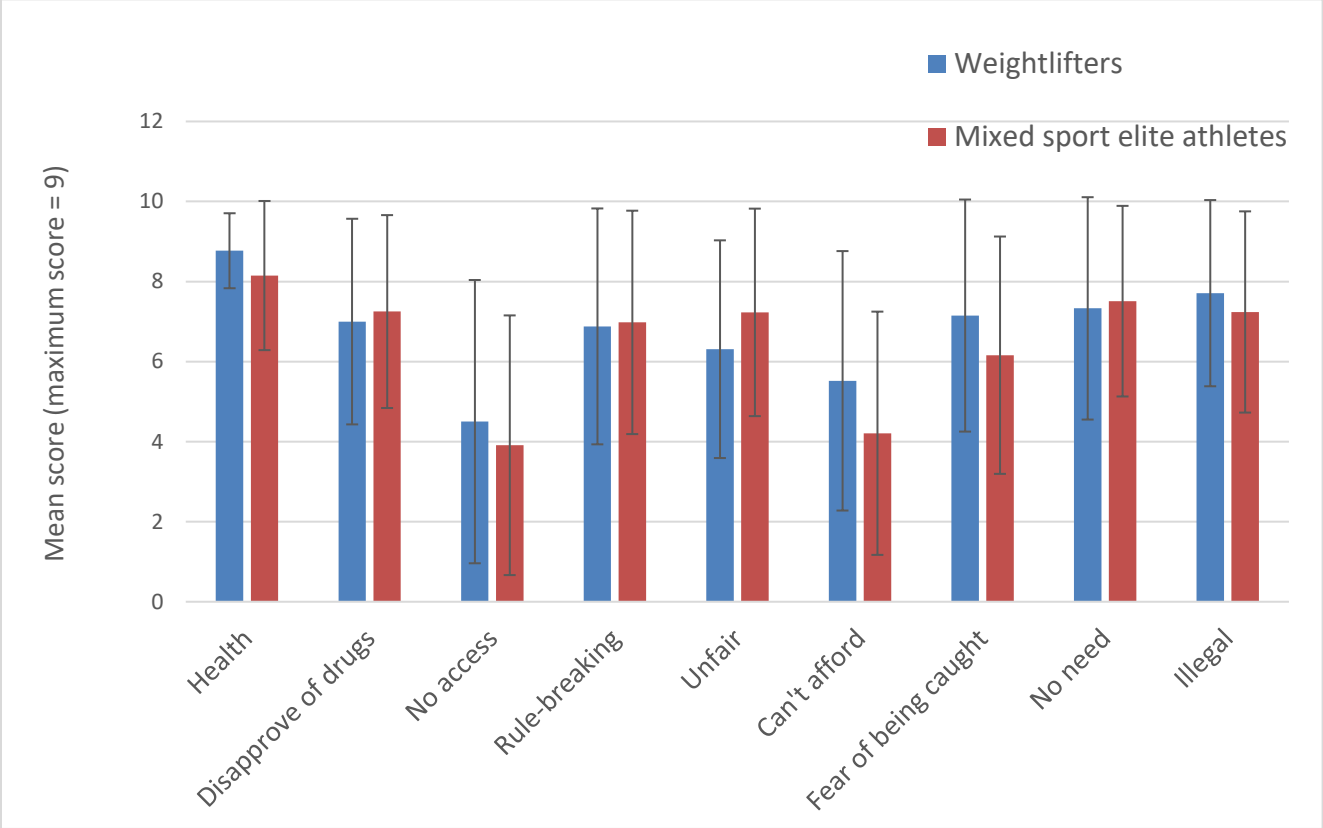


Figure 33: *Reasons against doping among young Hungarian young weightlifters and young elite athletes (ranked for importance)*

Reasons for doping and for not doping was also explored in a separate study with 180 adult Hungarian athletes (42.8% male, mean age = 21.44 ± 2.43, range = 17 – 31 years of age). This is an extended sample of Study 1.

Reasons for doping are presented in Figure 34, whereas reasons for avoiding doping are summarized in Figure 35. Overall, the pattern is similar to those observed among young athletes.

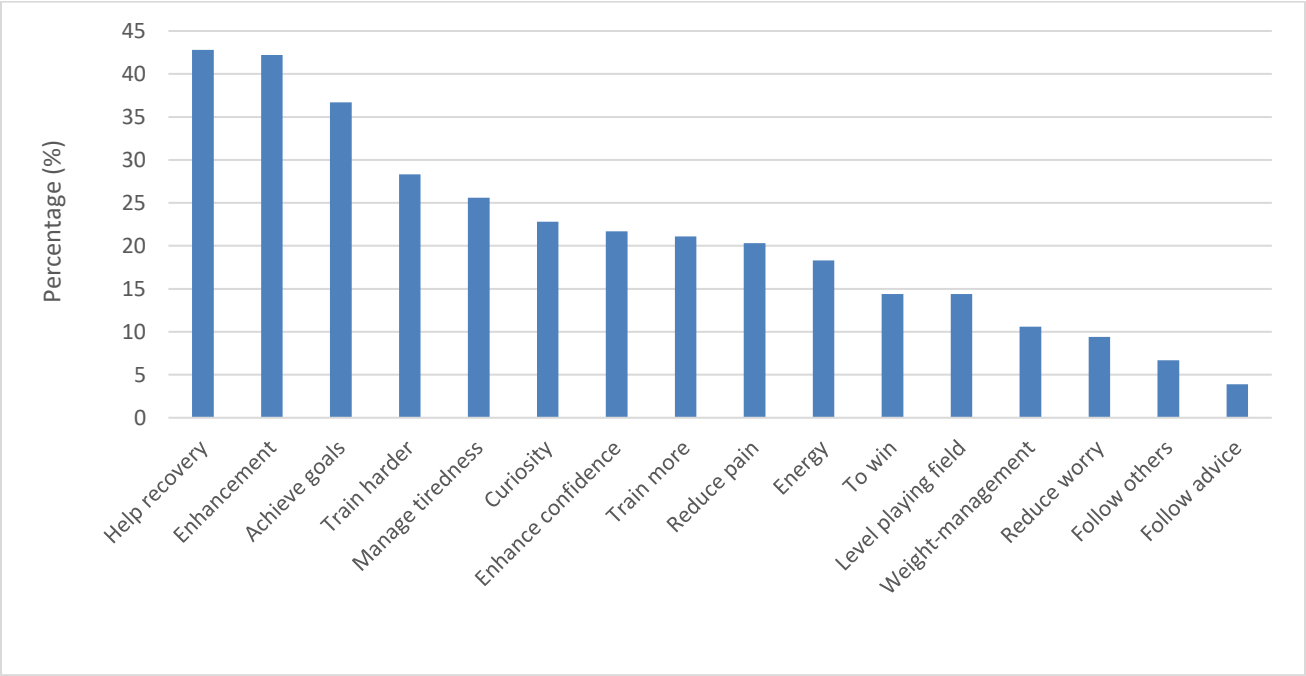


Figure 34: *Reasons for doping among Hungarian adult athletes (select all)*

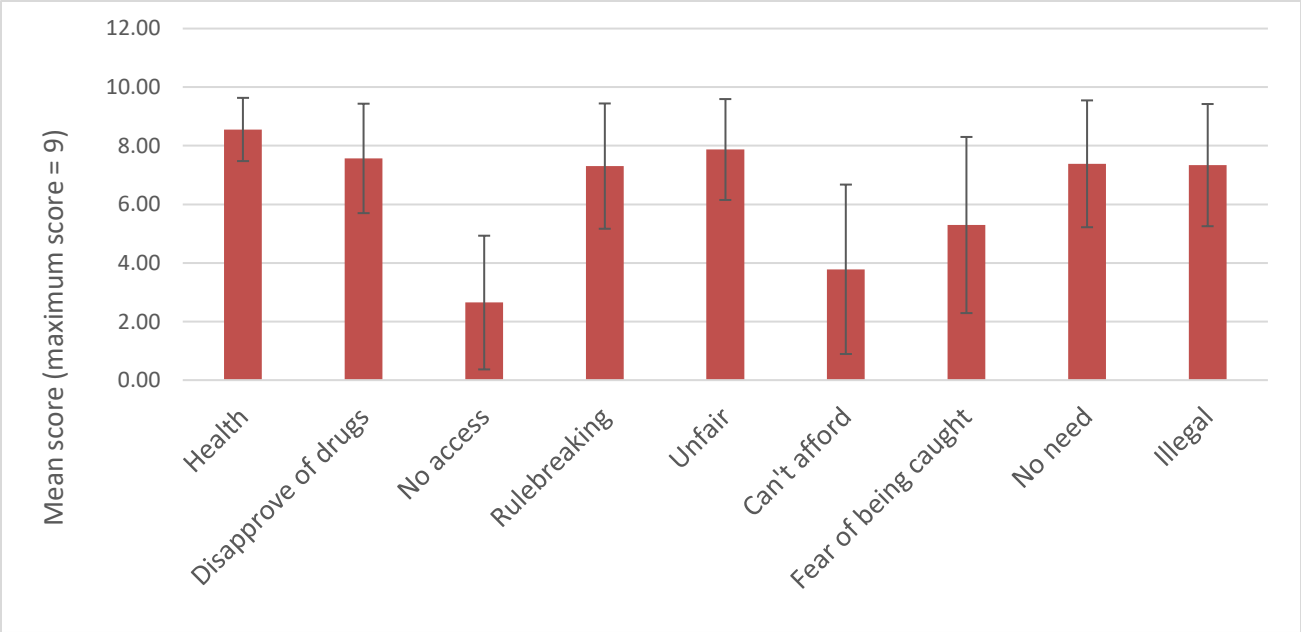


Figure 35: *Reasons against doping among Hungarian adult athletes (ranked for importance)*

Discussion

Social cognition and doping behaviour

Explicit attitude toward doping

In all studies, expressed attitudes toward doping were in the negative range. In other words, participating athletes expressed more or less negative attitudes toward doping, not a range between negative and positive.

Applications of the Performance Enhancement Attitude Scale (PEAS) added empirical evidence for the scale's scores internal reliability consistency. Cronbach alpha coefficients ranged above the 0.7 cutoff value in all studies. Short form of PEAS which contains only 8 items (PEAS-8) has also gained empirical support for its reliability and validity; with a possibility to reduce the number of items further to 7.

A full systematic review and meta-analysis on PEAS is available here: 10.31236/osf.io/k6gye

'Implicit attitude' and other response-time based measures

Building on the dominant literature providing support for the notion that implicit associations, either on their own (Greenwald et al, 2009; Gregg & Klymowsky, 2013) or in combination with explicit measures (Perugini et al, 2010), are able to predict behaviour, doping behaviour researchers had hoped that the IAT concept could be successfully exploited for counterbalancing sensitivity and predicting doping behaviour.

In relation to doping, research suggests a potential for the performance-enhancement related Implicit Associations Test to capture substantive group-level differences, undeclared attitudes to doping and to predict behaviour in self-reported and hypothetical situations above and beyond the explicit measures (Petróczi et al, 2008; 2010). In line with the literature (Petróczi, 2013b), many of the IATs trialled in this project produced reasonable and interpretable D-scores, suggesting that the tests indeed tapped into some association around the IAT constructs (usually, doping/supplements or some other legitimate substances contrasted with affective attributes such as good/bad or pleasant/unpleasant). This is

Predictive power

Athletes who were willing to admit doping use were willing to report a more supportive attitude, most likely as a result of maintaining cognitive consistency. Disappointing as it was, that fact that explicit doping attitudes have better discriminative power over implicit measures for doping behaviour for those athletes who are willing to admit their doping behaviour could have been anticipated. Because the exact opposite is not quite the case, implicit measures were consistently inferior predictors for known behaviour with affective implicit assessments remaining weak across repeated applications. However, despite falling short in showing that implicit attitudes are able to discriminate between doping users and non-users better than explicitly declared views, results of these studies made an important contribution to developing a better understanding of how athletes see doping by illustrating discordance between implicit and explicit doping attitudes. Some indications were found that the explicit-implicit combination could be indicative for behaviour that exist but denied (Petróczi, Aidman, et al, 2010; Petróczi, Uvacsek, et al, 2011).

However, contrary to the successful applications of the IAT concept in numerous fields (Greenwald et al, 2009), the studies applying implicit measures to doping provided evidence for the IAT effect but did so with very little ecological validity. To date, studies were unable to provide support for the expected predictive or discriminative power for doping behaviour over and above self-report. It is either because 'implicit doping attitudes' are not linked to the behaviour (or at least not in a sense that these implicit attitudes should represent an unspoken, subconscious evaluative balance between positive outcomes and negative consequences, and thus leading to a logical behavioural choice) or because the explanation lies in a potentially limiting discrepancy between the behaviour, the target construct and the measurement tool.

The underlying assumption for applying the implicit association concept to doping was the simple output model in which athletes either engage or not in doping, but if they do so, they must have a clear mindset that leads to and supports doping use. This mindset, owing to sensitivity, is best captured with implicit assessments. Value tags in the doping mindset must contradict the universally accepted positive values of sport, because doping is against the rules that are in place to ensure fair play and level playing field. Intriguingly, the mere existence of this clear mindset in which doping users must have a supportive attitude toward doping (i.e., 'doping is good') and clean athletes must think that ‘doping is bad’ has not been questioned in these papers. Rather, sources of the generally negative attitude and the lack of discriminative power were hypothetically linked to the characteristics of the stimuli sets such as having unclear boundaries between acceptable performance enhancing substances and doping (Petróczi et al,

2008; Brand et al, 2011), behavioural index (Petróczi et al, 2011) or simply having a naturally higher preference for the relational pair, which was health food in Brand et al (2014).

Explicit and implicit inconsistency

A polarisation of the explicit and implicit measurements emerged from the applications of affective doping IATs, according to whether there is a congruence of dissonance with the claimed and the actual behaviour. This polarisation also provides a possible explanation why implicit measures fail to predict behaviour over and above self-reports in studies where behaviour is indexed on self-reports. Affective implicit associations appear to have a weak link to actual doping behaviour, but combined with other assessments, they can provide a window into athletes' though processes about doping. The way doping related implicit assessments are performed appears to be indicative for the behavioural – cognitive consistency (i.e., absent, admitted or denied). Therefore, it is reasonable to assume that implicit associations may not be directly related to a particular behaviour but to the post-processing thoughts about that behaviour.

The doping-IATs in the included studies showed negative 'attitudes' toward doping. Against the stable and unfailingly fitting pattern of the explicit outcomes (i.e., confessed doping users exhibiting more lenient attitude toward doping, perceive doping to be more prevalent and report higher pressure to dope then self-claimed clean athletes), the consistently negative implicit attitude and the lack of discriminative power of implicit assessments suggest the presence of some unaccounted mechanisms that produce these perplexing dissonance. In brief, it is hypothesised that the actual implicit measurements obtained in field settings do not necessarily represent the construct they were intended to measure but rather, they are direct outcomes or at least partially confounded by some other underlying mechanism. The possible explanations for such a mismatch could arise from sampling, methodological issues and interpretation of the implicit measurements. From the methodological point of view, it is unlikely that the two dimensional model by which implicit association tests operates (e.g., doping is good/bad) is adequate to capture the complexity of the doping mindset.

Mental representation

Some evidence suggests that, contrary to the 'outside view' by general population, athletes' mental representations of doping overlap doping with supplements (probably rooted in shared 'functions'), but not with illegal drugs, as both 'being against the rules' (Petroczi, Mazanov, et al, 2011; Uvacsek et al, 2011). Contrasting nutritional supplements against doping only works from the legal/moral point of view; but not if functionality is the most salient tag in doping mental representation. To date, nutritional

supplements have been viewed as acceptable alternatives to doping. However, assuming that the progressive doping model will gain empirical support in the future and the presence of relational frames is demonstrated and linked to currently acceptable performance enhancing practices (e.g., "nutritional supplements helps my athletic performance but they are not as effective as doping"), then successful preventive effort should target not only doping, but its precursors, including the supplement use culture. That is not to suggest that the prohibited list should balloon to a compendium of performance enhancing substances. Instead, athletes should be helped to find ways to resist the culture of assisted performance enhancement and rationalise their choices about chemical assistance on real needs.

Malleability

Contrary to the prevailing assumption that implicit cognitions are stable reflections of people's inner thoughts wired in by long-term experiences, there is an emerging body of evidence suggesting otherwise. Literature evidence shows that whilst specific associations are resistant to change, global implicit cognitions are more malleable (Wiers, de Jong, Havermans & Jelicic, 2004). Research indicates that self-regulatory strategies can be employed to control implicit cognitions (Sherman et al, 2008), which is most relevant to impulsive drug use, mainly arising from a combination of craving and opportunity. Webb and colleagues (2012) showed that implementation intention using 'if-then' scenarios has a particularly promising ability to control automatic associations with effect maintained over a period of time. In connection with health-affecting behaviour, implicit motivations have shown to influence behavioural choices and thus holding great promise for amplifying the effectiveness of behavioural interventions (Sheeran, Gollwitzer & Bargh, 2013). Effective anti-doping measures should target implicit cognitive processes (Nosek & Riskind, 2012) and evaluations of such should ascertain whether observed change in explicitly declared attitude toward doping is mirrored in parallel implicit measures (Gawronski & Bodenhausen, 2006; Gawronski & LeBel, 2008, Han, Czellar, Olson & Fazio, 2010; James et al, 2010). The Self, and self-esteem has also shown to be instrumental in implicit attitude change (Prestwich, Perugini, Hurling & Richetin, 2010)

In relation to cognitions about performance enhancement, a recent study has shown that even a single exposure information intervention is able to change both implicit and explicit cognitions about prohibited performance enhancing substances and functional food, promoting the latter as a healthy and acceptable alternative to doping (James et al, 2010). However, caution in constructing, delivering and evaluating anti-doping messages intend to change attitudes is warranted as previous studies from the field of substance abuse showed that anti-drug advertisement had an effect on the explicit attitudes opposite to

what was intended. Increased knowledge about the prohibited substance was also noted (James et al, 2010). In Czywenska & Ginsburg (2007), the implicit attitude changed in the expected direction but suggested an unwanted relational effect (e.g., the more negative attitude toward marijuana yielded a more positive attitude toward smoking and vice versa). Explicit and implicit attitudes were dissociated with self-reported behavioural intention expectedly followed the explicitly expressed attitude. Translating changes in implicit associations to real life behavioural choices is yet to be done. Using a doping substance with the deliberate goal to enhance functionality is not an impulsive behaviour, thus it is being cognitively controlled, goal-oriented and effortful. Yet, automatic mental associations, habits and feelings still exert influence on people's ability to behave in a desired way to a varying degree. From the prevention/intervention point of view, the key question is what moderates the connection between the inner thoughts and actions, and how it can be changed or controlled.

Indexing doping behaviour

Major problem with doping models is how doping behavior is established. Obtaining reliable information on the behaviour is critical in establishing predictive or discriminative power. In the course of investigating the reliability and validity of indirect estimation methods, Lensvelt-Muelder and Boeije (2007) observed that people more likely answer sensitive autobiographical questions truthfully if the way the question is phrased makes allowance for their rationalization or more in line with their motives for that particular behavioural choice. This is in line with the general recommendations in social psychology to reduce response bias driven by self-protection or impression-management (Peter & Valkenburg, 2011; Tourengaeu & Yan, 2007). Petroczi & Naughton (2011) advocate for incorporating ways of obtaining objective information; or using such methods for verification or falsification of self-reported behavioural information.

Combination of self-reports with analytical methods

Combination of survey methodology with analytical methods highlighted that approach requires careful consideration of the advantages and limitations of the method of choice to ensure that it is able to provide the information that is needed.

When survey is complimented with analytical data (e.g., hair analysis) to verify self-reported information on substance use, substance and timeframe must be carefully matched.

Social projection

Contrary to the optimism by Moston, Engelberg and Skinner (2014) about using the false consensus effect as an indicator (but not evidence) for doping involvement, its application in field settings is limited. The higher estimation of perceived doping prevalence is relative (interpreted in comparison to the group average of the 'clean athletes'); influenced by the social distance between the person making the estimate and the group for which the estimation is made (Jones, 2004) and, perhaps most importantly, it

Honesty Priming

Honesty goal priming is a useful research tool to explore the magnitude of potential underreporting; and to obtain a more truthful response to sensitive question(s). The results clearly indicate that honesty priming task only produces the expected influence if participants are actively engage in the priming task. In other words, sustained cognitive effort is required for the impact. Therefore, only tasks that cannot be solved by guessing or progress on with random responding are suitable as honesty goal prime. This observation is in line with a literature, which attempted to replicate Rasinski et al (2005) study on honesty goal priming. For example, a study by Pasher et al (2013) were unsuccessful in three experiments replicating the priming effect using the synonym-task but failed to suggest that the reason for this fail is likely to be the lack of engagement and cognitive effort (i.e., the task could be 'completed' without active engagement).

The field would benefit from exploring (1) fading (i.e., how long the priming effect lasts) and (2) whether the cognitive demand of the subsequent question interfere with the desired priming effect.

Attachment security: Developing a set of suitable honesty priming tasks would offer valuable research tools. For example, a secure and authentic person should be honest with both self and others. Having documented that authenticity is related to dispositional attachment security, and that experimentally augmenting a person's sense of security increases state authenticity, Gillath et al (2010) showed positive the effects of attachment security on honesty. Specifically, experimentally enhanced attachment security increased willingness to be authentic, reduced the inclination to lie, and resulted in less actual cheating in simulated situation.

Self-affirmation: Self-affirmation theory in social psychology concerns with how individuals adapt to information or experiences that are threatening to their self-concept (Steele, 1988). Experimental investigations offer robust evidence that after self-affirmation (i.e., individuals reflect on values that are

personally relevant to them) they are less likely to be defensive when confronted with information that contradicts or threatens their sense of self (McQueen & Klein, 2006). Applying self-affirmation theory to anti-doping, Barkoukis et al (2015) showed that self-affirmation manipulation on decision making about doping use led to significantly lower intentions to dope and temptation to engage in doping under risk-conducive situations. This result is in line with research evidencing that self-affirmation priming directly influences behavioral intentions when the intended behaviour is congruent with the presented messages. More importantly, health psychology research also offers robust evidence showing that self-affirmation has a positive influence on how people react to health or other personally relevant messages. Self-affirmation priming foster open-mindedness, cognitive flexibility and reduced self-serving, biased processing (e.g., less message derogation or message rejection), which in turn leads to increased message acceptance (e.g., Cohen et al, 2007; Epton et al, 2013; Harris & Epton, 2010; Pavey & Sparks, 2012; Sherman & Cohen, 2002).

Timing is important. Briñol et al (2007) showed that self-affirmation also impacts on message processing in cases when the message is not threatening to the self but it only increase the use of self-generated thoughts in response to a persuasive message when induced after message reception. Self-affirmation before the message can have the opposite effect because self-affirmation can decrease information processing when induced prior to receiving the message.

However, adding priming task considerably increases the length of the survey and time required for completion. In some cases, it is hard to integrate the priming task into the survey. Furthermore, priming involves a degree of deception, which – with proper ethical scrutiny – can be justified on genuine research needs but it is against the spirit of positive approach and working in partnership with athletes, coaches and other members of the athlete entourage. In surveys where the goal is to gather data to inform anti-doping education or evaluate the effectiveness of the anti-doping problems via changes in knowledge, capabilities, attitudes and perceptions, honesty priming has no place.

Conclusion and future directions

Explaining doping behavior

Finding a set of factors that precipitate doping behaviour has been the holy grail of doping behaviour research. Literally hundreds of studies have been conducted into the influence of a myriad of social cognitive and personality factors (Ntoumanis et al, 2014; Blank et al, 2016), curiously showing a little effect for most and significant effect for two: past experience with dietary supplements and close environment (i.e., knowing doping users). With the caveat that the reviewed studies mostly relied on self-reports, this outcome is telling. Results from the studies presented in this report supports these observations.

The use of nutritional supplements is related to doping and can be explained by the 'performance mindset'. Often interpreted within the 'gateway theory' (Backhouse et al, 2013) and presented as a slippery slope, suggesting that doping use is more likely if one uses nutritional supplements without making an attempt to understand why.

There are little data in the present set of studies to say much about why knowing people who use doping increases the likelihood of doping. One obvious explanation is that it may signal a culture where doping is accepted or even promoted. The other plausible explanation is more direct: knowing people who use doping means access to information and supply.

Based on the results from the studies included in this report, placed in literature context, it is hypothesized that:

(1) involvement in doping is incremental – which means early prevention and positive solutions that address the goal without doping is important (Petróczi & Aidman, 2008);

(2) functional and moral aspects of doping, and the dynamics between the two are important; and thus

(3) doping and related cognitions can only be properly understood in context (Petróczi et al, 2017).

Research framed around the gateway theory of doping consistently provides evidence for the increased risk or willingness to use prohibited performance enhancing substances if supplements are used for

performance enhancements (e.g., Backhouse et al, 2013; Mazanov, et al, 2008; Mazanov & Huybers, 2010; Papadoupolous, et al, 2006; Stewart et al, 2013). One possible explanation for this link is not an acquired 'taste for pills', quest for shortcuts, desire to win at all costs or gaining advantage but it is simply a learned behaviour. The incremental model of doping behaviour (IMDB) builds on the Life-cycle model (Petroczi & Aidman, 2008) as it posits that doping is a motivated, goal oriented, sustained, iterative behaviour, where involvement in assisted performance enhancement is gradual but not necessarily logical or linear (although for clarity, it is depicted as a linear progress in Figure 24). In this model, doping is primarily a functional rather than a moral choice. his view is not dissimilar to the professional sport development stages proposed by Brisonneau (2006) for explaining the different view of doping practices by athletes at different stages of their athletic career. However, the key difference is that the IMDB sees doping as learned behaviour, rather than as conformity to the accepted norms and practices at the different carrier stages. During sport involvement, athletes are accustomed of assisting their natural talent and training with a wide range of external means. This behaviour is not only accepted but actively encouraged and supported in competitive sport. From this perspective, the doping can be seen as the behavioural translation of the insightful observation made by Beamish and Ritchie (2005) explaining the doping phenomenon by a paradigm shift between systematic efforts to maximise athletic capacities by training and expanding human physical and mental capacities with doping via chemical, medical and genetic assistance. A plethora of literature testifies for the extent of research into training methods, psychology, diet, functional food and supplementation, all with the single aim of achieving increase in performance, either directly or indirectly by expediting recovery from training, physical strain or injury (Tokish, Kocher & Hawkins, 2004). Consequently, by the time athletes face rigorous anti-doping measures, they spent the better part of their sport carrier being accustomed to assisted performance enhancements and believing that additional means are necessary.

Accepting the notion that doping is a contextualised behaviour (Hauw & Billard, 2012; Hauw, 2013) and that it is resulting from two contradicting expectations, then doping is simply a specific way of performance enhancement that inherently involves breaking some generally agreed or imposed but voluntarily accepted rules, such as rules of the sport or a game. As such, doping only lasts as long as the need is present for performance enhancement during the active athletic career and triggered by athletic-related life events such as injury or other threats to an elite athlete status (Mazanov, Huybers & Connor, 2011; Smith et al., 2010; Overbye, Knudsen & Pfister, 2013).

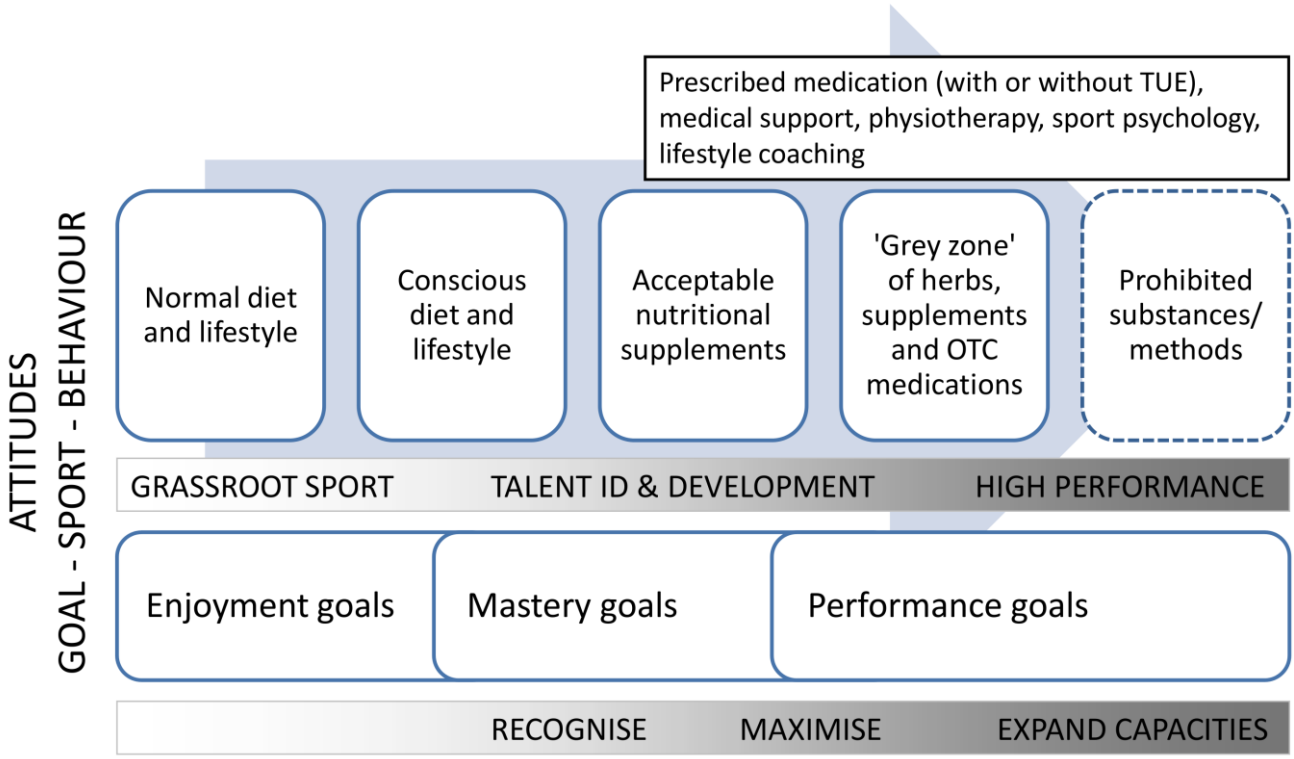


Figure 36. *The proposed incremental model of doping behaviour (IMDB) showing the hypothesised progressive involvement in assisted performance enhancement as sport-involvement and its related goals change.*

The life-cycle model of doping (Petroczi & Aidman, 2008) assumes that the use of performance enhancements grows out of habitual engagement in a range of acceptable performance enhancing practices. The key feature of the model is that doping is strategic (functional) and it recognises that sustained doping needs a positive feedback. Owing to large inter-individual differences, doping does not work for all equally; or for some, it may not even work at all. The ability to maximise the benefit from doping partly depends of the individual metabolic profiles thus there is no way of knowing the benefits until tried. The life cycle model also recognises that doping does not happen in a vacuum and theoretically considers the complexity of the circumstances in which a decision regarding doping is made.

The Incremental Model of Doping Behaviour (IMDB, Petroczi, 2013a) posits that the progress from one stage of performance enhancement to the next is driven by a range of vulnerability factors, controlled by internal and external inhibiting factors and continuously moderated by the social, economic, political and cultural environmental constituencies, such as the legal status and easy access to performance enhancing drugs, accessible medical and pharmacological advancements and the perceived pressure to

perform well. Career-influencing events such as injuries, moving up a level, or before retirement make athletes more vulnerable to doping (Mazanov et al., 2011; Smith et al., 2010; Overbye et al., 2013; Stewart et al., 2013), so does having experience with legal performance enhancing practices (Backhouse et al., 2011; Mazanov et al, 2008; Papadopoulos et al., 2006), and shared norms in the individuals' social group (Bilard et al, 2011; Lentillon-Kaestner & Carstairs, 2010; Pappa & Kennedy, 2013). In the context of the high reported use of supplements, herbs, minerals and over-the-counter medications by elite level athletes (e.g., Tscholl et al, 2010; Tscholl et al, 2008; Tsitsimpikou et al, 2009), it is reasonable to assume, as the IMDB suggests, that athletes are accustomed to use various means to directly or indirectly help their athletic performance throughout their athletic career.

Just as social representations, beliefs and social constructs combine with personal motivations and decision-making processes for influencing a young adult's motivation to initiate or continue illicit drug use (Zinberg, 1984), young athletes' behavioural choices are heavily influenced by the perception of what serious sport involves, including drastic measures for performance enhancement (Lentillon-Kaestner & Carstairs, 2010; Ohl et al, 2013; Bloodworth & McNamee, 2010). Gatti (2006) believes that drug use is profoundly linked to the way entertainment and social facilitation are perceived by youth in post-industrial societies. Doping is linked to the commodification of high performance sport (McNamee, 2011).

The research implication of the IMBD is the introduction of functionality to counterbalance the dominance of moral connotation. Doping is not good for various reasons, including breaking some voluntarily agreed rules, but it is prohibited because it works. Athletes in close contact with performance enhancing substances are likely to have ambivalent thoughts about doping, especially when it comes to the so called 'grey zone'. The latter encapsulates the use of medication up to the prohibited limit as well as misuse of the TUE system. Affective implicit associations are not capable of capturing such nuances and the inconsistency in mental representations.

Developing the IMDB further, it can be expanded to see what is clean sport to athletes; and how anti-doping education fits to specific stages and elements. This new model is depicted in Figure 36. The key aspect of the enhanced model is that it shifts the focus from doping (right hand side of the 'hard line') to the wide range on the left-hand side; to athletes (which – despite the concerning reports of doping prevalence – still constitute the majority yet overlooked segment of the athlete population) who do not dope. Including 'clean sport' and 'clean athletes' in anti-doping is crucial for multiple reasons:

(1) clean athlete population is not homogeneous - what constitute clean sport and what is morally acceptable (or unacceptable) are individually set ('soft line');

(2) this ‘soft line’ is fluid and likely to change over one’s career and across situations – therefore anti-doping education should incorporate and encourage decision making skills along with a prescriptive approach of telling athletes what they cannot do under WADA Anti-Doping Code;

(3) reasons for doing something are not the polar opposites of not doing it (Richetin et al, 2011; 2012) – because they rely on separate goals and driven by separate motivation systems, cognitions about not performing a behaviour are not simple opposites of cognitions about performing the same behaviour. Therefore both reasons for use of doping and staying away from doping have predicts doping behaviour in its own unique way; and

(4) anti-doping education must address wanting to stay clean, vulnerable for and tempted to use doping.

Considering organised competitive sport as a social institution, we can draw upon the general literature on institutions to understand the different sources of legitimacy of anti-doping and behavioural reasoning for compliance. Theorists have identified three distinct systems - regulative, normative and cognitive - as central elements of institutions (Scott, 1995). Notably these are not systems that independently exist but rather representing different layers of an organisation; or represent different perspectives. Economists and legal scholars see organisations as legislative systems, sociologists tend to see them as normative systems whereas psychologists focus on individuals and their mind-sets (Scott, 1981; 1995; Meyer & Scott, 1983). Each of these systems provides a unique basis for anti-doping legitimacy:

- The regulative system of anti-doping is comprised of policies, rules and regulations. The source of legitimacy for the anti-doping regulative system is the legality of the institution that set the rules and have the authority to impose sanctions for rule breaking; thus in this system it is assumed that athletes are compliant to avoid sanctions and they avoid prohibited substances because they have to.
- Normative systems are the collections of norms, customs, habits and local practices. Legitimacy of the normative anti-doping system is based on shared moral and ethical standards, and adherence to the spirit of sport rather than formalised rules or prohibition. Athletes are compliant with anti-doping because of the sense of duty and perceived responsibility as an athlete, and they are adherent to the clean sport norms because they feel they ought to be.
- Cognitive systems comprise of individual values, beliefs and assumptions. Athletes avoid doping because they want to, because being a ‘clean athlete’ is an integral part of their social identity

and driven by personal desire. The source of anti-doping legitimacy is in the cultural systems, the micro-environment that surrounds the athlete.

Both normative and cognitive systems draw attention to the importance of culture. If doping culture prevails (e.g., professional cycling in the 1990s – 2000s) then the shared mindset athletes adopt is one that encourages doping use. Figure 37 presents a conceptual map of the key constituents of the anti-doping system.

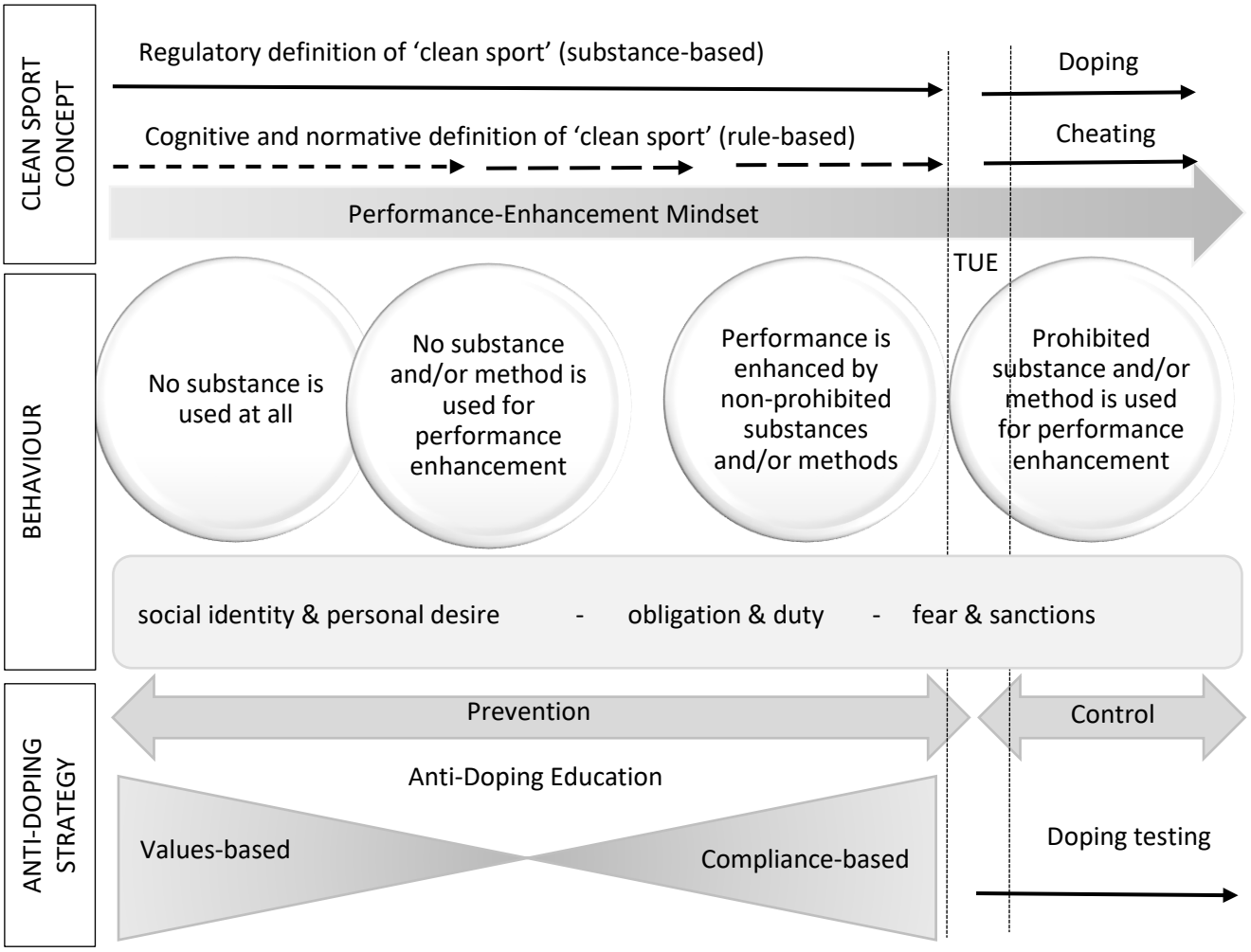


Figure 37*: Regulatory, normative and social cognitive context of clean sport and doping*

In contrast to static models – that focus on stepping across the regulative barrier – the enhanced model propose is a dynamic and situated explanation for doping.

- The model is situated because it allows positioning any specific doping-related behaviour such as supplement use, doping use or complete avoidance across cognitive (personal and social), normative (social) and regulative (institutional) zones.
- The model is also dynamic because it recognises that these positions are not stable and may shift over one's athletic lifecycle.

One key aspect of the model is that it draws attention to the fact that 'clean' is not a uniform concept and a rich variety of behaviour choices fits within its wide spectrum. This has important implications for anti-doping education.

Performance Mindset

The term 'performance-enhancement mindset' has been coined in relation to athletes' conceptualization of performance-enhancing drug use (Petróczi et al, 2011; Petróczi, 2013a; Petróczi et al, 2017). This refers to how athletes think about performance and what is the personal importance of performance, which in turn influences the way they approach performance-enhancement. The latter may or may not include the use of substances for performance-enhancing reasons. Equally, performance enhancement may or may not include substances and/or methods, which are prohibited in competitive sport.

Contemporary anti-doping should focus on supporting high performing athletes to cope with the demands of their sport career and stay clean in a highly competitive environment - instead of directly targeting the problem behaviour (doping use) and presuming that the majority of the athletes are 'at risk' for doping unless they are taught about the moral and health reasons against doping. For genuine integration into the 21st century sport and society, anti-doping must acknowledge the values attached to performance enhancement, help athletes to cope with pressures of performing in a highly competitive environment (and suspecting others' doping practices). Effective anti-doping efforts must be positive, proactive and pragmatic. They must take into consideration how a 'performance mindset' forms in parallel with the career transition to elite level. The focus of anti-doping should change from controlling the potential dopers to helping clean athletes to maximise their athletic potential in a clean sport environment.

Because this is a fluid landscape which not only varies across countries but also changes globally over time, there is a need for developing a better understanding of how those who are directly affected 'think'

about performance and performance enhancement. Emerging evidence from surveys and qualitative studies indicate that clean sport has multiple meanings and its definition varies from one individual to the next. If broad categories are to be used, one distinct category is where clean sport is defined based on the *substance* ('not using prohibited substances'); whereas the other is defined based on *rules* ('not breaking the rules' or 'not cheating').

How athletes think about doping and clean sport has profound implication on anti-doping education, thus this aspect calls for further investigation.

Mental Representation of Doping

Results from social projection of doping in contrast to other substance categories such as nutritional supplements and illegal drugs draw quantitative doping researchers' attention to athletes' mental representation of doping. The established domain specificity between doping and illegal drugs (as socially sensitive but unrelated substance category), coupled with the blurred lines between doping and nutritional supplements (as socially non-sensitive but related substance category) indicated that athletes' mental representation of doping may not align perfectly to the prevailing societal view seeing doping as cheating. The results from the affective response-time based implicit tests, somewhat disappointing at first on their own, provided further support to the proposition that athletes, first and foremost, think of doping in functional terms focusing on the performance enhancing properties, with the moral aspect and the fact that doping is prohibited thus cheating adding complexity to the picture.

Mental representations of doping can be conceptualised as a collection of doping related information that are stored with evaluative tags in memory (Petroczi, 2013a; 2013b). Both the selection of available information and the attached evaluative tags are based on personal experiences, hopes, fears, beliefs and environmental influence. Mental representations are assumed to reflect the interplay between athletes' motivations to engage in and the evaluations of doping behaviour. In reality, athletes in close contacts with performance-enhancing substances and accustomed to using a range of (acceptable) ergogenic aids are likely to have ambivalent thoughts about doping. Thus a simplistic moral (ethical/unethical) or affective (good/bad) frame alone, as evidenced in the studies comprising of this thesis, is unlikely to be able to capture the true essence of the relevant mental representation.

Furthermore, mental representations are thought to be dynamic, not inert or static. The life cycle model (Petroczi & Aidman, 2008) suggests, social cognitions athletes hold about doping are dynamic and change over time based on feedback and new experiences, but relatively stable at a given time (i.e., not

situational). If we accept two propositions simultaneously where one is that heuristical thinking is a property of the mind, the natural and unconscious way of thinking rather than a conscious choice, and the second one is that heuristics rely on the acutely most salient mental representations, then two possibilities arise: (1) self-reports and implicit assessments might elicit different but equally valid mental representations, and (2) both could be different from those activated when an actual decision is made about doping. Alternatively, there is a possibility that a hierarchy among mental representations exists, and this is unique to and characterises the individual. That is, there are mental representations, associative or relational, in the mind that are consistently more salient than others, regardless of the situational context. In this case, the researcher imposed frames could fit to this hierarchy and be recalled when performing the IAT tasks and act as heuristics in decisions. If the latter is true, then the question is if there is a 'typical frame' that is salient for doping users, those who contemplate doping and non-users and characterises how they subconsciously 'think' about doping; and if there is, whether it is the same that is most accessible and salient in actual decisions or not; and whether these mental representations manifest in explicit declarations as justifications for use or absence (e.g., health, risk, illegality, function). Finding answers to these questions could provide a valuable starting point for targeted prevention. Carefully constructed measures should be able to contrast the culturally prevailing frame (moral) against the most salient mental representations athletes, in favour for or refuting doping, most likely to have.

Some evidence suggests that, contrary to the ‘outside view’ by general population, athletes’ mental representations of doping overlap doping with supplements (probably rooted in shared ‘functions’), but not with illegal drugs, as both ‘being against the rules’. Contrasting nutritional supplements against doping only works from the legal/moral point of view; but not if functionality is the most salient tag in doping mental representation. Future studies should specifically explore the relational frames in implicit doping cognitions, because the anchors of these frames can be instrumental in early prevention.

To date, nutritional supplements have been viewed as acceptable alternatives to doping. However, assuming that the progressive doping model will gain empirical support in the future and the presence of relational frames is demonstrated and linked to currently acceptable performance enhancing practices (e.g., "*nutritional supplements helps my athletic performance but they are not as effective as doping*"), then successful preventive effort should target not only doping, but its precursors, including the supplement use culture.

Doping attitude

Attitude toward doping is in the center of doping behavior research, and anti-doping education.

Doping attitude as a measurable psychological construct is defined as the evaluative judgement of doping practice based on personal experience, filtered through individual values and disposition (Petróczi & Aidman, 2009). In the literature, reflecting on the way it is assessed, doping attitude is referred to as implicit attitude and explicit attitude. This inherently assumes that these are separate constructs which some – based on dual processing - would argue that is the case. Others posits that attitudes are neither explicit nor implicit, only expressed as such. Detailed discussion of this aspect is beyond the scope of this report[11]. From the research methodological point of view it is important to be clear about how attitudes (and other social cognitive concept) are assessed.

- In direct assessment mode, researchers ask participant to make the evaluation directly on a bi-directional scale. For example, athletes are asked to judge if doping is or using doping in the next three months would be good or bad; foolish or wise; risky or safe; fair or unfair; beneficial or detrimental. Several studies reported here included this form of attitude assessment.

- Indirect assessment uses a set of statements (which together often form a psychometric scale) to gauge one's attitude via agreement and disagreement with these statements. For example, athletes are asked to rate the level of their agreement/disagreement with the 17 items forming the Performance-Enhancement Attitude Scale. Being a psychometric scale is not a condition. The key aspect is that respondents are not required to make their evaluation of the attitude object but rather the degree of their positive or negative evaluation (attitude) is inferred from their agreement/disagreement of the attitude items. Studies included in this report used the full version and the short version of the Performance Enhancement Attitude Scale (Petróczi, 2002; Petróczi & Aidman, 2009); and pilot tested a new indirect measure that separates moral, functional and performance aspects.

- Implicit assessment utilizes stimulus compatibility or interference which – when set strategically - causes a difference in how fast respondents can perform a simple task. For example, athletes are

[11] See more in the following papers:
Petróczi, A. (2013). The doping mindset–Part II: Potentials and pitfalls in capturing athletes' doping attitudes with response-time methodology. Performance Enhancement & Health, 2(4), 164-181.
Baumgarten, F., Lucidi, F., Mallia, L., Zelli, A., & Brand, R. (2016). Bury the inner hatchet: Complex propositions mediate the relationship of potentially discrepant implicit and explicit attitudes on doping intention. Performance Enhancement & Health, 5(1), 10-16.

ask to sort doping-related words into categories but they are not asked no make any judgement about the attitude object. The tests presented in this report uses a computer and a specialized software that runs the test and measures response time in milliseconds however, it is not always the case. For example, Chan et al (2017) used paper & pencil version of the test.

Collectively, studies showed that direct assessment generally shows good internal consistency reliability, thus they are safe options in research projects. The PEAS remains a valid and reliable measure of general (moral) doing attitude. Its short version (PEAS-8) which contains only eight items of the original 17 also showed good internal consistency reliability and can be recommended for future research where length of the assessment is an issue and brief assessment is preferred (e.g., when using a battery of tests or in field settings).

Over the years, and in the studies presented here, the moral slant of PEAS has become apparent. For a more accurate (and holistic) assessment of doping attitude, there is a need to develop a more nuanced measure that separates the moral, functional and performance aspects of doping attitude.

Implicit associations

Results from implicit association studies to date made advances in understanding the implicit associations doping users and non-users hold about performance enhancements whilst contributing to the body of knowledge on malleability of and contextual influences on implicit associations. The overall results suggest that mental representations of doping is the function of the behavioural path athletes follow, and its measures are influenced by the cognitive and behavioural consistency. The less than convincing discriminatory and predictive power could be explained by cognitive (in)consistency and externally imposed moral heuristics. In establishing predictive validity, it must be recognised that implicit measures can never outperform explicit measures if the predicted behaviour (doping use) is indexed on explicit admittance.

Researchers are strongly encouraged to take up the challenge implicit assessment procedure and interpretation presents and experiment with various forms of implicit assessments involving athletes from various sports, competition levels and performance enhancing substance user groups. The focus should be placed on understanding what influences performance in the IATs and what IATs actually measure, instead of being fixated on the outcomes as measures of ‘true’ attitudes or predictors. In order to make progress, researchers should dispel the common misconception that implicit measures are panaceas for

avoiding social desirability or reflect athletes' true feelings; or can be used as lie detectors. Doping implicit measures are not necessarily implicit doping constructs that predict doping behaviour per se but rather, they reflect athletes' and the various non-athletic population groups' thoughts about doping behaviour. To facilitate accurate explicit and implicit assessments, doping attitude is best conceptualised as a collection of evaluations of the self-relevant thoughts about doping behaviour, stored in mental representations about doping and contextually retrieved. The potential influence of the pre-set framing effect, relational frames and salience asymmetries underscore the need of understanding the participants' mindsets before implementing implicit associations. To capture mental representations outside of the prevailing moralistic framework, it is recommended that the instrumental nature of doping is to be recognised and alternative frames are incorporated into doping research and anti-doping efforts. The importance of considering metacognitive processes of attitudes goes beyond the assessment level and has implications for anti-doping. The need for further research in implicit doping-related cognition is underscored by the fact that currently very little is known about how anti-doping messages are processed at the implicit level; and how its degree of subjective self-relevant nature affect effectiveness; whether it changes the dynamics of explicit-implicit attitudes and how potential ambivalence is resolved. The field needs more research at the measurement level before having confidence in using these implicit measurements in applied settings.

Implicit measures are very versatile assessment tools, but also highly sensitive to structural and contextual features. When a battery of explicit and implicit assessment is used in a single setting, implicit tests should precede any explicit measures in order to avoid inadvertent priming effect. Measurements that rely on implicitly evoked thoughts through priming are also part of the implicit social cognition family. Despite their potential, such measures have not yet been used in doping research thus is omitted from this chapter. Furthermore, it is recommended that the true nature of the implicit test is kept hidden from respondents, which is often achieved by presenting the implicit measure task as a 'lexical sorting task' or 'testing ability to focus under sustained cognitive demand'.

Interested researchers not yet familiar with the implicit assessment technique should seek guidance from the relevant literature on the importance of selecting category labels and stimuli, interpretation of what SRC-based tests actually measure along with cultural and contextual influences and on individuals' performance on implicit tests. Finally, researchers using implicit testing in doping research should be encouraged to share unexpected results. Accompanied with potential explanations based on available evidence, unexpected results could be instrumental in moving implicit doping cognition research forward.

Perceived prevalence

Projection about doping prevalence confirmed to the expected pattern. Athletes, without exception, made a lower (more conservative) estimate about their own sport, own team, own country than about others. Results suggest a clear pattern for ingroup conservative estimation and outgroup liberal bias. One can make a plausible argument that ingroup projections are more likely to be accurate because people are able to make a better 'guess' about people they are close to. This, however, does not explain the consistently higher estimation for the outgroups.

The key characteristic of social projection is the inherent egocentric bias. Because of this, the projected figures are not only potentially inaccurate as prevalence figures, but also reveal more about the person making the projection through his/her perception of others, rather than about the target population of about which the estimation is made. However, the final outcome of the repeated social projection exercise suggests that social projection does not necessary signal the existing behaviour but rather, it is a function of normative perception and the explicitly held view of the behaviour in general. In the light of the results presented here, the literature precedence of referring subjectively projected figures as actual prevalence estimations is highly questionable. Athletes tend to acknowledge the presence of doping in sport in general but maintain the view that it is always more of a problem in other teams, in other countries or in other sports, not their own but those who admit involvement give higher estimates compared to those who declare no involvement.

The interpretation of projections is highly dependent upon how the projection is obtained, namely whether it is specific knowledge or perceptions; or it is an estimate for 'most people' or for a specific group or a hypothetical 'third person'. Despite being underlined by different cognitive mechanisms, results from both the factual and specific information of the known others and the general perceptions of the unknown others (also referred to as social projection) are somewhat reflective of the respondent. Social projection is rooted in the self and manifests in thinking processes where people assume others to be similar to themselves (Robbins & Krueger, 2005). On one hand, this assumption allows people to make quick predictions about what others are like or how they likely to behave but it also automatically fills the gap if factual information is required but not readily available in memory. This latter aspect makes social projection an attractive - if somewhat elusive - candidate for being a proxy measure for doping behaviour. Knowing doping users is also indicative of the person's own involvement in doping by either being a user or knowing and surrounded by users. This feature is exploited in the indirect estimation methods based

on social networks (e.g., Network Scale-Up, Bernard et al, 2010). Nonetheless, these projected prevalence measures are only suggestive for involvement and flag a potential high risk status but under no circumstances they can be interpreted as actual involvement in doping. Using projected figures at face value as indirectly obtained prevalence rate is inappropriate.

Honesty goal priming

The task is to find as many honesty-related words as possible in a set time (e.g., 1 minute). The minimum (e.g., 4 or 5 honesty related words) can be set to allow progress. This setting forces participants to take the task seriously and make the necessary cognitive effort (and thinking intensively of 'honesty' while completing the task). Note on recommended use: because it involves a degree of manipulation, it is best used in experimental settings for testing or developing methods.

Social Network Analysis

Social network analysis (SNA) to investigate peer influence on explicit and implicit measures offers an interesting avenue to understand the immediate athlete environment and it is worth pursuing further. At the minimum level, SNA afforded discovering and describing the 'invisible' community structure within the team. However, the key sampling requirement for SNA limits the sample size to a defined network. Using larger sport teams (e.g., American football), or sport clubs where athletes train together could afford somewhat larger samples but these will still considered small for frequency-based inferential statistics. It is therefore recommended that researchers do not solely rely on statistical significance but report and consider effect sizes when investigate differences and relationships between measures within the group.

Careful consideration should be given to clustering method. Hard clustering yields clean group structures and boundaries (any one participant can only belong to one cluster/sub-group) which helps between-cluster comparisons. On the other hand, fuzzy clustering yields a more realistic and life-like situation, and identify individuals who belong to more than one cluster/sub-group. These individuals are bridges between groups and have an important role in transferring ideas, values, information, and influence from one group to another.

Significance to doping prevention

The results of this project are highly relevant and significant for WADA and their doping prevention efforts by improving methodology (self-reports) typically employed to measure change and demonstrate impact. The significance of this project lies in the premise that the results not only reinforce the long-lived lingering doubt over the validity of self-report data on socially sensitive topics but suggest that respondents may consistently manipulate their answers on all related measures in order to maintain the image they wish to project. Hence strategic responding can seriously undermine the validity of self-reports, with reliability (= consistency) remaining unaffected as respondents' answers appear to be consistent with the image they try to create.

The project looked beyond self-reports to offer a valuable insight into the fuller picture of the social desirability effect on self-reported information on behaviour as well as related social cognitive measures; and trialled a handful of alternative methods that could be successfully employed in the place of direct self-reports.

Policy recommendations for using implicit associations and projections

One of the fundamental challenges in anti-doping is identifying athletes who use, or are at risk of using, prohibited performance enhancing substances. The growing trend to employ a forensic approach to doping control aims to integrate information from social science doping research into organised intelligence to accelerate the pursuit of clean sport. Beyond the foreseeable consequences of a positive identification as a doping user, this task is further complicated by the discrepancy between what constitutes a doping offence in the World Anti-Doping Code (2015, 2021) and operationalized in doping research.

Whilst psychology plays an important role in anti-doping through intervention and prevention, its contribution to the array of doping diagnostic tools is limited. Policy recommendations put forward by Petroczi et al (2015a, 2015b) called for guidance on appropriate use of psychometric assessments in anti-doping. In these papers we argued that both self-reported and response-time based psychometric tests for doping have been designed, tested and validated to explore how athletes feel and think about doping in order to develop a better understanding of doping behaviour, not to establish evidence for doping.

Owing to the cognitive complexity surrounding test performance, the lie detector tests for detecting concealed life-events (e.g., doping use) based on response-time differences or physical responses are prone to produce false or non-interpretable outcomes in field settings. A false 'positive' psychological profile for doping (or even failing to produce a definite negative profile) affects not only the individual athlete but also their entourage, their organisation and sport itself.

The proposed policy guidance aims to (1) protect the global athletic community against social, ethical and legal consequences from potential misuse of psychological tests, including applications as forensic diagnostic tools in both practice and research; and (2) find a way that protects, helps and facilitates progress in anti-doping; and to bring academic expertise to practice.

Individual differences in implicit cognition exert a profound influence on social behaviour, including attitudes, stereotypes and self-concept. Their assessment poses one of the most intriguing challenges in psychological measurement. At this point in time, there is no valid psychometric test for identifying doping behaviour at the individual level. The psychometric properties of the existing measurements are not sufficiently robust for individual diagnostics; even when experts use them. These instruments are acceptable research tools - not more and not less. Anti-doping funding bodies are advised to tread with care and caution into the terrain of identifying dopers based on results of the existing psychometric tests.

Central to this argument is that whilst psychometric measurements are vital in both research and practice, it is acknowledged that they are based on arbitrary metrics. As such they are appropriate for testing and modifying existing psychological theories or generating new ideas but caution is warranted when "researchers wish to make inferences about the true, absolute standing of a group or individual on the latent psychological dimension being measured" (Blanton & Jaccard, 2006, p27).
Those who apply explicit and implicit measurements in field settings must also acknowledge their limitations. It is particularly important if any of these psychometric measurements are used as a proxy for doping behaviour.

Projected figures provide useful information for prevalence perception, but they cannot be combined, or even directly compared as true 'prevalence rates'. Whilst perceived prevalence does not reveal anything about the true prevalence of doping, it offers an insight into how athletes' perceive their close- as well as more distant personal environments. Labelled as self-fulfilling prophecy, Moston et al (2015) argue that perceived high prevalence of doping – albeit untrue at the time – may ultimately turn into a true prevalence because it serves as social norm to which athletes align their actions; and anti-doping education needs

to counteract this undesirable impact. Having transparent and accurate information on doping prevalence is key to this effort.

Athletes' mental representation of doping, along with a distinct functional- and moral aspects, calls for better conceptual clarity in anti-doping education. Values-based education aligns well with the moral aspects but it inevitably opens the scope of education to other kinds of rule-breaking in sport and perhaps better captured as educating for the integrity of sport (values of sport) where doping is one, but not the only form of rule breaking in sport. Information-based education is linked to the functional aspects of performance enhancing substances. Having most athletes engage in some form of performance-enhancement with not-prohibited substances, information based-education is better limited to giving clear guidelines of what is prohibited and look for ways to support athletes to stay on the 'clean' side of sport. In this, a marked shift is required. Research as well as anti-doping should focus on athletes who prefer train and compete clean and support them doing so as oppose to assume that all athletes would dope unless stopped. It is not right to assume that everyone involved in competitive sport is tempted by doping and is deterred only by the threat of sanctions; or health and moral reasoning as part of the anti-doping education.

Research supporting anti-doping should focus why athletes become involved in doping and, more importantly, why they do not. These reasons – more so than attitudes - are vital for devising relevant, meaningful and effective anti-doping education programmes (Petróczi et al, 2017). Notably: reasons for doping, or not doping, are not polar opposites. We cannot simply take a set of reasons for doping and flip them to have a set of protective factors against doping. Equally, we cannot take the opposites of the reasons for not doping to explain why an athlete might decide to engage in prohibited practices. Both are equally important, so is understanding the difference.[12]

Athletes who chose to be clean are the majority. No studies reported here, or in the literature, shows positive attitude toward or preference for doping – only more or less negative attitudes. Therefore, clean athletes should not be taken for granted or overlooked: their support (and supporting them) are critical for the future of anti-doping (Englar-Carlson et al, 2016; Petróczi et al, 2017).

[12] See the book chapter in for an in-depth argument: Petróczi, A., Norman, P., & Brueckner, S. (2017). Can we better integrate the role of anti-doping in sports and society?. A contemporary values-based psychological approach to prevention. In: O Rabin & Y Pitsiladis (Eds.) Medicine and Sport Science, Vol. 61. Acute Topics in Anti-Doping. Chapter 4.2. (pp.160-176) Karger.

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Appendices

Appendix A: Ethical Approval

Kingston University London

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Professor Andrea Petroczi
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8 October 2010

Dear Professor Petroczi

I am writing to confirm that the following Research Project was recently considered by the Kingston University Science Faculty Research Ethics Committee and has now been approved in full:

Investigating the utility of implicit associations and combined methods in obtaining reliable information on and predicting doping behaviour – PETROCZI, Andrea

Science Faculty Ethics Committee Membership:

Dr J Bradbury
Prof C Cairns (Chair)
Dr A Hughes
Dr A Mann
Prof A Petroczi
Dr L Renshaw

Yours sincerely

Professor Chris Cairns
Chair

Kingston University London

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Professor Andrea Petroczi
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13 January 2011

Dear Professor Petroczi

I am writing to confirm that the following Research Project was recently considered by the Kingston University Science Faculty Research Ethics Committee and has now been approved in full:

"Explicit and implicit measures of social projection" - PETROCZI, Andrea

Science Faculty Ethics Committee Membership:

Dr J Bradbury
Prof C Cairns (Chair)
Dr A Hughes
Dr A Mann
Prof A Petroczi
Dr L Renshaw

Yours sincerely

Professor Chris Cairns
Chair

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Dr Andrea Petroczi
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13th May 2009

Dear Dr Petroczi

I am writing to confirm that the following Research Project was considered by the Kingston University Science Faculty Research Ethics Committee on 13th May 2009 and has now been approved:

Do incentives moderate the overestimation of questionable behaviour owing to the False Consensus Effect? The case of performance enhancing and psychoactive drug use - PETROCZI, Andrea

Science Faculty Ethics Committee Membership

Dr P Barra
Prof C Cairns (Chair)
Dr A Hughes
Dr A Mann
Dr A Petroczi
Dr L Renshaw

Yours sincerely

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29 October 2013

Professor A Petroczi
Faculty of Science, Engineering and Computing
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Dear Professor Petroczi

I am writing to confirm that the following research project was considered by the Faculty Research Ethics Committee at its meeting on 10 January 2013, and has been approved:

Exploring athletes' and students' inner thoughts about performance-enhancing drugs: functional use or cheating

Faculty Research Ethics Committee membership

Professor C Cairns (Chairman)
Dr P Barra
Dr M Colbert
Dr J Denholm-Price
Dr H Hadavinia
Dr A Hughes
Dr A Mann
Professor H Modjtahedi
Professor A Petroczi
Professor P Remagnino
Dr L Renshaw
Dr D Wertheim

Yours sincerely

Professor Chris Cairns
Committee Chairman

FACULTY OF SCIENCE, ENGINEERING & COMPUTING
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Appendix B: Construct matrix for implicit assessments

CLASSIC BRIEF IAT

SINGLE-CATEGORY VARIATION OF THE BRIEF IAT (all other tests)

Non-focal category is always instructed as “everything else”.

TESTS

Stimuli of the Brief Implicit doping attitude (CLASSIC IAT)

Category labels	Words (stimuli)
Good	beautiful, joy, love, smile
Bad	agony, terrible, poison, hate
Doping	steroid, drug, stimulant, hormone
Altitude training	oxygen, mountain, acclimatisation, elevation

IAT effect = [Good+ Doping] - [Bad+ Doping]. Altitude training is non-focal.

Stimuli of the Brief Implicit doping attitude (AFFECTIVE ATTITUDE)

Category labels	Words (stimuli)
Pleasant	beautiful, happy, fun, friendly
Unpleasant	sad, ugly, hostile, nasty
Doping	steroid, drug, stimulant, hormone
Altitude training	oxygen, mountain, acclimatisation, elevation

IAT effect = [Pleasant+Doping] - [Unpleasant+Doping]. Altitude training is non-focal.

Stimuli of the Brief Implicit risk / doping test (COGNITIVE ATTITUDE)

Category labels	Words (stimuli)
Dangerous	hazardous, risky, toxic, harmful
Safe	harmless, risk-free, nontoxic, secure
Doping	steroid, drug, stimulant, hormone
Altitude training	oxygen, mountain, acclimatisation, elevation

IAT effect = [Secure+ Doping] - [Risky+ Doping] - Altitude training is non-focal.

Stimuli of the Brief Implicit foolish/wise - doping test (COGNITIVE ATTITUDE)

Category labels	Words (stimuli)
Foolish	stupid, dumb, idiotic, unwise
Wise	sensible, clever, smart, intelligent
Doping	steroid, drug, stimulant, hormone
Altitude training	oxygen, mountain, acclimatisation, elevation

IAT effect = [Wise+ Doping] - [Foolish+ Doping]. Altitude training is non-focal.

Stimuli of the Brief Implicit cheat /clean doping test (IMPLICIT MORAL NORM)

Category labels	Words (stimuli)
Cheating	deceptive, misleading, dishonest, unfair
Clean	honest, open, respectable, fair
Doping	steroid, drug, stimulant, hormone
Altitude training	oxygen, mountain, acclimatisation, elevation

IAT effect = [Fair + Doping] - [Cheating + Doping]. 'Altitude training' is non-focal.

Stimuli of the Brief Implicit doping prevalence test (DESCRIPTIVE NORM)

Category labels	Words (stimuli)
Widespread	common, usual, everyone, prevalent
Rare	uncommon, unusual, nobody, scarce

Doping	steroid, drug, stimulant, hormone
Altitude training	oxygen, mountain, acclimatisation, elevation

IAT effect = [Doping+Widespread] - [Doping+Rare]. Altitude training is non-focal

Stimuli of the Brief Implicit doping / Self test (IDENTIFICATION)

Category labels	Words (stimuli)
Me	I, myself, mine, my
Not me	they, their, them, others
Doping	steroid, drug, stimulant, hormone
Altitude training	oxygen, mountain, acclimatisation, elevation

IAT effect = [Doping+Me] - [Doping+Not me]. Altitude training is non-focal.

Stimuli of the Brief Implicit risk test (IDENTIFICATION)

Category labels	Words (stimuli)
Me	I, myself, mine, my
Not me	they, their, them, others
Risky activity	rock climbing, parachuting, bungee, cross-motor
Safe activity	gardening, fishing, walking, videogaming

IAT effect = [Safe activity+Me]+ [Risky activity+Me]; 'Not me' is non focal.

Stimuli of the Brief Implicit cheat test (IDENTIFICATION)

Category labels	Words (stimuli)
Me	I, myself, mine, my
Not me	they, their, them, others
Cheat	deception, mislead, dishonesty, fraud
Honest	fair, thruth, openness, honour

IAT effect = [Cheat+Me] - [Honest+Me]. 'Not me' is non focal.

Stimuli of the Brief Implicit doping/NS test (UTILITY)

Category labels	Words (stimuli)
Advantageous	useful, beneficial, worthy, rewarding

Disadvantageous	useless, worthless, unrewarding, harmful
Doping	steroid, drug, stimulant, hormone
Supplements	vitamin, ginseng, mineral, calcium

IAT effect = [Advantageous+Doping] - [Disadvantageous+Doping]. 'Supplements' is non-focal.

Stimuli of the Brief Implicit SD test (IMPRESSION MANAGEMENT)

Category labels	**Words (stimuli)**
Me	I, myself, mine, my
Not me	they, their, them, others
Desirable behaviour	honesty, helpfulness, care, giving
Undesirable behaviour	cheating, lying, stealing, ignorance

IAT effect = [Desirable behaviour+AAS] - [Undesirable behaviour+AAS]. 'Not me' is non-focal.

Appendix C: Suggested measures for anti-doping research and programme evaluation

General Doping Attitude

Short form of PEAS (Petroczi, 2002; Petroczi & Aidman, 2009). It measures favourable / unfavourable opinion of doping (as a phenomenon, not as a behaviour choice). With words in square brackets, revised items can be created (in which case, scoring must be reversed).

ITEMS *Rate your agreement with each statement below:*	Strongly disagree	Disagree	Somewhat	Somewhat agree	Agree	Strongly agree
Doping is not cheating, since everyone does it.	①	②	③	④	⑤	⑥
Doping is an unavoidable part of the competitive sport.	①	②	③	④	⑤	⑥
The risks related to doping are exaggerated.	①	②	③	④	⑤	⑥
Legalising performance enhancements would [not] be beneficial for sports.	①	②	③	④	⑤	⑥
Athletes should [not] feel guilty about breaking the rules and taking performance-enhancing drugs.	①	②	③	④	⑤	⑥
Only the quality of performance should matter, not the way athletes achieved it.	①	②	③	④	⑤	⑥
There is no difference between drugs, fibreglass poles, and speedy swimsuits that are all used to enhance performance.	①	②	③	④	⑤	⑥
Doping is [not] necessary to be competitive.	①	②	③	④	⑤	⑥

Perceived Prevalence

If 0% represents nobody and 100% represents everybody, what percentage of athletes in your team / your sport / your country do you think are using prohibited performance enhancing methods?

Honesty Priming Task

Wordsearch puzzle is recommended over synonym task. Word search puzzle for honesty priming should use honesty related words. The puzzle can be generated online.

The example below is a 14 x 14 letter square with 10 honesty-prime and 4 other neutral words. It was generated using an online wordsearch puzzle-maker (free): https://thewordsearch.com (Note: there are several equally suitable online puzzle makers).

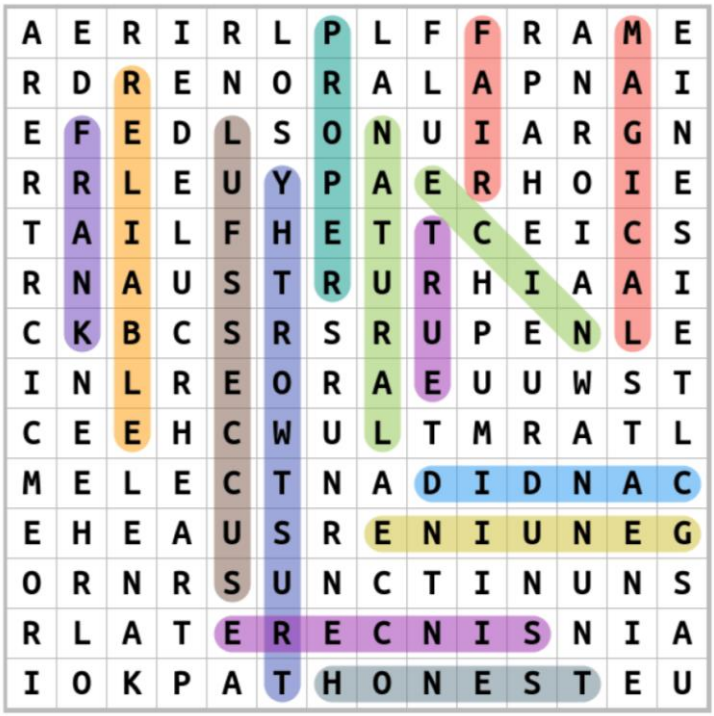
honesty

A	E	R	I	R	L	P	L	F	F	R	A	M	E
R	D	R	E	N	O	R	A	L	A	P	N	A	I
E	F	E	D	L	S	O	N	U	I	A	R	G	N
R	R	L	E	U	Y	P	A	E	R	H	O	I	E
T	A	I	L	F	H	E	T	T	C	E	I	C	S
R	N	A	U	S	T	R	U	R	H	I	A	A	I
C	K	B	C	S	R	S	R	U	P	E	N	L	E
I	N	L	R	E	O	R	A	E	U	U	W	S	T
C	E	E	H	C	W	U	L	T	M	R	A	T	L
M	E	L	E	C	T	N	A	D	I	D	N	A	C
E	H	E	A	U	S	R	E	N	I	U	N	E	G
O	R	N	R	S	U	N	C	T	I	N	U	N	S
R	L	A	T	E	R	E	C	N	I	S	N	I	A
I	O	K	P	A	T	H	O	N	E	S	T	E	U

NATURAL
TRUE
MAGICAL
FRANK
CANDID
TRUSTWORTHY
PROPER
GENUINE
RELIABLE
SUCCESSFUL
HONEST
NICE
SINCERE
FAIR

Play this puzzle online at : https://thewordsearch.com/puzzle/2266543/

Solution:



Social desirability

Single question measure to assess social desirability. The degree by which socially desirable responding affects other social cognitive measures (attitude, willingness, anticipated regret, legitimacy perception, etc.) can be assessed by the strength of correlation between the SD scores and the scores on the measure of interest.

To what degree the following statement is true for you?	**Not true at all** ⟷ **Very true**
I am willing to do things just to avoid looking bad.	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩