

## Enhancing Grit through Functional Imagery Training in Professional Soccer

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## ABSTRACT

Functional Imagery Training (FIT) extends multisensory imagery training by involving athletes with goal setting and appraisal. We measured the effect of FIT on 24 professional soccer players' grit, a personality trait associated with perseverance for a long-term goal. In a stepped-wedge design an immediate (n=9) and delayed (n=10) group received FIT at week 1 or week 6, and were measured at week 12. A self-selected control group (n=5) received no intervention. The delayed group were also measured at week 6 just before their intervention, and week 18. Grit scores in both intervention groups increased following the intervention, but the control group did not. The delayed group increased in grit between weeks 6 and 12, showing the effectiveness of the intervention over a relatively short timeframe, and continued to improve to week 18. In intervention groups, vividness of goal imagery also increased, and players perceived that FIT improved sports performance.

(Words: 149)

Key words: grit, functional imagery training, behaviour change, professional soccer, motivational interviewing.

## INTRODUCTION

Association football, or soccer, is perhaps the most popular international sport (Houston & Wilson, 2002) with an estimated 250 million soccer players worldwide (Giulianotti, Rollin, Weil, Joy, & Alegi, 2017). In the 2016-17 season, 160 teams competed in the English National Leagues across Level 1 (the Premier League) to 6 (National League North/South), with each team aiming to win their division and the prize of promotion or the championship itself. To do so, every team member needed to perform at a sustained level for forty to fifty matches over the season. Sporting excellence is always the aim of any sports team, and success is the consequence of sustained hard work. Duckworth, Peterson, Matthews, and Kelly (2007), attribute success to a personality trait named *grit*, defined as a perseverance and passion for a long-term goal. A gritty goal-focused individual is tenacious when presented with challenges and exudes effort to deter setbacks, disappointments, hardship and plateaus (Duckworth et al., 2007). Importantly, gritty individuals are ruthlessly goal-focused, and whilst others may quit or change the direction of their outcome, gritty individuals do not. In this paper, we report an intervention conducted with an English professional soccer team, to improve each of its team member's grit through imagery based motivational training.

The concept of grit has been applied widely, from United States Military Academy drop-out rates (Duckworth & Quinn, 2009) to marriage (Eskreis-Winkler, Shulman, Beal, & Duckworth, 2014). In the realms of performance, Duckworth and Quinn (2007) found that expert spellers at the National Spelling Bee competition had a higher level of grit, and this was positively correlated with performance. In soccer, Larkin, O'Connor, and Williams (2016), examined Australian elite youth male soccer players' grit scores and their correlation with several factors of performance, finding that the level of grit positively correlates with

time spent in sport specific activities. In addition, Larkin et al., (2016) found that grittier players outperformed less gritty players on decision-making and situational probability tasks.

In the workplace, Ion, Munroe-Chandler and Loughhead (2017), assessed 170 Romanian adults to demonstrate the validity of grit against the Five-Factor Model (FFM) (Costa & McCrae, 1992) to predict work related outcomes. The findings indicate that grit has little predictive power of workplace outcomes beyond the FFM personality traits, indicating that grit could have succumbed to the “jangle fallacy” (Kelley, 1927) – whereby two concepts are different by name alone. Notably, Ion et al., (2017) list limitations impacting the results, such as the correlational nature of the study, a poor fit of some data, and self-report measures. It could also be argued that passion to succeed in the workplace is not intrinsic with all workers, therefore adding to the limitations.

A meta-analytic amalgamation of the grit literature representing 66,806 individuals has been conducted by Credé, Tynan, and Harms (2017). Their results revealed that grit has a very strong correlation with the FFM conscientiousness facet, and is only moderately correlated with performance. On one hand, conclusions from Credé et al’s., (2017) analysis leaves readers with the knowledge that grit has no link with performance and success, and on the other hand, there is a gap in the research that explores interventions to best develop character traits.

In professional sport, the application of grit is unknown, and the way to increase grit, especially as it can be perceived as a hereditary personality factor (Turkheimer, Pettersson, & Horn, 2014) needs further examination. Rimfeld, Kovas, Dale, and Plomin, (2016) conducted research using twins to assess hereditary personality traits such as conscientiousness and grit, and the link with academic success. Although their research did reveal a genetic link to grit, they concluded that this did not mean that grit could not be environmentally influenced, and there is a need for a novel intervention (Rimfeld et al., 2016) to modify traits.

Personality traits comparable to grit such as mental toughness (e.g., Mahoney, Gucciardi, Ntoumanis, & Mallet, 2014) and resilience can be the consequence of adequate mental skills training and positivity. Duckworth and colleagues (2007) clarify that grit is “not just resilience in the face of failure” (p. 1087), but due to long term goals, and where mental toughness can be linked to extrinsic motivation, grit is focused on intrinsic passion (Reed, 2014). Recognizably, in the lexical semantics of all comparable personality traits with grit, is the ability for an individual to bounce back from failure and adversity. Fletcher and Sarkar, (2012) interviewed twelve Olympic champions, examining the relationship between sports performance and resilience, and found that elite athletes could cope with negative stressors by considering a setback as a positive event. This applied particularly at the peak of their sporting careers. Goal focused tasks based on individual specific feedback to correct failure is thought to feed into optimal sporting performance. Helmreich, Kunzler, Chmitorz, König, Binder, and colleagues (2017) reviewed interventions to train resilience, such as cognitive-behavioural therapy, mindful-based therapy, and problem-solving therapy. They argued that resilience interventions based on cognitive-behavioural therapy could succeed by challenging maladaptive thoughts and teaching coping strategies.

Mattie and Munroe-Chandler (2012) assessed 151 varsity athletes using the Mental Toughness 48 Inventory (MT48) and the Sport Imagery Questionnaire (SIQ). Specifically, within the five subscales of the SIQ, motivational general-mastery emerged positively correlated to the MT48, revealing that motivational imagery is an effective strategy to increase mental toughness. In disability sport, researchers (Guerin, Munroe-Chandler, & Loughhead, 2014) found identical results, increasing the need for motivational imagery to be used in sport. Vealey and Greenleaf (2001) define imagery as “using all the senses to re-create or create an experience in the mind” (p. 248), and motivational imagery focuses on a goal orientated approach. Combining the need to develop a novel intervention through goal-

centered motivation, this study tests the potential for Functional Imagery Training (FIT) (Andrade, Khalil, Dickson, May, & Kavanagh, 2016) as a way to develop character, precisely; grit.

Andrade et al., (2016) developed FIT as a client-centered approach “that creates a context where people are encouraged to consider the utility and possibility of functional behaviour change” (p. 259). FIT pairs the spirit of Motivational Interviewing (MI) (Miller & Rollnick, 2012) with a focus upon enhancing the concreteness and vividness of an individual’s goal-related mental imagery. The effectiveness of MI has been well documented (e.g., Parsons, Rosof, Punzalan, & Di Maria, 2005; Rollnick, Miller, & Butler, 2007) and reviewed (e.g., Burke, Arkowitz, & Menchola, 2003; Martins & McNeil, 2009) considering various domains of behaviour change such as substance abuse (Burke, Dunn, & Atkins, 2004) and diet management (VanWormer & Boucher, 2004). The FIT approach, grounded through MI principles, promotes a way of attaining mastery-involving feedback (Moles, Auerbach & Petrie, 2017), going one step further than the typical methodology. Sometimes, generic motivational statements are read to the participant to promote repeatability (see Mueller & Dweck, 1998), whereas the FIT approach uses (for example) reflective statements to generate client led intrinsic motivation based around their individual goal. Additionally, critical evaluation and goal appraisal is a consequence of the individuals’ behaviour change process. Moles and colleagues (2017) state that the type of feedback is vital to enhance low grit scores, and this study agrees with their finding.

FIT has been used in weight loss (Andrade, Khalil, Dickson, May, & Kavanagh, 2016; Solbrig, Jones, Kavanagh, May, Parkin, & Andrade, 2017) and when treating alcohol cravings (Kavanagh, May, & Andrade, 2009), demonstrating significant behaviour change to manage intrusive thoughts. In FIT, clients are guided through a series of mental imagery exercises and trained to practice imagery at home. Whilst FIT scripts have been developed

for scientific rigor (see Andrade, et al., 2016), there is also a requirement for flexibility when following an MI approach as individual goals differ. FIT allows an individual to choose their goal and become reflective of their achievement – two elements that Duckworth (2013) states are vital for the development of grit. The FIT approach acknowledges the requirement for task mastery feedback to create an appropriate motivational climate essential for grit development (Moles, Auerbach, & Petrie, 2017), and supports the individuals' strategy for change.

Learning environments have received significant attention through achievement goal theory (Ames & Archer, 1987; Dweck & Leggett, 1988; Weiner, 1985), examining the reasons for thinking and feeling that lead to action. Weiner (1972; 1985) suggested that attributions are linked to the individuals' locus of control, stability, and skill controllability. Therefore, the perception of how learning occurs, through hard work and not fixed innate talent, will promote motivation and subsequently, effort. Ames (1992) identified that by having the right motivational goal climate, self-improvement, mastery, effort, and learning will all be enhanced. To harness the best motivational climate for personal development, Miller and Rollnick (2012) recommend that goals are set by the client and supported by the practitioner. In sports performance, both MI and FIT have not been used in any capacity, but there is a strong link between motivational and cognitive strategies in sport using imagery to change behaviour (Pavio, 1985).

This study investigates the practical use of FIT in sport to enhance grit, and compares the effect over different durations following the intervention. Changes in grit would support the notion that personality traits, especially those similar to grit, are modifiable through cognitive motivational strategies, and can be enhanced through the strategic use of goal-related mental imagery. Beyond this, the practical applications of FIT use in sport for behavior change and personality development is innovative in sport psychology, as all

interventions are traditionally practitioner lead, using a preselected goal (Holmes & Collins, 2001; Smith, Wright, Allsopp, & Westhead, 2007). Uniquely, the FIT approach allows for the athlete to select their goal, trains the athlete how to use imagery at periodic times to promote autonomy, and supports motivational growth through mutual collaboration.

## METHOD

### *Participants*

Twenty-four male participants aged 21-33 ( $M=25.8$ ) were recruited as an opportunity sample from a professional soccer team who, at the time of the study, were in the English Sky Bet League Two. All participants were first team players, with two French participants and twenty-two from the United Kingdom. All participants agreed to participate in the study and complete the grit measures, but five participants declined the opportunity to take part in the FIT intervention. This self-selected non-intervention group became a *de facto* control group ( $n = 5$ ). The other participants were randomly allocated to either an immediate FIT group ( $n = 9$ ) or a delayed FIT group ( $n=10$ ).

### *Materials*

The twelve item Grit-O scale (Duckworth, Peterson, Matthews, & Kelly, 2007) was used as the dependent variable to monitor the impact of the intervention. The internal consistency of the Grit-O scale (see Duckworth et al., 2007) links total scores to time spent in education, through questions on two lower-order facets; consistency of interests (passion) and perseverance of effort. Furthermore, Duckworth et al., (2007) found that neither facet was more predictive than the other, but together formed a higher-construct (grit), which is a consistent predictor of outcome. Although the shorter Grit-S scale (Duckworth & Quinn, 2009) has shown consistent reliability for the measurement of grit, we decided that the retention of Grit-O questions such as “I have achieved a goal that took years of hard work”



and “I have overcome setbacks to conquer an important challenge” are important factors for athletes to rate as they may reveal additional insight into sporting grit.

A semi-structured interview was adapted from Andrade et al., (2016) to suit a sporting context. Participants were specifically asked to recognize an area of their performance they were struggling with, and to imagine as vividly as they could past occasions where they had succeeded, and what it would feel like to succeed in the future. For this process imagery was used to examine memories/projections and explore performance congruence. For task mastery congruence discussion, strategy performance was explored, along with arousal and anxiety control, and cognitive modification (aligned with Martin, Moritz, & Hall, 1999).

### *Procedure*

Ethical approval was granted by the relevant institutional ethical committee. All participants gave written informed consent and were interviewed by the first author, who is a trained MI practitioner. All participants completed the Grit-O scale in a group session, and those in intervention groups were then seen individually for a semi-structured FIT interview based on the spirit of MI. A stepped-wedge design (Hussey & Hughes, 2007) was used, whereby the same intervention is cascaded in different groups over time. In this case, the immediate intervention group received an hour-long FIT session in the week following the initial grit assessment. The delayed intervention group received no intervention for six weeks and then received an hour-long FIT session, following a second grit assessment point. All participants in the intervention groups received a 15 minute booster session six weeks after their FIT session in which they were reminded to complete the imagery tasks, received feedback, and any questions were answered. The control group also had a 15 minute booster session at six weeks, in which their goals and motivation to achieve them were discussed in the spirit of a motivational interview. A stepped-wedge design was employed due to the lengthy initial interviews and the availability of professional athletes, plus the hosting

organizations requirement for all participants to receive the FIT intervention if they so desired. When constraints exist in the intervention delivery and the whole sample cannot start immediately, the stepped-wedge design is a valid solution to ensure suitable phasing of implementation (Craig, Dieppe, Macintyre, Michie, Nazareth, & Petticrew, 2008).

Twelve weeks after the initial session (six weeks into the delayed group's intervention) all participants completed the grit assessment once again. Only at this point were the scales scored, to avoid researcher bias during intervention delivery. In addition, intervention participants were asked to subjectively rate the effectiveness of FIT on their sporting performance from 1 (has not helped my performance) to 10 (has completely helped my performance). Finally, the delayed group completed an additional grit assessment at week 18, twelve weeks after their FIT session.

#### *The FIT intervention*

Once the participant consented to take part in the study, the four processes of MI were followed; engaging in conversation, focusing on an area of improvement, evoking talk about change, and then onto planning for development (based on Miller & Rollnick, 2012). In the focusing stage, the experimenter asked what the participant 'struggles' with, in relation to their sporting performance. They were asked to focus on what a 'gritty and resilient' athlete would do to overcome setbacks, and if they could see themselves able to make those changes to enhance their performance. Throughout the process, feedback focused on intrinsic task mastery (Dweck & Leggett, 1988) and goal orientation. If the participant demonstrated an increase in change talk, their level of congruence would be examined. In the evoking stage, participants demonstrated a need to change/adapt behaviour to become more gritty and resilient. Participants were asked if they had ever used imagery to cope with difficult or upcoming performances. Participants often stated that they do use imagery in some capacity,

however this was not structured or part of a routine. Participants were then asked if they would like to learn how to become an effective user of functional imagery.

To familiarize participants with the mental imagery instructions we first asked them to complete an exercise, developed in the clinical psychology literature, which focusses on using sensory modalities such as touch, taste, smell and vision to imagine cutting up a lemon (Holmes & Mathews, 2005). After the exercise, participants were asked to rate their experience of the imagined episode on a scale from 1 (no image) to 10 (extremely vivid). Participants were then asked to recall a situation where they had shown high resilience. This successful memory was used as a benchmark and was elaborated on to draw out the feeling of success related to optimal performance. Participants then focused on a specific goal to increase their sporting grit. This goal was then related to an everyday activity or frequent behaviour, such as putting on boots, pulling up socks or walking onto the pitch, and a motivational cue added. The researcher then asked the individual to imagine doing that behaviour and imagining successfully achieving the goal, again using each sensory modality. Taking photos or videos (usually on phones) was encouraged (see Solbrig, et al., 2017), such as a photo of the changing room and/or pitch, to be used to look at and imagine the motivational cue and further independently complete the imagery task. Participants were then asked to rate their confidence in their ability to complete the imagery task when performing the motivational cue (from 1: I can't do it, to 10: positive I can do it). If ratings were less than 7, participants were given extra imagery training and support. At the end of the study, vividness of the goal imagery was measured again on the same 1-10 scale.

## RESULTS

During the initial session, participants indicated that there were areas of their performance they “struggled with”, specifically; “overthinking” (n = 9, 38%), “mental fatigue” (n = 6, 25%), “challenging for every ball” (n = 5, 21%), “thinking about being

subbed” ( $n = 2, 8\%$ ), and “worrying about injury” ( $n = 2, 8\%$ ). There were no initial differences in mean grit scores between the control ( $M=3.76, SD=.62$ ), delayed ( $M=3.74, SD=.72$ ), and immediate intervention ( $M=3.91, SD=.39$ ) group scores ( $F<1$ ). The delayed intervention group did not change in grit between the initial session and week 6 ( $M=3.72, SD=0.57$ ), when they received FIT  $t(9)=.218, p=.832$ , Cohen’s  $d=.03$ .

At the FIT session, the two intervention groups’ mean confidence to use goal imagery did not differ (immediate:  $M=8.4, SD=1.59$ ; delayed  $M=7.7, SD=1.25, t(17)=1.14, p=.270$ ), Cohen’s  $d=.44$ . An ANOVA on the goal imagery vividness ratings collected at the FIT session and the final session (in week 12 or week 18) showed a main effect of time ( $F(1,17)=17.8, p=0.001, \eta_p^2 = .512$ ), but no effect of intervention, nor an interaction (both  $F<1$ ). Vividness increased over this period from a mean of 7.9 ( $SD=1.4$ ) to 9.3 ( $SD=0.7$ ), Cohen’s  $d=1.00$ , showing the benefit of continued practice in imagining the goal.

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Insert Figure 1 around here

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Pre-intervention and final grit scores of the control and combined intervention groups were compared within a 2 (time) x 2 (intervention) ANOVA. The interaction of time by intervention showed that grit scores increased more in the twelve weeks following FIT delivery for the intervention groups than for the control group  $F(1,22)=5.62, p=.027, \eta_p^2 =.204$  (Figure 1). There was also a main effect of time  $F(1,22)=16.1, p=.001, \eta_p^2 =.42$ , but no main effect of intervention  $F(1,22)=3.21, p=.087, \eta_p^2=.127$ . The grit measure comprises two subscales, perseverance of effort and passion, which correlated positively at each measurement point ( $.70 < r < .92$ ), and overall  $r(68) = .85, p < .001$ . While perseverance of effort also showed the interaction of time by intervention  $F(1,22)=4.49, p=.046, \eta_p^2 =.17$ ,

passion did not  $F(1,22)=2.48$ ,  $p=.130$ ,  $\eta_p^2=.10$ , perhaps due to the low power of this analysis (power=.33).

Planned one-tailed contrasts within each group showed no change in grit over twelve weeks for the control group ( $t(4)=1.12$ ,  $p=.326$ ), Cohen's  $d=.32$ , but an increase in grit in the twelve weeks following FIT delivery for both intervention groups (immediate:  $t(8)=3.71$ ,  $p=.006$ , Cohen's  $d=1.71$ ; delayed:  $t(9)=4.21$ ,  $p=.002$ , Cohen's  $d=1.55$ ). The delayed group also increased in grit from the week 6 (just before FIT) to the week 12 (six weeks after FIT) measurement points  $t(9)=3.19$ ,  $p=.006$ , Cohen's  $d=1.09$ .

Finally, during week 12, all intervention participants were asked to provide subjective feedback, examining how the intervention has helped improve areas of sporting development, and rated the effectiveness of FIT from 1 (did not help my performance) to 10 (has completely helped my performance). Participants found that FIT had improved their sporting performance ( $M=8.53$ ,  $SD=.77$ ) with no ratings less than 7.

## DISCUSSION

The purpose of this study was to evaluate the effect on professional athletes' grit scores through a novel imagery-based motivational intervention. We examined three groups, with the two cascaded intervention groups showing a significant improvement in grit following the intervention. While the delayed group showed an improvement in grit scores after only six weeks of the intervention, they continued to improve significantly over a further six weeks. Due to the use of FIT, participant's imagery vividness scores improved after twelve weeks, and individual feedback revealed that each player perceived that FIT had helped improve their performance. The practical use of FIT, and for that matter, any imagery intervention, is mastered with prolonged deliberate practice. Specifically, with FIT, the focus is primarily on encouraging the athlete to apply imagery to their personal sporting development goal, linking a cue to trigger the use of imagery.

Imagery methodologies such as PETTLEP (Holmes & Collins, 2001), that use physical, environmental, task, timing, learning, emotion and perspective directional scripts, have provided a structure for both practitioners and clients to use. Suggestions on imagery scripts (Andrade et al., 2016) and themes (Holmes & Mathews, 2005) provide a rigorous basis for research and application. Likewise, Miller and Rollnick's (2012) suggestions of the four-process MI model allows for a collaborative, yet person centered approach, to long-term behaviour modification. In this applied study using professional soccer players, their performance perceptions after using FIT, although subjective, demonstrates its potential effectiveness.

At the end of the season, the club finished in second place in their division, only missing out on the title on goal difference. While it is tempting to claim that FIT played a part in this achievement, it is impossible to know how the team would have performed without it. It is worth mentioning that each player throughout the season whether in the intervention group or not, displayed high amounts of effort at each training session and during every match. FIT did not add to the already existing hard work of each player, merely to their individual resilience and ability to overcome set-backs. The team's promotion to the next league made follow-up interviews with the players impossible, as several were released from their contracts at the end of the season.

The duration required for FIT delivery in sport requires further examination. On one hand, the results indicate that a six-week imagery intervention has detectable benefits, as shown by Potter, Devonport and Lane (2005), but the improvements were only significant to twelve weeks. Additionally, longer follow-ups may show a continued increase in grit. Therefore, recommendations for sport psychologists based on this study indicate a requirement for prolonged intervention durations, and autonomous goal setting that uses positive motivational imagery to enhance task-mastery. There are also constraints for

psychologists working in applied settings, and subsequently a need for reflexivity when designing the FIT delivery and throughout implementation.

There are a series of limitations with applied studies, the main one for this study being the self-selected control group. For MI to be core to the philosophy of FIT, participants were given the autonomy to opt out and were asked if they would like to be retested on their level of grit periodically during the season. However, the independent groups design was not the core focus of the study, but one worth reporting. Importantly, the repeated measures design holds significant value as it indicates that FIT develops character. A second limitation is the cascaded stepped-wedge design, which could impact consistency with FIT delivery. To combat this issue, a semi-structured interview was conducted, and the same sequence of goal and cue focus adhered to during intervention delivery. A third limitation, is the absent measurement of each individual's previous imagery practice, as used by Hall, Mack, Paivio, and Hausenblas (1998). Although the SIQ (Hall et al., 1998) would provide a useful insight into each participant's current use of imagery, we only had a small initial amount of time with the squad, which was taken up with grit measurement and a project introduction. Once the interviews commenced, we felt that the interview would be disrupted from the spirit of MI if questionnaires were conducted. Therefore, measuring goal confidence and vividness would be equally valuable and allow for practical use within the session. Finally, we recognized the overlap between grit and similar terms, such as conscientiousness, at the start of the study. To focus on grit alone, the FIT interviews were individually goal focused, emphasizing the impact an explicit small goal can have on long term progress.

It is highly recommended for replication that the intervention is delivered by an experienced MI practitioner with FIT training. Although more research with larger samples, different teams/sports, and consideration of different league standings would be of benefit, this study provides experimental grounding for future research to be based upon. This study

extends the practical use of FIT as it takes it beyond its origins in changing eating habits and alcohol cravings into the domain of sporting performance.

The personality trait of grit, as Rimfeld et al., (2006) suggest, is not immutable. Whilst there may be genetic links between personality traits, FIT is a tool which can form part of ongoing character development, and in doing so, promote performance. The Grit Scale has proved to be a valid tool at measuring the impact of the FIT intervention in professional soccer. As research expands to higher levels of sport, there could be a requirement for a more sensitive dependent variable, as it could be argued that individuals who have reached the highest level in sport would already be highly gritty, resilient, and mentally tough. Therefore, whilst a new grit measurement tool is being developed, FIT for sport research should focus on working with athletes who are at academy/talent levels, collecting additional data and training others to deliver the FIT methodology, with the hope to further validate this study's findings. Mental imagery plays a crucial role in developing grit and perceived sporting performance, and the FIT intervention has shown its effectiveness outside of clinical settings. This experimental research conducted in a controlled yet applied setting draws on intrinsic motivational to change behaviour through goal appraisal. Although we do recognize limitations within this study, FIT improved grit scores in as little as 6 weeks and significantly after 12 weeks. Additional research will now focus on training others to deliver the FIT intervention to ensure reliability, and the long-term effects of the intervention.



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## REFERENCES

- Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of educational psychology*, 84(3), 261.
- Ames, C., & Archer, J. (1987). Mothers' beliefs about the role of ability and effort in school learning. *Journal of educational psychology*, 79(4), 409.
- Andrade, J., Khalil, M., Dickson, J., May, J., & Kavanagh, D. J. (2016). Functional Imagery Training to reduce snacking: Testing a novel motivational intervention based on Elaborated Intrusion theory. *Appetite*, 100, 256-262.
- Burke, B. L., Arkowitz, H., & Menchola, M. (2003). The efficacy of motivational interviewing: A meta-analysis of controlled clinical trials. *Journal of Consulting and Clinical Psychology*, 71, 843–861.
- Burke, B. L., Dunn, C. W., & Atkins, D. C. (2004). The emerging evidence base for motivational interviewing: A meta-analytic and qualitative inquiry. *Journal of Cognitive Psychotherapy*, 18, 309–322.
- Costa, P. T., & McCrae, R. R. (1992). Normal personality assessment in clinical practice: The NEO personality inventory. *Psychological Assessment*, 4(1), 5–13.
- Craig, P., Dieppe, P., Macintyre, S., Michie, S., Nazareth, I., & Petticrew, M. (2008). Developing and evaluating complex interventions: the new Medical Research Council guidance. *British Medical Journal*, 337, a1655.
- Credé, M., Tynan, M. C., & Harms, P. D. (2017). Much ado about grit: A meta-analytic synthesis of the grit literature. *Journal of Personality and Social Psychology*, 113(3), 492.
- Duckworth, A. (2013, April). *Angela Duckworth: The key to success? Grit* [Video

file]. Retrieved from

[http://www.ted.com/talks/angela\\_lee\\_duckworth\\_the\\_key\\_to\\_success\\_grit?language=en](http://www.ted.com/talks/angela_lee_duckworth_the_key_to_success_grit?language=en)

- Duckworth, A. L., & Quinn, P. D. (2009). Development and validation of the Short Grit Scale (GRIT-S). *Journal of personality assessment*, 91(2), 166-174.
- Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: perseverance and passion for long-term goals. *Journal of personality and social psychology*, 92(6), 1087.
- Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological review*, 95(2), 256.
- Eskreis-Winkler, L., Duckworth, A. L., Shulman, E. P., & Beal, S. (2014). The grit effect: Predicting retention in the military, the workplace, school and marriage. *Frontiers in psychology*, 5, 36.
- Fletcher, D., & Sarkar, M. (2012). A grounded theory of psychological resilience in Olympic champions. *Psychology of sport and exercise*, 13(5), 669-678.
- Giulianotti, R. C., Rollin, J., Weil, E., Joy, B., & Alegi, P. A. (2017, January 16). Football. Encyclopedia Britannica. Retrieved from <https://www.britannica.com/sports/football-soccer>
- Guerin, E. A., Munroe-Chandler, K. J., & Loughhead, T. M. (2014). The relationship between imagery use and mental toughness in athletes with a disability. *Journal of Exercise, Movement, and Sport* (SCAPPS refereed abstracts repository), 46(1).
- Hall, C. R., Mack, D. E., Paivio, A., & Hausenblas, H. A. (1998). Imagery use by athletes: development of the Sport Imagery Questionnaire. *International Journal of Sport Psychology*, 29(1), 73-89.
- Helmreich, I., Kunzler, A., Chmitorz, A., König, J., Binder, H., Wessa, M., & Lieb, K. (2017,

- January 12). *Psychological interventions for resilience enhancement in adults*. *The Cochrane Library*. Retrieved from <http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD012527/epdf>
- Holmes, E., & Mathews, A. (2005). Mental Imagery and Emotion- A Special Relationship? *Emotion*, 5(4), 489–497.
- Holmes, P. S., & Collins, D. J. (2001). The PETTLEP approach to motor imagery: A functional equivalence model for sport psychologists. *Journal of Applied Sport Psychology*, 13(1), 60-83.
- Houston, R. G., & Wilson, D. P. (2002). Income, leisure and proficiency: an economic study of football performance. *Applied Economics Letters*, 9(14), 939-943.
- Hussey, M. A., & Hughes, J. P. (2007). Design and analysis of stepped wedge cluster randomized trials. *Contemporary clinical trials*, 28(2), 182-191.
- Ion, A., Mindu, A., & Gorbănescu, A. (2017). Grit in the workplace: Hype or ripe? *Personality and Individual Differences*, 111, 163-168.
- Kavanagh, D. J., May, J., & Andrade, J. (2009). Tests of the elaborated intrusion theory of craving and desire: Features of alcohol craving during treatment for an alcohol disorder. *British Journal of Clinical Psychology*, 48(3), 241-254.
- Kelley, T. L. (1927). *Interpretation of Educational Measurements*. Yonkers-on-Hudson, N.Y: World Book Company.
- Larkin, P., O'Connor, D., & Williams, A. M. (2016). Does grit influence sport-specific engagement and perceptual-cognitive expertise in elite youth soccer? *Journal of Applied Sport Psychology*, 28(2), 129-138.
- Mahoney, J. W., Gucciardi, D. F., Ntoumanis, N., & Mallet, C. J. (2014). Mental toughness in sport: Motivational antecedents and associations with performance and psychological health. *Journal of Sport & Exercise Psychology*, 36, 281–292.

- Martin, K. A., Moritz, S. E., & Hall, C. R. (1999). Imagery use in sport: A literature review and applied model. *The sport psychologist*, 13(3), 245-268.
- Martins, R. K., & McNeil, D. W. (2009). Review of motivational interviewing in promoting health behaviors. *Clinical psychology review*, 29(4), 283-293.
- Mattie, P., & Munroe-Chandler, K. (2012). Examining the relationship between mental toughness and imagery use. *Journal of Applied Sport Psychology*, 24(2), 144-156.
- Miller, W. R., & Rollnick, S. (2012). *Motivational interviewing: Helping people change*. New York, NY: Guilford.
- Moles, T. A., Auerbach, A. D., & Petrie, T. A. (2017). Grit Happens: Moderating Effects on Motivational Feedback and Sport Performance. *Journal of Applied Sport Psychology*, 1-16.
- Mueller, C. M., & Dweck, C. S. (1998). Praise for intelligence can undermine children's motivation and performance. *Journal of personality and social psychology*, 75(1), 33.
- Parsons, J. T., Rosof, E., Punzalan, J. C., & Di Maria, L. (2005). Integration of motivational interviewing and cognitive behavioral therapy to improve HIV medication adherence and reduce substance use among HIV-positive men and women: Results of a pilot project. *AIDS Patient Care and STDs*, 19, 31-39.
- Paivio, A. (1985). Cognitive and motivational functions of imagery in human performance. *Canadian Journal of Applied Sport Sciences*, 10, 22-28.
- Potter, I., Devonport, T. J., & Lane, A. M. (2005). Comparing physical, environment, task, timing, learning, emotion and perspective elements (PETTLEP) and traditional techniques of motor imagery. *International Society of Sport Psychology*, Sydney, Australia.
- Reed, J. (2014). A survey of grit and exercise behavior. *Journal of Sport Behavior*, 37(4), 390.

- Rimfeld, K., Kovas, Y., Dale, P. S., & Plomin, R. (2016). True grit and genetics: Predicting academic achievement from personality. *Journal of personality and social psychology*, 111(5), 780.
- Rollnick, S., Miller, W. R., & Butler, C. C. (2007). *Motivational Interviewing in Health Care: Helping Patients Change Behavior*. NY: The Guilford Press.
- Smith, D., Wright, C., Allsopp, A., & Westhead, H. (2007). It's all in the mind: PETTLEP-based imagery and sports performance. *Journal of Applied Sport Psychology*, 19(1), 80-92.
- Solbrig, L., Jones, R., Kavanagh, D., May, J., Parkin, T., & Andrade, J. (2017). People trying to lose weight dislike calorie counting apps and want motivational support to help them achieve their goals. *Internet Interventions*, 7, 23-31.
- Turkheimer, E., Pettersson, E., & Horn, E. E. (2014). A phenotypic null hypothesis for the genetics of personality. *Annual review of psychology*, 65, 515-540.
- VanWormer, J. J., & Boucher, J. L. (2004). Motivational interviewing and diet modification: A review of the evidence. *The Diabetes Educator*, 30, 404-416.
- Vealey, R. S., & Greenleaf, C. A. (2001). Seeing is believing: Understanding and using imagery in sport. In J. M. Williams (Ed.), *Applied sport psychology: Personal growth to peak performance* (4th ed., pp. 247-272). Mountain View, CA: Mayfield.
- Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological review*, 92(4), 548.
- Weiner, B. (1972). Attribution theory, achievement motivation, and the educational process. *Review of educational research*, 42(2), 203-215.

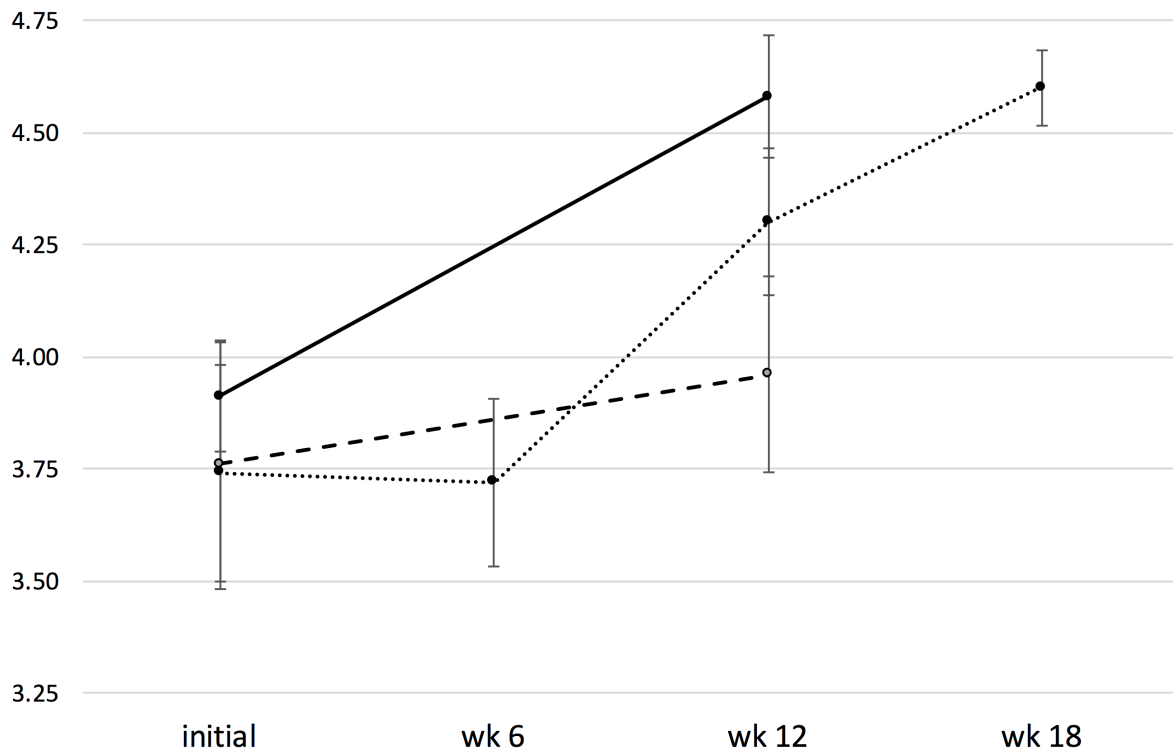


Figure 1: Grit scores increased following FIT for both the immediate (solid line) and delayed (dotted line) intervention groups, but the control group (dashed line) did not change. The delayed intervention group continued to improve for a further six weeks. Bars show 1 SEM.