State extraversion and emergent leadership: Do introverts emerge as leaders when they act like extraverts?

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Abstract

Extraverts are more likely than introverts to emerge as leaders, however little is known about the explicit behaviours that cause such an advantage and what introverts can do to overcome their relative disadvantage. Utilising an experiment (n = 601) in a group context, we assessed the effects of manipulating state extraversion on peer-rated emergent leadership, self-rated emergent leadership, and post-activity affect. Participants completed a big five personality measure and were randomly assigned to one of three conditions: a control condition, an 'act extraverted' treatment, or an 'act introverted' treatment. Results confirmed extraverts' emergent leadership advantage but demonstrated that state extraversion was the proximal cause of emergent leadership, with both extraverts and introverts emerging as leaders when instructed to act extraverted. Acting introverted i) had a particularly deleterious effect on self-rated emergent leadership regardless of trait extraversion, ii) caused a reduction in positive affect for ambiverts and extraverts but not for introverts, and iii) caused an increase in negative affect for ambiverts and extraverts but not for introverts.

Keywords: extraversion; introverts; personality; emergent leadership; positive and negative affect

Introduction

It is well-established that trait extraversion is the strongest big five predictor of emergent leadership (e.g., Judge, Bono, Ilies, & Gerhardt, 2002). Those high in extraversion ('extraverts') compared to those low in extraversion ('introverts') are more likely to take on informal leadership roles, more likely to exert social influence, and more likely to be perceived as 'leader-like' by their peers. The positive relationship between extraversion and leadership has been termed the 'extraverted leadership advantage' (Grant, Gino, & Hofmann, 2011). Extraverts not only have an advantage emerging into leadership roles, but also enjoy a general advantage in terms of their leadership performance and their tendency to adopt a transformational leadership style (Bono & Judge, 2004). By extension, therefore, introverts experience a relative disadvantage. The fact that introverts tend to be quiet, passive and reserved may be a key reason for such a disadvantage, although to our knowledge such a behavioural explanation has not been explicitly investigated.

Little is currently known as to what introverts can do to reduce their relative disadvantage in leadership situations. Traditionally, trait extraversion has been treated as a fixed construct and its association with leadership outcomes has offered little guidance for aspiring introverted leaders. Consequently, there has been a paucity of research directly exploring strategies that introverts can adopt to improve their leadership outcomes. In the current article we therefore explore the nature of the extraversion-emergent leadership relationship in detail, and specifically investigate whether introverts' disadvantage emerging into leadership roles can be reduced. We draw from recent theoretical and empirical work in personality psychology and propose that extraverted *states* rather than extraverted *traits* are a proximal cause of emergent leadership. This theoretical and empirical work challenges common assumptions about introverts and suggests that introverts are capable of enacting extraverted behaviour and, surprisingly, appear to enjoy doing so (McNiel & Fleeson, 2006;

McNiel, Lowman, & Fleeson, 2010). In the following sections we propose and test a new model of emergent leadership that recognises the role state extraversion plays in causing leadership outcomes. We utilise an experiment to assess whether introverts can strategically enact extraverted behaviour to reduce their disadvantage in leadership emergence contexts, which, in turn, advances the literature on the role behavioural interventions have in enhancing leadership outcomes.

The importance of emergent leadership for individuals and organisations

Becoming a leader is often coveted as a marker of success and a goal many aspire to achieve. The process of rising into a leadership position, either formally or informally, is known as leadership emergence and those that successfully navigate the leadership emergence process are emergent leaders. From a distal perspective, the leadership emergence process is thought to have its roots in evolutionary psychology (van Vugt & Ahuja, 2011; van Vugt, Hogan, & Kaiser, 2008; van Vugt & Ronay, 2014) and is a human universal (Brown, 1991). Indeed, some have argued that the motivation to emerge as a leader stems from the various benefits leadership roles have historically offered in terms of more resources, preferential mating opportunities, social status, and so forth (van Vugt & Ahuja, 2011)[1]. Today, formal and informal leadership roles continue to offer a range of benefits including higher status, social influence and increased income.

The process of leadership emergence is also relevant for organisational success. That is, organisations require high performing leaders to emerge via promotion and selection channels. Unfortunately, however, those emerging as leaders within organisations are not always the most suitable for those positions. As noted by some scholars (e.g., Hogan, Curphy,

[1] Although we also acknowledge that there were costs to the individual leader if they made mistakes (e.g., gossip, ridicule, banishment, execution, etc.).

& Hogan, 1994; Hogan & Kaiser, 2005), leadership failure may be as high as fifty percent, in part because of incorrect alignment between the leader's skills and behaviours and those required to address organisational challenges. Leadership emergence is thus important for both individuals and organisations. As yet, however, there has been relatively little work investigating exactly how leaders emerge, or what behaviours emergent leaders enact to be regarded as leader-like (a notable exception being the work on charisma; Antonakis, Fenley, & Liechti, 2011).

Emergent leadership and trait theory

What traits predict emergent leadership? Over the preceding half-century, the trait theory of leadership, which asserts that leaders emerge and perform effectively due to their innate characteristics, has drawn much controversy despite the empirical evidence supporting it (Kirkpatick & Locke, 1991; Zaccaro, 2007; Zaccaro, Green, Dubrow, & Kolze, 2018). Indeed, the literature comprehensively supports the idea that stable personality traits reliably predict emergent leadership across multiple contexts, with extraversion being an important predictor (Judge et al., 2002; Wilmot, Wanberg, Kammeyer-Mueller, & Ones, 2019; Zaccaro et al., 2018)[2]. The implication is that behaviour consistent with extraversion (e.g., assertiveness, boldness, talkativeness, etc.) is required to be perceived as leader-like (Do & Minbashian, 2014). Indeed, extraverts tend to be more confident in work and team situations (Hartman & Betz, 2007; Thoms, Moore, & Scott, 1996), which may contribute to why others perceive them as leader-like. Extraverts are thought to possess such confidence because of a readily activated dopaminergic system in the brain, which, among other factors, drives the motivation to attain dominance and to assert oneself socially (Depue & Collins, 1999).

[2] We acknowledge that other traits also play important roles in emergent leadership (e.g., intelligence, physical characteristics, gender, race, etc.).

Furthermore, although subordinate facets of extraversion – dominance, assertiveness and sociability in particular – are associated with emergent leadership (Do & Minbashian, 2014; Judge et al., 2002), the broader construct of extraversion is the most parsimonious and necessarily captures the underlying commonalities between subordinate facets.

Despite the established empirical associations between traits and emergent leadership, there are some limitations and valid criticisms of the trait theory of leadership. Some have pointed out that trait theory is merely descriptive, too simplistic and provides no guidance as to how to enhance traits to thus better participate in leadership (Northouse, 2016; O'Connor & Jackson, 2010). Indeed, the trait theory of leadership as it applies to leadership emergence does not directly address *how* certain traits predict emergent leadership. Trait theory simply describes which individuals, based on their personality traits, are likely to be successful in leadership situations. Trait theory is therefore not prescriptive – it cannot be used to prescribe what individuals should explicitly do to achieve leadership goals.

In the current article we address the descriptive limitation of trait theory by integrating the trait theory of leadership with a state-trait model of leadership. We integrate personality states into the trait theory of leadership in order to investigate the specific behaviours extraverts adopt when emerging as leaders. We investigate whether *acting* extraverted (a state-dependent construct) serves as a proximal cause of leadership emergence beyond *being* extraverted (a trait-dependent construct). In doing so, we extend the trait theory of leadership from a purely descriptive, empirical account of leadership emergence, to one that is process-based, in line with recent calls to go beyond trait level explanations of leadership phenomena (Acton, Foti, Lord, & Gladfelter, 2019; Antonakis, Day, & Schyns, 2012; Zaccaro et al., 2018). By manipulating states, we shift the focus from stable dispositions to specific behaviours under conscious control. Finally, the current article also serves as an example for how behaviours derived from stable personality dispositions can be

strategically enacted by individuals to achieve leadership outcomes, which is not something that can be as readily achieved with other stable traits (e.g., intelligence, gender, race, etc.).

A state-trait model of emergent leadership

To develop a set of hypotheses which help to explain why and how extraverts have an advantage in leadership situations, we draw from an influential theoretical model of personality termed 'whole trait theory' (Fleeson 2001; Fleeson & Gallagher, 2009; Fleeson & Jayawickreme, 2015; Fleeson, Malanos, & Achille, 2002; McCabe & Fleeson, 2012; McNiel & Fleeson, 2006). Drawing from the work of Mischel (2004), whole trait theory is an explanatory account of personality that integrates the widely replicated big five trait taxonomy with explanatory social-cognitive mechanisms (e.g., "goals, beliefs, values, scripts, life stories, etc."; Fleeson & Jayawickreme, 2015, p. 84). Whole trait theory is largely based on a distinction between personality traits (e.g., extraversion) and personality states (e.g., short-term extraverted behaviour), and conceptualises personality traits as frequency distributions of personality states. The implication being that someone high on a certain trait is simply one who engages in more behaviours consistent with that trait. For example, an extravert will, on average, act more bold, assertive, energetic, and talkative than an introvert. A key component of whole trait theory, and one particularly relevant to the current study, is that people are capable of both trait-typical and 'counterdispositional' behaviour, but have a preference to engage in more trait-typical behaviour (Fleeson & Gallagher, 2009; Fleeson et al., 2002; McNiel & Fleeson, 2006). Such counterdispositional behaviour has been induced in experiments where participants are able to act extraverted or introverted on demand as required of the experiment treatment (Davydenko, Zelenski, Gonzalez, & Whelan, 2020; Jacques-Hamilton, Sun, & Smillie, 2019; McNiel & Fleeson, 2006; Margolis & Lyubomirsky, 2020; Sun, Stevenson, Kabbani, Richardson, & Smillie, 2017; Zelenski et al.,

2013; Zelenski, Santoro, & Whelan, 2012). Similar work has also been done to enhance leadership emergence by training participants to be more charismatic (Antonakis et al., 2011).

In applying whole trait theory to the leadership context, we suggest that introverts have the capacity to enact extraverted behaviour as needed during the emergence process, however are simply less inclined to do so when able to freely choose (forecasting that it will be unpleasant may be a key reason why; Spark, Stansmore, & O'Connor, 2018; Zelenski et al., 2013). Thus, ordinarily, introverts will be less likely to emerge as leaders in leadership situations, however when instructed to act extraverted in such situations, it follows that introverts will emerge as leaders as often as extraverts. We therefore suggest that extraverts emerge as leaders primarily due to their tendency to engage in extraverted behaviours (e.g., being assertive, bold, talkative, etc.) and that, by extension, state extraversion causes an increase in emergent leadership, hence:

H1a. Enacted (state) extraversion causes an increase in emergent leadership.

H1b. Enacted (state) introversion causes a decrease in emergent leadership.

We expect that both hypotheses will hold equally across all levels of trait extraversion.

Post-activity affect

An important extension of whole trait theory and counterdispositional behaviour research is the effect that such behaviour has on psychological well-being, particularly with respect to positive affect (McCabe & Fleeson, 2012; McNiel & Fleeson, 2006). Studies linking counterdispositional behaviour and affect have assessed whether acting extraverted is as good as being extraverted from an affect-inducing perspective. Through a series of experiments, it was shown that acting extraverted caused an increase in positive affect to an equivalent degree for both introverts and extraverts, although extraverts still experienced higher baseline levels overall (McNiel & Fleeson, 2006). Other studies (e.g., Margolis &

Lyubomirsky, 2020; Jacques-Hamilton et al., 2019) have similarly shown that positive affect is increased when state extraversion is enacted (noting that introverts may experience a relatively blunted effect for *momentary* positive affect compared to *retrospective* positive affect; Jacques-Hamilton et al., 2019[3]) and have also shown that only extraverts experience deleterious consequences if acting counterdispositionally (in their case, when they act introverted) compared to their respective baseline (Zelenski et al., 2012). In the current article we therefore seek to extend the aforementioned research to post-activity positive affect as influenced by behaviour relevant to leadership emergence. We therefore test the following hypotheses:

H2a. Acting extraverted during the leadership emergence process increases post-activity positive affect.

H2b. Acting introverted during the leadership emergence process decreases post-activity positive affect.

Although studied to a lesser extent due to its association with trait neuroticism, we also test the effect of extraverted behaviour on post-activity negative affect. Research has shown that state extraversion is negatively related to negative affect (e.g., Zelenski et al., 2013) and hence we test the following hypotheses:

H3a. Acting extraverted during the leadership emergence process decreases post-activity negative affect.

H3b. Acting introverted during the leadership emergence process increases post-activity negative affect.

We expect that H2 and H3 will hold equally across all levels of trait extraversion.

[3] In Jacques-Hamilton et al. (2019), momentary positive affect refers to the positive affect that occurred at the same time as the extraverted behaviours in the past hour, whereas retrospective positive affect refers to the positive affect experienced over the previous week.

Methods

Participants

Six-hundred-and-twelve first-year university business students participated in the study as part of a class exercise, however 11 were excluded due to missing data across all dependent variables (three participants) or because there were no observer ratings completed (eight participants). Of the remaining 601, 301 acted as peer-observers within the two experiment conditions and therefore only their peer-ratings of emergent leadership were used. In all, the total number of remaining cases available for hypothesis testing was 300, where 192 were in the control condition, 53 were assigned to the act extraverted treatment and 55 were assigned to the act introverted treatment. The reason for the uneven size of these groups is explained later. Table 1 details the participant characteristics across conditions. Across all conditions, participants were aged between 16 and 48 (M = 19.94, SD = 3.53), 154 were female and 128 were male (18 did not indicate gender). The only selection criterion was enrolment in the first-year university course. There was no incentive for participating in the study beyond its value as a voluntary class activity to practice group problem-solving skills. The activity was not mandatory for students' formal assessment.

INSERT TABLE 1 ABOUT HERE

Measures

Personality traits. We measured personality traits using 40 adjectives from the Big Five Mini-Markers inventory (Saucier, 1994). Each of the five traits consisted of eight items each, however the item *bashful* was dropped from extraversion due to poor item-rest correlation (r = .14). Extraversion therefore included (where the last three were reversed scored) *talkative*; *extraverted*; *energetic*; *bold*; *shy*; *withdrawn*; *quiet* and had good reliability

(α = .84, 95% CI [.81, .86]). The other traits (openness, conscientiousness, agreeableness and neuroticism) were measured to confirm successful randomisation. Openness included (where the last two were reversed scored) *creative*; *intellectual*; *philosophical*; *complex*; *deep*; *imaginative*; *uncreative*; *unintellectual* and had acceptable reliability (α = .73, 95% CI [.68, .77]). Conscientiousness included (where the last four were reversed scored) *practical*; *organised*; *systematic*; *efficient*; *inefficient*; *sloppy*; *careless*; *disorganised* and had good reliability (α = .83, 95% CI [.80, .85]). Agreeableness included (where the last four were reversed scored) *warm*; *sympathetic*; *kind*; *cooperative*; *unsympathetic*; *rude*; *harsh*; *cold*; and had good reliability (α = .81, 95% CI [.78, .85]). Neuroticism included (where the last two were reversed scored) *touchy*; *moody*; *fretful*; *jealous*; *temperamental*; *envious*; *unenvious*; *relaxed* and had acceptable reliability (α = .70, 95% CI [.65, .75]). Participants were given the following instruction prior to rating their personality: *In the table below you will find a series of adjectives that, in general, describe you as an individual. Using the 1-5 scale below please indicate (by circling) how much you agree or disagree that the adjective describes you*. Personality was successfully randomised across conditions, as shown in Table 1.

Emergent leadership. Because emergent leadership refers to the perception of leader-like ability as opposed to actual performance over time (which is a measure of leadership effectiveness; Hogan et al., 1994), and because a dedicated emergent leadership measure was not available, we developed a measure based on items from a range of published works (Lanaj & Hollenbeck, 2015; Morris & Hackman, 1969; Smith & Foti, 1998; Taggar, Hackett, & Saha, 1999)[4]. Participants were given the instruction: *Thinking only about the individuals in your group* ***during this activity****, using the 1-5 scale below please indicate (by circling) how much you agree or disagree with each of the statements below as they apply to each*

[4] Note that this measure was first reported in Spark et al. (2018).

participant (including yourself). The five items in the scale included: *He/she/I was the real leader of the group; He/she/I influenced group decisions; If asked to meet a second time with this exact group to work on an identical type of task*, *I think this person would make a desirable leader; He/she/I led the conversation in the group; He/she/I exemplified leadership*. Because both a peer-rated and self-rated measure was taken, inter-rater (k = 3) agreement was assessed for the peer-rated measure using the intraclass correlation coefficient, which showed that a moderate-to-good level of agreement was evident amongst raters (ICC = .71, 95% CI [.66, .75]). For the self-rated measure, an alpha score was calculated which showed excellent reliability (α = .93, 95% CI [.91, .94]).

Post-activity positive and negative affect. Positive and negative affect were measured immediately after the activity with the following instruction, noting that the measure was designed to capture affect 'right now' rather than in relation to the activity: *Thinking only about how you feel* ***right now****, using the 1-5 scale below please indicate (by circling) how much you agree or disagree with each of the following statements*. This instruction was followed by the items *I feel pleased*; *I feel happy*; *I feel strong*; *I feel interested*; *I feel excited* for positive affect which had good reliability (α = .85, 95% CI [.83, .88]), and the items *I feel upset*; *I feel nervous*; *I feel distressed*; *I feel fearful*; *I feel worried* for negative affect which had good reliability (α = .89, 95% CI [.87, .91]). The items were based on the Positive and Negative Affect Schedule (Watson, Clark, & Tellegen, 1988).

Age and female. Age and female (coded as males = 0 and females = 1) were included in *t*-tests to confirm that groups were successfully randomised across conditions, as shown in Table 1.

Experiment design

A between-person experiment was used where participants were only allocated to one of three experimental conditions: a control condition, an 'act extraverted' treatment, or an 'act

introverted' treatment. For each condition, the same group formation rules applied, which consisted of four participants per group where one was assigned as the actor (noting that some groups did not achieve a full complement[5]). Assignment of participants to roles and groups was random. All participants provided emergent leadership ratings for all other participants in their group.

Experiment procedure

A trained facilitator was assigned to lead each cohort of groups, which typically consisted of up to six groups within a classroom. Facilitators were trained to lead the activity but were blind to the experimental hypotheses. The facilitator briefed the participants on the activity, obtained consent, and allowed individuals to exit if they wished to. After the brief was given, a participant pack was randomly handed out by the facilitator to each participant where each pack was appropriate to the experiment condition. Once the participant packs were handed out, participants moved into their groups and completed the baseline personality testing, which occurred approximately five minutes before the activity.

Participants were then instructed to read their specific set of instructions, which differed depending on their experiment condition. Participants did not know that other group members had been given different acting instructions. The non-actors were given the same instruction, which simply read: *You do not have any special instructions. Please wait for further instructions from the facilitator*. Because all control participants were given the non-actor instruction, we were able to include all control group participants in the analysis for the

[5] Sixteen participants were from a two-person group, 42 were from a three-person group and the remaining 242 were from a four-person group. Group size did not affect the results.

control condition to boost power after appropriate omnibus testing[6]. The control condition therefore contained the largest number of participants.

Participants in the extraverted treatment were instructed to act *energetic*, *talkative*, *enthusiastic*, *bold*, *active*, *assertive*, and *sociable*, and participants in the introverted treatment were instructed act *quiet*, *reserved*, *lethargic*, *passive*, *compliant*, and *unadventurous*. The adjectives were derived from Goldberg (1992), which in turn was used to develop the mini-markers (Saucier, 1994) used as our operationalisation of trait extraversion and enacted extraversion. A similar approach has been taken in other studies (e.g., McNiel & Fleeson, 2006), except that our study utilised many more neutral observers and only had one actor per group. Given that peer-ratings were important, our design ensured that multiple observer (non-actor) ratings were obtained without being influenced by their own set of behavioural instructions.

Next, the groups began their group activity, which took 20 minutes. Every group was given the same group problem solving exercise which was developed by NASA (Survival! Exploration: Then and Now, 2006). The objective of the scenario was to rank order 15 survival gear items from highest priority to lowest priority having just crash-landed on the Moon. At the conclusion of the activity, participants were then asked to complete the final set of questionnaires, which included the emergent leadership scale (observer and self) and post-activity affect scale. Once all questionnaires were completed, participants were asked to return them to the front of the room. During the return process, the facilitator was required to

[6] To justify our point here, we conducted an ANOVA to test whether each control participant (where each participant could be one of 'Participant A', 'Participant B', 'Participant C', or 'Participant D') experienced the activity in the same way, as measured by consistent ratings for the dependent variables. This was indeed the case (peer-rated emergent leadership, $F(3, 187) = 0.92$, $p = .434$; self-rated emergent leadership, $F(3, 167) = 0.66$, $p = .578$; positive affect, $F(3, 185) = 0.86$, $p = .461$; negative affect, $F(3, 185) = 0.58$, $p = .629$).

leave the room for one minute as a final step to ensure participant anonymity. Ethics approval was granted by the university Human Research Ethics Committee.

Data analysis procedure

A multivariate model was constructed using the 'lavaan' (Rosseel, 2012) structural equation modelling package in R (R Core Team, 2018), the scripts and data for which are available at https://osf.io/x9fq8/. All relevant variables were modelled as latent variables to account for measurement error and all variables were free to covary. lavaan was used because the data for self-rated emergent leadership was missing at random (see Appendix 1) and therefore estimation was needed using full information maximum likelihood (FIML; Baraldi & Enders, 2010). Given that the vast majority of missing data were associated with self-rated emergent leadership, FIML allowed the existing data for the other dependent variables to be used in the modelling that would otherwise be listwise deleted (compare the results to Appendix 3 taking note of the consistency of estimates). The independent variables included the two treatment conditions (act extraverted and act introverted) where each was dummy coded (the control condition coded as 0 and the treatment coded as 1). Trait extraversion was included as the primary covariate of theoretical relevance. Other control variables – age, female, openness, conscientiousness, agreeableness, neuroticism – were also included in the full model (after comparison with the model that excluded control variables). The dependent variables included peer-rated emergent leadership, self-rated emergent leadership, post-activity positive affect and post-activity negative affect. To check whether the treatment effects were consistent across all levels of trait extraversion, two trait extraversion x treatment effect interaction terms were entered into the model (one for each treatment). We found support for an act introverted treatment x trait extraversion interaction term predicting post-activity positive affect and post-activity negative affect and hence conducted follow-up

analysis on these two interactions (detailed later). The final model is shown in Figure 1 (noting that the control variables are not shown to avoid clutter).

INSERT FIGURE 1 ABOUT HERE

The analysis of the model shown in Figure 1 is given by the following simultaneous equations:

$$Y_1 = b_{10} + b_{11}X_1 + b_{12}X_2 + b_{13}X_3 + b_{14}X_1X_3 + b_{15}X_2X_3 + b_{1c}CONTROLS + e_1 \quad (1)$$

$$Y_2 = b_{20} + b_{21}X_1 + b_{22}X_2 + b_{23}X_3 + b_{24}X_1X_3 + b_{25}X_2X_3 + b_{2c}CONTROLS + e_2 \quad (2)$$

$$Y_3 = b_{30} + b_{31}X_1 + b_{32}X_2 + b_{33}X_3 + b_{34}X_1X_3 + b_{35}X_2X_3 + b_{3c}CONTROLS + e_3 \quad (3)$$

$$Y_4 = b_{40} + b_{41}X_1 + b_{42}X_2 + b_{43}X_3 + b_{44}X_1X_3 + b_{45}X_2X_3 + b_{4c}CONTROLS + e_4 \quad (4)$$

where Y_1 is peer-rated emergent leadership, Y_2 is self-rated emergent leadership, Y_3 is post-activity positive affect, Y_4 is post-activity negative affect, X_1 is the act extraverted treatment, X_2 is the act introverted treatment, X_3 is trait extraversion, X_1X_3 is the act extraverted treatment x trait extraversion interaction term, X_2X_3 is the act introverted treatment x trait extraversion interaction term, and c represents the subscript for the control variable estimate.

Drawing from equations (1) through (4), an important post hoc analysis is the assessment of the degree to which the treatment conditions predict the dependent variables, both individually and differentially. As explicated in Edwards (1995), in order to properly conduct differential comparisons, the respective equations must be subtracted from each other. For example, if the analysis in question is to determine the relative effect of the extraverted treatment (X_1) on peer-rated (Y_1) vs self-rated (Y_2) emergent leadership, the beta from the respective equations must be compared under an equality constraint in line with the formula

$$Y_1 - Y_2 = (b_{10} - b_{20}) + (b_{11} - b_{21})X_1 + (b_{12} - b_{22})X_2 + (b_{13} - b_{23})X_3 + (b_{14} - b_{24})X_1X_3 + (b_{15} - b_{25})X_2X_3 + (b_{1c} - b_{2c})CONTROLS + (e_1 - e_2) \quad (5)$$

where the null hypothesis is that $b_{11} - b_{21} = 0$ (equivalently, $b_{11} = b_{21}$). The preceding logic is operationalised in the multivariate model shown in Figure 1 by comparing a constrained model, where $b_{11} = b_{21}$, to an unconstrained model where these parameter estimates are free to vary. A Wald test is used to compare models and if the test is significant, we can claim that the parameter estimates are not equal and therefore acting extraverted does cause a differential effect on the two measures of emergent leadership.

With the preceding logic in mind, the following constraints were tested: i) the differential effect of the act extraverted treatment on the peer-rated and self-rated emergent leadership ratings, given by the $b_{11} = b_{21}$ constraint; ii) the differential effect of the act introverted treatment on the peer-rated and self-rated emergent leadership ratings, given by the $b_{12} = b_{22}$ constraint; iii) the differential effect of the act extraverted and act introverted treatments on peer-rated emergent leadership, given by the $b_{11} = -b_{12}$ constraint (note the negative sign for $-b_{12}$ to represent the opposite effect of the act introverted treatment); and iv) the differential effect of the act extraverted and act introverted treatments on self-rated emergent leadership, given by the $b_{21} = -b_{22}$ constraint. The constraints for the post-activity affect equations were not relevant due to the interaction terms being significant.

Regarding the act introverted treatment x trait extraversion interaction terms predicting post-activity affect as per equation (3) and equation (4), follow-up Johnson-Neyman analysis (Bauer & Curran, 2005; Johnson & Neyman, 1936; Johnson & Fay, 1950; Spiller, Fitzsimons, Lynch Jr, & McClelland, 2013) was used to identify a specific point of mean-centred extraversion beyond which the individual trajectories of the treatment vs control conditions were significantly different from each other given an alpha of .05. Because the Johnson-Neyman process is iterative and may therefore falsely discover a significant

point, a recent calculation adjustment by Esarey and Summer (2018) has been developed. We have applied Esarey and Summer's adjustment in the current study, which makes the point of significance more conservative. Note that the Johnson-Neyman method we applied used the univariate models predicting Y_3 and Y_4 shown in equation (3) and equation (4), respectively, and used the average score of the respective items for the latent variables (i.e., measurement error was not explicitly modelled as part of the interaction probing procedure).

To test for the presence of demand effects on observer ratings as a consequence of experiment condition, we ran an ANOVA whereby we tested the four dependent variables across the three conditions in the observers only. These models were non-significant[7].

[7] Peer-rated emergent leadership, $F(2, 435) = 2.00$, $p = .136$; self-rated emergent leadership, $F(2, 404) = 1.55$, $p = .213$; positive affect, $F(2, 434) = 1.33$, $p = .266$; negative affect, $F(2, 434) = 0.03$, $p = .968$.

Results

Means, correlations, standard deviations and reliability estimates are shown in Table 2[8].

INSERT TABLE 2 ABOUT HERE

Table 3 summarises the results from the multivariate analysis. We report here the results from the full model including control variables, noting that the estimates are consistent with or without control variables. Regarding peer-rated emergent leadership, trait extraversion was significant (b = 0.245, SE = .072, p = .001) as were the act extraverted (b = 0.296, SE = .109, p = .007) and act introverted (b = -0.433, SE = .114, p < .001) treatments. Neither the act extraverted treatment x trait extraversion (b = 0.245, SE = .072, p = .001) nor act introverted treatment x trait extraversion (b = 0.024, SE = .166, p = .886) interactions were significant. Regarding self-rated emergent leadership, trait extraversion was significant (b = .168, SE = .085, p = .047) as were the act extraverted (b = 0.282, SE = .129, p = .029) and act introverted treatments (b = -1.147, SE = .143, p < .001). Neither the act extraverted treatment x trait extraversion (b = 0.193, SE = .196, p = .326) nor act introverted treatment x trait extraversion (b = -0.137, SE = .192, p = .477) interactions were significant. In terms of testing the differential effect that the act extraverted treatment had on peer-rated vs self-rated emergent leadership, the $b_{11} = b_{21}$ equality constraint was tested against the unconstrained model and was not significant ($\chi^2_{(1)}$ = 0.015, p = .903), which indicates that the act extraverted treatment had an equal effect on peer-rated and self-rated emergent leadership. The same analysis was conducted for the act introverted treatment ($b_{12} = b_{22}$), which was

[8] Note that Table 2 is based on a reduced sample due to listwise deletion.

significant ($\chi^2_{(1)} = 26.537$, $p < .001$). Thus, the act introverted treatment had a larger effect on self-rated emergent leadership than it did on peer-rated emergent leadership. In terms of testing the differential effect that the act extraverted treatment versus act introverted treatment had on peer-rated emergent leadership ($b_{11} = -b_{12}$), the constraint was not significant ($\chi^2_{(1)} = 0.658$, $p = .417$) indicating that the act introverted treatment had an equal and opposite effect as the act extraverted treatment on peer-rated emergent leadership. Finally, regarding the differential effect that the act extraverted treatment versus act introverted treatment had on self-rated emergent leadership ($b_{21} = -b_{22}$), the constraint was significant ($\chi^2_{(1)} = 17.306$, $p < .001$) indicating that the act introverted treatment had a larger effect on self-rated emergent leadership than the act extraverted treatment. Thus, H1a and H1b were fully supported, such that the act extraverted treatment (act introverted treatment) caused an increase (decrease) in both peer-rated and self-rated emergent leadership even after controlling for trait extraversion. Furthermore, the act introverted treatment was particularly potent in terms of a deleterious effect on self-rated emergent leadership.

INSERT TABLE 3 ABOUT HERE

Regarding post-activity positive affect, trait extraversion was significant ($b = 0.171$, SE = .071, $p = .016$), the act extraverted treatment was not ($b = 0.058$, SE = .108, $p = .591$) and the act introverted treatment was ($b = -0.426$, SE = .111, $p < .001$). Whilst the act extraverted treatment x trait extraversion interaction was not significant ($b = -0.233$, SE = .167, $p = .162$), the act introverted treatment x trait extraversion interaction was ($b = -0.497$, SE = .159, $p = .002$). To probe the interaction further, a univariate model given by equation (3) with Johnson-Neyman analysis revealed that a region of significance occurs above -0.366 on a mean-centred scale of extraversion (range of -1.750 to 1.678) such that

individuals with moderate or higher levels of extraversion experienced lower levels of positive affect when in the act introverted treatment compared to participants in the control condition. The interaction is depicted in Figure 2. Overall, trait extraversion was positively associated with post-activity positive affect, however when extraverts and ambiverts were instructed to act introverted, they experienced a reduction in post-activity positive affect. Participants in the act extraverted treatment did not experience additional post-activity positive affect compared to participants in the control condition. H2a was therefore not supported in that the act extraverted treatment did not cause an increase in post-activity positive affect. However, H2b was partially supported in that the deleterious effect of the act introverted treatment only became apparent at medium to high levels of trait extraversion.

INSERT FIGURE 2 ABOUT HERE

Regarding post-activity negative affect, trait extraversion was significant (b = -0.239, SE = .074, p = .001) as was the act introverted treatment (b = 0.425, SE = .112, p < .001), however the act extraverted treatment was not (b = -0.063, SE = .112, p = .576). Whilst the act extraverted treatment x trait extraversion interaction was not significant (b = 0.157, SE = .171, p = .361), the act introverted treatment x trait extraversion interaction was (b = 0.331, SE = .162, p = .041). To probe the interaction further, a univariate model given by equation (4) with Johnson-Neyman analysis revealed that a region of significance occurs above -0.637 on a mean-centred scale of extraversion (range of -1.750 to 1.678) such that individuals with moderate or higher levels of extraversion experienced higher levels of negative affect when in the act introverted treatment compared to participants in the control condition. The interaction is depicted in Figure 2. Overall, trait extraversion was negatively associated with post-activity negative affect, however when extraverts and ambiverts were instructed to act introverted,

they experienced an increase in post-activity negative affect. Participants in the act extraverted treatment did not experience different levels of post-activity negative affect compared to participants in the control condition. H3a was therefore not supported in that the act extraverted treatment did not cause a decrease in post-activity negative affect. However, H3b was partially supported in that the deleterious effect of the act introverted treatment only became apparent at medium to high levels of trait extraversion.

Discussion

We conducted an experiment in a group context relevant to the leadership emergence process. The experiment consisted of three conditions (act extraverted treatment, act introverted treatment, and a control condition with no acting instructions) and was designed to test the causal role extraverted and introverted behaviours have in the leadership emergence process. We used multivariate analysis whereby all independent variables simultaneously predicted all dependent variables. Our first hypothesis predicted that extraverted (introverted) behaviour would increase (decrease) emergent leadership. We found support for our first hypothesis in that extraverted behaviour caused an increase in both peer-rated and self-rated emergent leadership, and introverted behaviour caused a decrease in both peer-rated and self-rated emergent leadership. This effect was true for all levels of trait extraversion (i.e., no trait extraversion x treatment condition interaction was supported). Furthermore, we also found that introverted behaviour caused a large reduction in self-rated emergent leadership in comparison to peer-rated emergent leadership and had a larger effect on self-rated emergent leadership compared to extraverted behavior.

Our second hypothesis predicted that extraverted (introverted) behaviour would cause an increase (decrease) in post-activity positive affect and our third hypothesis predicted that extraverted (introverted) behaviour would cause a decrease (increase) in post-activity negative affect. Support for both hypotheses was conditional in that we tested for an interaction between treatment condition and trait extraversion and found that acting introverted (but not extraverted) caused a reduction in post-activity positive affect compared to controls (where trait extraversion predicted higher levels of positive affect) and caused an increase in post-activity negative affect compared to controls (where trait extraversion predicted lower levels of negative affect). However, follow-up analysis revealed that the simple effect difference between the act introverted treatment and controls was only

significant for those with an extraversion score in the upper two-thirds of the distribution (i.e., not introverts). Introverts did not benefit in terms of post-activity positive affect from acting extraverted, but nor did they suffer any deleterious effects from acting introverted. However, extraverts (and to a lesser extent, ambiverts) did suffer deleterious consequences from acting introverted in terms of lower post-activity positive affect and higher post-activity negative affect.

Our study extends the trait theory of leadership by incorporating the important role of behavioural states: Extraverts emerge as leaders more often than introverts due to the specific behaviours they use when interacting with others. These specific behaviours are consistent with trait-typical behaviours found at the positive end of the extraversion continuum. In addition, the act introverted treatment had a particularly strong effect on the *lack of self-perceived* leadership emergence, both in terms of i) comparing the effect of the act introverted treatment versus the act extraverted treatment on self-rated emergent leadership, and ii) comparing the effect of the act introverted treatment on peer-rated versus self-rated emergent leadership.

Our findings allow us to move beyond merely describing the traits of emergent leaders. Emergent leadership is not simply a characteristic of people as much as it is an outcome of behaviour within the context of the leadership emergence process. Our work therefore advances trait theory from primarily descriptive to partially prescriptive: Introverts and extraverts are capable of leadership-relevant behaviours and such behaviours can be enacted when seeking to enhance emergent leadership outcomes.

The effect of state introversion

Why did the act introverted treatment have such a strong effect on (low) self-rated emergent leadership? We speculate that because the activity in our experiment was (necessarily) socially oriented, it was not introverted behaviour per se which was problematic

but was instead a mismatch between introverted behaviour and the socially-oriented context of the activity. Thus, we suggest that to act introverted makes one think they stand out (for the wrong reasons) compared to acting extraverted. Such a mismatch was a necessary design feature of our study because it needed to simulate a typical dynamic of emergent leadership (i.e., problem-solving within a group context). Despite not making any formal hypotheses with respect to the relative effect of our treatments on peer-rated versus self-rated emergent leadership, we were surprised by the severe reduction in self-rated emergent leadership in comparison to peers' ratings. Indeed, our results suggest that to act introverted in a social context such as that employed in this study, is to cause a significant detriment to one's perception of emergent leadership capability. This effect was true for both introverts and extraverts and can be summed up in the following way: *Whereas introverted behaviour in leadership emergence contexts causes others to think less of your emergent leadership ability, it's not as bad as you think*. We suspect that similar deleterious effects may also be seen in social contexts unrelated to group-problem solving (e.g., networking events, parties, workplace social events, etc.), although specific research is needed. If we are correct, the consequences for introverts (or even extraverts who act introverted for whatever reason) could be quite deleterious. Given that leadership emergence necessarily occurs within a social context, a mismatch problem may be an unavoidable challenge for introverts. The good news is that our results show that introverts can overcome the mismatch challenge by enacting extraversion should they wish to.

State extraversion, trait extraversion and endogeneity

Although we found that the act extraverted and act introverted treatments predicted leadership emergence, they did not fully account for the positive effects of trait extraversion on emergent leadership. In other words, observers in the act extraverted treatment were still less likely to perceive introverts to be emergent leaders compared to extraverts after

controlling for extraverted behaviour. The fact that extraverts are regarded as more leader-like even within treatments (and after controlling for other exogenous variables) suggests that other features or strategies are enjoyed or employed by extraverts that provide them with an additional advantage over and above the behaviours measured here. The unmeasured features or strategies contributing to such an advantage may be more typical of other traits (e.g., openness or conscientiousness) or may be more nuanced behaviours not captured in traditional state/trait measures, such as body language, vocal delivery (e.g., see Truninger, Ruderman, Clerkin, Fernandez, & Cancro, In Press), eye contact, choice of words, and so forth. Indeed, research has shown that even facial features can be detected by observers as markers of personality (e.g., Penton-Voak, Pound, Little, & Perrett, 2006) and can occur in as little as 50 milliseconds (Borkenau, Brecke, Möttig, & Paelecke, 2009).

Having noted other potential causal links between trait extraversion and emergent leadership, such causes are likely proximal manifestations of the exogenous role trait extraversion has as a distal cause of leadership emergence (see Antonakis, 2011; Antonakis, Bendaham, Jacquart, & Lalive, 2010). That is, trait extraversion is not influenced by other variables that are also correlated with the errors of emergent leadership, as evidenced in our study by trait extraversion's estimates being consistent when controls were added. By contrast, state extraversion is a potentially endogenous variable in terms of predicting emergence in that it is predicted by trait extraversion (see Fleeson & Gallagher, 2009). However, given that we have been able to i) manipulate state extraversion experimentally thus making it exogenous with respect to emergent leadership, and ii) measure emergent leadership using both self- and peer-ratings, we are confident in making the claim that *both* trait and state extraversion have a causal role in the determination of emergent leadership and that our claim is not at risk of the 'zero-variable' problem (see Wicklund, 1990) where the dependent variable is nothing more than the independent variable relabelled (see also

'endogenous theorising'; Antonakis, 2017). An important implication of the preceding points is that trait extraversion, and personality more broadly, should be included in studies of leadership as critical exogenous variables (see Antonakis, 2011).

Post-activity affect

In terms of the relationship with post-activity affect, the act introverted treatment caused a general reduction in positive affect and an increase in negative affect. However, when probing the interactions shown in equation (3) and equation (4), the reduction in positive affect and increase in negative affect was only true for ambiverts and extraverts – introverts were essentially unaffected by treatment condition in terms of post-activity affect levels. Other research has shown similar resistance in introverts to changes in positive affect following social interaction (Duffy, Helzer, Hoyle, Helzer, & Chartrand, 2018). Overall, extraverts were therefore worse off than introverts when instructed to act introverted. That a deleterious effect on affect occurs as a consequence of acting introverted in a social context make sense from the perspective that humans are highly social and hence disengaging from social interaction may cause a sense of rejection. Similar results have been found in other studies (e.g., Zelenski et al., 2012). One possible explanation is that introverted behaviour in social contexts causes an acute reduction in dopaminergic activity in the brain. When dopaminergic activity is impaired, as occurs when rewards are withheld, a deleterious impact on affect is observed. Indeed, impaired dopaminergic response has been associated with depression (Belujon & Grace, 2017; Nestler & Carlezon Jr, 2006; Panksepp, 1998), which in turn is characterised by a severe reduction in positive affect, an increase in negative affect, and a decrease in social interaction. What our design is not able to disentangle is what comes first – deleterious effects on affect or reductions in emergent leadership, or indeed if they are simply simultaneous consequences. Our design assumed a simultaneous model and whereas we suspect the effects are simultaneous (at least insofar as post-activity affect is concerned),

further research is needed to disentangle such a possibility. In any case, what we have shown is that, in addition to what one *thinks* of their own emergent leadership capability, the behaviours which cause leadership emergence also likely have consequences for how one *feels* momentarily (i.e., immediately after the group task in our study).

Situation effects

Notwithstanding our claim that both trait and state extraversion cause emergent leadership and our earlier discussion on the mismatch between state introversion and socially-oriented contexts, we would be remiss if we did not address the role of situation effects on our results more broadly. In considering the effect of situations on the generalisability of our findings, we consider here the overarching concept of 'situation strength' (see Judge & Zapata, 2015; Meyer, Dalal, & Hermida, 2010), which can be defined as the 'force' a situation exerts to influence behavior. A 'strong' situation occurs when situational cues primarily govern behavior, whereas a 'weak' situation occurs when situational cues are limited or ambiguous (Caspi & Moffitt, 1993) and hence requires personality to 'fill the gap'. We suggest that emergent leadership is better facilitated when (social) situations exert a relatively weak force and that the effects of extraversion will be strongest in weak situations. Because weak social situations do not impose strong cues upon the group or the individual (e.g., in terms of specifying who should lead), it follows that extraversion (both trait and state) will play a dominant causal role. In the current study, we created an experimental task that we believe simulates informal leadership situations in terms of situational strength in that it provided *some* cues about appropriate behavior (e.g., face-to-face interaction, groups of three or four, an ambiguous task was to be completed, etc.) whilst otherwise allowing individuals to choose their behavioural strategy – it was thus representative of a relatively weak situation. Contrast weak situations to strong situations where, for example, a highly dominant formal leader is appointed or where a specific problem is to be solved and an expert

is present (thus the expert is expected to lead by virtue of their expert power; French & Raven, 1959). In such strong situations, for a non-presumptive leader to emerge, the individual would need to show exceptionally strong extraverted behaviours. It would thus be interesting for future studies to test enacted extraversion (introversion) in combination with different situation strengths to better understand the boundary conditions of the effects we have reported in our study (e.g., testing groups where tasks are very clear and an expert is present, or testing whether the presence of a formally appointed leader impacts emergence). In line with Furr and Funder's (2018) argument that there is plenty of variance to go around with respect to both situation and person variables when explaining social behavior, we predict that trait and state extraversion will still play a role in strong situations, and whilst they will play a *relatively* smaller role compared to the role they play in weak situations, their role in strong situations will not be reduced to zero.

Practical implications

Our results suggest several important implications for organisations and for extraverts and introverts aspiring to leadership positions. First, behaviours are highly relevant proximal causes of how others perceive one's leadership potential. Specific behaviours like acting bold, talkative and energetic and avoiding behaviours like passiveness and shyness improves emergent leadership potential. Both extraverts and introverts are capable of engaging in such behaviours on demand (consistent with other studies; McNiel & Fleeson, 2006; Zelenski et al., 2013). That extraverted behaviours can be enacted without negative emotional consequences is important because our results suggest that if such behaviours are employed on a strategic basis, introverts will benefit compared to if they were to act according to their 'natural' behavioural tendencies.

Second, the importance of state extraversion for emergent leadership is also of immense value to organisations. Indeed, until now, the primary policy implication of the trait

theory of leadership is that organisations should select individuals for leadership roles based on their traits. We suggest that organisations would benefit from setting expectations for extraverted behaviour in situations where emergent leadership in certain individuals is desirable (e.g., unstructured group tasks, team meetings, etc.). Third, and as an extension of the former point, our study shows that behavioural interventions work, which has also been shown in the personality psychology literature (e.g., Margolis & Lyubomirsky, 2020; McNiel & Fleeson, 2006) and more recently in the leadership literature (e.g., Antonakis et al., 2011).

Fourth, our results suggest that individuals (and those managing them) need to be mindful of engaging in introverted behaviour when the context calls for extraverted behaviour. When such a combination is present, reductions in acute well-being (as measured by positive and negative affect) follow, especially for extraverts.

Limitations

We note several limitations. First, the sample was a student sample. Whereas other studies have shown similar findings across study settings, at least insofar as the relationship between trait extraversion and emergent leadership is concerned (Judge et al., 2002; Luria & Berson, 2013), a study drawing from professional leaders would nevertheless be welcome. Second, our experiment included one situational context. Although we encourage replication across settings to test boundary conditions on the effects reported here, we expect our findings will be consistent in situations relevant for informal emergent leadership because they are inherently social in nature (i.e., to be seen as leader-like in the presence of others). The replication of our findings in other non-leadership contexts would also be very interesting (e.g., at networking events, or less formal contexts that may otherwise contribute to formal leadership emergence). Third, we did not test lower level traits at the aspect (DeYoung, Quilty, & Peterson, 2007) or facet level. Replicating our design and manipulating specific behaviours might uncover new insights into which behaviours have the largest effect

in terms of encouraging emergent leadership. Finally, we did not capture subtle behavioural patterns such as body language, eye tracking, tone of voice, and so forth. Such additional behaviours may help to explain why extraverts enjoyed an additional emergent leadership advantage within treatment condition, although care is needed to manage the endogenous nature of these additional behaviours (for ideas, see Antonakis et al., 2010).

Conclusion

That extraverts emerge as leaders more often than introverts is well established, however the literature has not provided much beyond this descriptive observation. Our findings show for the first time that when individuals enact extraversion (and avoid enacting introversion) when engaged in a group-based activity, they are perceived as more leader-like by peers, as well as themselves. A particularly interesting finding is that acting introverted in social contexts produces deleterious effects on self-perceived emergent leadership and affect. In addition, the deleterious effect on affect is particularly pronounced for extraverts acting introverted.

Our findings provide valuable insight into the specific behaviours required to increase emergent leadership potential. As we and other researchers have shown, both introverts and extraverts are capable of counterdispositional behaviour when needed and as such may be able to strategically employ such behaviours to achieve their leadership and career goals. Indeed, an introvert aspiring to become a leader may benefit from such behaviours, especially during opportune times (e.g., when others are watching). In many respects, our results indicate that there is mostly upside potential for introverts compared to their baseline state. The same is not true for extraverts, although such a negative effect for extraverts is offset somewhat by their naturally favourable level of emergent leadership potential and affect. Individuals may therefore need to be mindful of the psychological and emergent leadership

consequences of acting introverted in social contexts and consciously adjust their behaviour should they wish to mitigate such consequences.

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Tables

Table 1.

Participant characteristics across conditions.

	Control condition		Act extraverted treatment					Act introverted treatment				
	M	SD	M	SD	$\lvert t \rvert$	df	p	M	SD	$\lvert t \rvert$	df	p
Age	19.84	3.67	19.40	2.13	1.05	126.61	.296	20.75	4.67	1.29	70.58	.201
Female	0.57	0.50	0.57	0.50	0.02	75.92	.984	0.44	0.50	1.61	86.71	.110
Openness	3.63	0.56	3.67	0.50	0.44	90.61	.662	3.59	0.56	0.42	87.79	.673
Conscientiousness	3.82	0.62	3.70	0.56	1.38	90.54	.172	3.74	0.61	0.89	89.36	.377
Extraversion	3.33	0.70	3.23	0.67	0.89	85.91	.376	3.39	0.73	0.59	85.22	.558
Agreeableness	3.89	0.59	3.95	0.54	0.68	89.17	.496	3.85	0.54	0.45	94.15	.655
Neuroticism	2.66	0.51	2.62	0.56	0.42	77.11	.675	2.71	0.47	0.66	92.50	.513

Note: n (control condition) = 192, n (act extraverted treatment) = 53, n (act introverted treatment) = 55. Welch's two-tailed two sample t-tests are calculated for the treatment conditions in comparison to the control condition. Female is coded as 0 = male and 1 = female.

Table 2.

Intercorrelations, means, standard deviations and reliability scores.

#	Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Age	19.79	3.43	--															
2	Female	0.58	0.49	-.136*	--														
3	Openness	3.64	0.56	.051	-.098	***.73***													
4	Conscientiousness	3.76	0.62	.038	.064	.127*	***.83***												
5	Extraversion	3.32	0.70	-.029	-.114	.264**	.036	***.84***											
6	Agreeableness	3.91	0.55	-.033	.160*	.149*	.218**	.000	***.81***										
7	Neuroticism	2.68	0.51	-.026	.188**	.046	-.192**	-.097	-.307**	***.70***									
8	Control condition	0.65	0.48	-.011	.068	.005	.072	.041	.013	.003	--								
9	E	0.19	0.39	-.054	.019	-.009	-.051	-.117	.016	-.064	-.644**	--							
10	I	0.17	0.38	.070	-.107	.003	-.039	.070	-.033	.062	-.609**	-.215**	--						
11	Extraversion (mc) x E	-0.03	0.29	.011	-.036	.076	-.006	.424**	.031	-.077	.149*	-.231**	.050	--					
12	Extraversion (mc) x I	0.02	0.31	.052	-.028	.122	.057	.443**	.002	-.005	-.078	-.027	.128*	.006	--				
13	EL (peers)	3.43	0.77	-.046	-.132*	.139*	.027	.239**	-.044	.065	.062	.160*	-.245**	.092	.080	***.71***			
14	EL (self)	3.32	0.97	-.094	-.013	.126*	.062	.115	.052	.067	.227**	.180**	-.477**	.086	-.010	.612**	***.93***		
15	Post-activity PA	3.25	0.76	.069	-.027	.083	.234**	.012	.134*	-.064	.141*	.051	-.233**	.000	-.122	.181**	.363**	***.85***	
16	Post-activity NA	1.70	0.76	.055	-.079	-.022	-.068	-.130*	-.135*	.081	-.201**	-.026	.284**	-.038	.043	-.284**	-.301**	-.227**	***.89***

Note: n = 243 after listwise deletion. E = act extraverted treatment (coded as 1 where the control is coded as 0). I = act introverted treatment (coded as 1 where the control is coded as 0). PA = positive affect. NA = negative affect. mc = mean-centred. EL = emergent leadership. SD = standard deviation. Control condition coded as 0 = treatment conditions, control condition = 1. Female coded as 0 = male, 1 = female. Cronbach alpha scores are shown in italics on the diagonal except for EL (peers) which shows the inter-rater agreement coefficient.

* $p < .05$, ** $p < .01$.

Table 3.

Multivariate analysis results and dependent variable covariances.

		Model 1 – without control variables				Model 2 – full model with control variables			
	Par.	*b* / ψ	SE *b*	*p*	β / *r*	*b* / ψ	SE *b*	*p*	β / *r*
Equation 1 (Y_1 = Peer-rated emergent leadership)									
Act extraverted treatment	b_{11}	0.301	.111	.007	.186	0.296	.109	.007	.186
Act introverted treatment	b_{12}	-0.422	.115	< .001	-.265	-0.433	.114	< .001	-.275
Trait extraversion	b_{13}	0.263	.069	< .001	.374	0.245	.072	.001	.355
Act extraverted treatment x trait extraversion	b_{14}	0.020	.169	.907	.009	0.024	.166	.886	.011
Act introverted treatment x trait extraversion	b_{15}	-0.156	.161	.332	-.078	-0.137	.159	.389	-.070
Age	b_{16}	--	--	--	--	-0.010	.012	.376	-.062
Female	b_{17}	--	--	--	--	-0.192	.092	.036	-.158
Openness	b_{18}	--	--	--	--	0.033	.047	.484	.053
Conscientiousness	b_{19}	--	--	--	--	0.239	.209	.252	.089
Agreeableness	b_{110}	--	--	--	--	0.031	.123	.799	.022
Neuroticism	b_{111}	--	--	--	--	0.495	.267	.064	.197
Equation 2 (Y_2 = Self-rated emergent leadership)									
Act extraverted treatment	b_{21}	0.290	.130	.025	.122	0.282	.129	.029	.119
Act introverted treatment	b_{22}	-1.132	.143	< .001	-.484	-1.147	.143	< .001	-.489
Trait extraversion	b_{23}	0.195	.081	.016	.189	0.168	.085	.047	.163
Act extraverted treatment x trait extraversion	b_{24}	0.179	.197	.363	.056	0.193	.196	.326	.060
Act introverted treatment x trait extraversion	b_{25}	-0.175	.192	.362	-.060	-0.137	.192	.477	-.047
Age	b_{26}	--	--	--	--	-0.020	.015	.160	-.083
Female	b_{27}	--	--	--	--	-0.174	.110	.113	-.096
Openness	b_{28}	--	--	--	--	0.075	.056	.182	.081
Conscientiousness	b_{29}	--	--	--	--	0.438	.262	.094	.109
Agreeableness	b_{210}	--	--	--	--	0.153	.147	.298	.071
Neuroticism	b_{211}	--	--	--	--	0.680	.325	.036	.182
Equation 3 (Y_3 = Post-activity positive affect)									
Act extraverted treatment	b_{31}	0.017	.110	.875	.010	0.058	.108	.591	.033
Act introverted treatment	b_{32}	-0.422	.112	< .001	-.243	-0.426	.111	< .001	-.244
Trait extraversion	b_{33}	0.136	.068	.044	.178	0.171	.071	.016	.223
Act extraverted treatment x trait extraversion	b_{34}	-0.187	.168	.268	-.079	-0.233	.167	.162	-.097
Act introverted treatment x trait extraversion	b_{35}	-0.441	.159	.006	-.203	-0.497	.159	.002	-.228

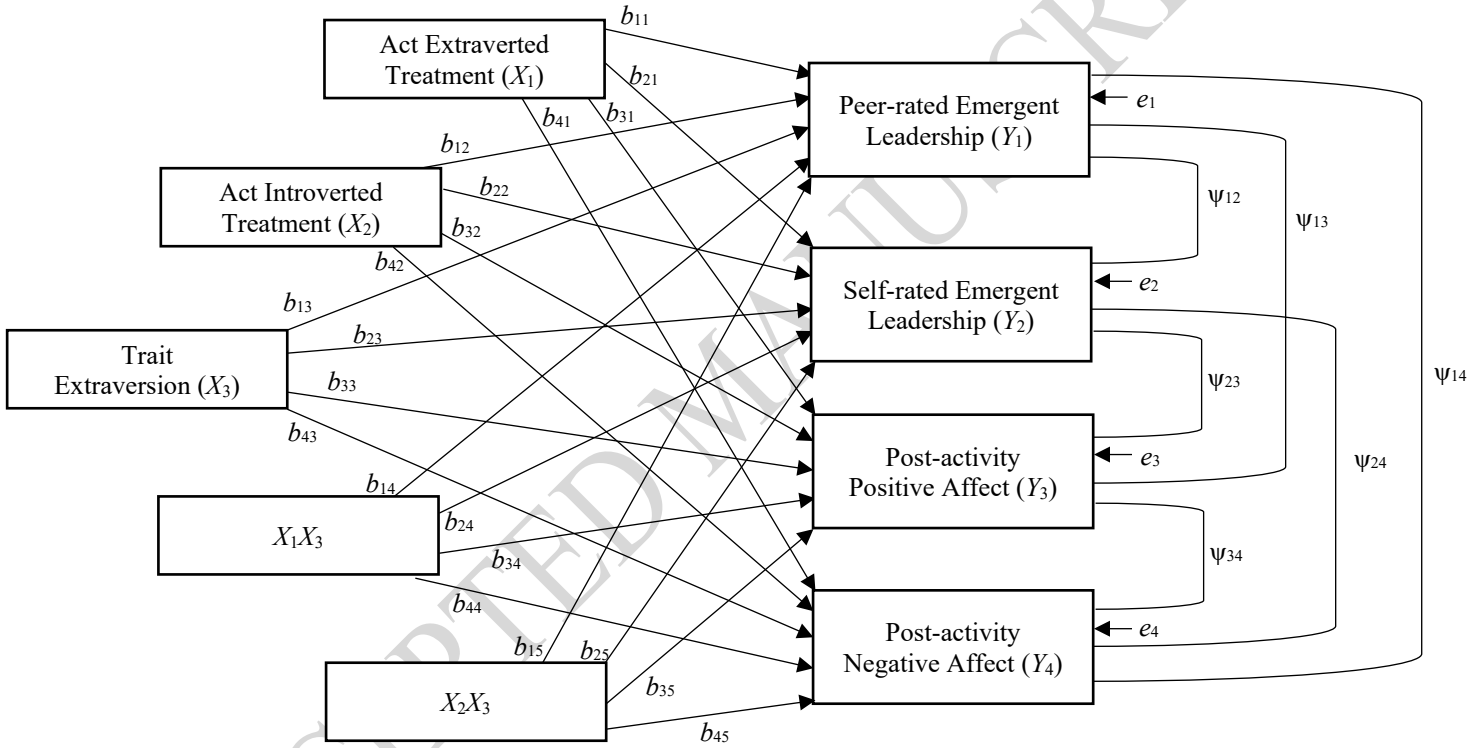
Age	b_{36}	--	--	--	--	0.019	.011	.105	.101
Female	b_{37}	--	--	--	--	-0.066	.090	.462	-.049
Openness	b_{38}	--	--	--	--	-0.028	.047	.553	-.041
Conscientiousness	b_{39}	--	--	--	--	0.666	.244	.006	.223
Agreeableness	b_{310}	--	--	--	--	0.191	.124	.124	.119
Neuroticism	b_{311}	--	--	--	--	0.136	.231	.555	.049
Equation 4 (Y_4 = Post-activity negative affect)									
Act extraverted treatment	b_{41}	-0.048	.113	.669	-.026	-0.063	.112	.576	-.034
Act introverted treatment	b_{42}	0.455	.113	< .001	.248	0.425	.112	< .001	.232
Trait extraversion	b_{43}	-0.204	.070	.004	-.251	-0.239	.074	.001	-.297
Act extraverted treatment x trait extraversion	b_{44}	0.112	.173	.519	.045	0.157	.171	.361	.063
Act introverted treatment x trait extraversion	b_{45}	0.280	.163	.085	.122	0.331	.162	.041	.145
Age	b_{46}	--	--	--	--	-0.004	.012	.727	-.021
Female	b_{47}	--	--	--	--	-0.089	.094	.343	-.063
Openness	b_{48}	--	--	--	--	0.058	.049	.236	.080
Conscientiousness	b_{49}	--	--	--	--	-0.306	.218	.161	-.098
Agreeableness	b_{410}	--	--	--	--	-0.252	.130	.052	-.150
Neuroticism	b_{411}	--	--	--	--	0.065	.236	.784	.022
Covariance with peer-rated emergent leadership									
Self-rated emergent leadership	ψ_{12}	0.307	.048	< .001	.732	0.281	.046	< .001	.720
Post-activity positive affect	ψ_{13}	0.054	.030	.069	.154	0.053	.028	.059	.165
Post-activity negative affect	ψ_{14}	-0.089	.031	.005	-.242	-0.096	.030	.001	-.281
Covariance with self-rated emergent leadership									
Post-activity positive affect	ψ_{23}	0.162	.037	< .001	.331	0.155	.036	< .001	.338
Post-activity negative affect	ψ_{24}	-0.093	.037	.012	-.180	-0.093	.035	.009	-.192
Covariance with post-activity positive affect									
Post-activity negative affect	ψ_{34}	-0.108	.031	.001	-.251	-0.086	.029	.004	-.214

Note: Model 1 n = 264. Model 2 n = 243. Full information maximum likelihood estimation. Treatments are coded as 0 = control, 1 = treatment. b = unstandardised regression coefficient, ψ = covariance coefficient, β = standardised regression coefficient, r = correlation.

Figures

Figure 1.

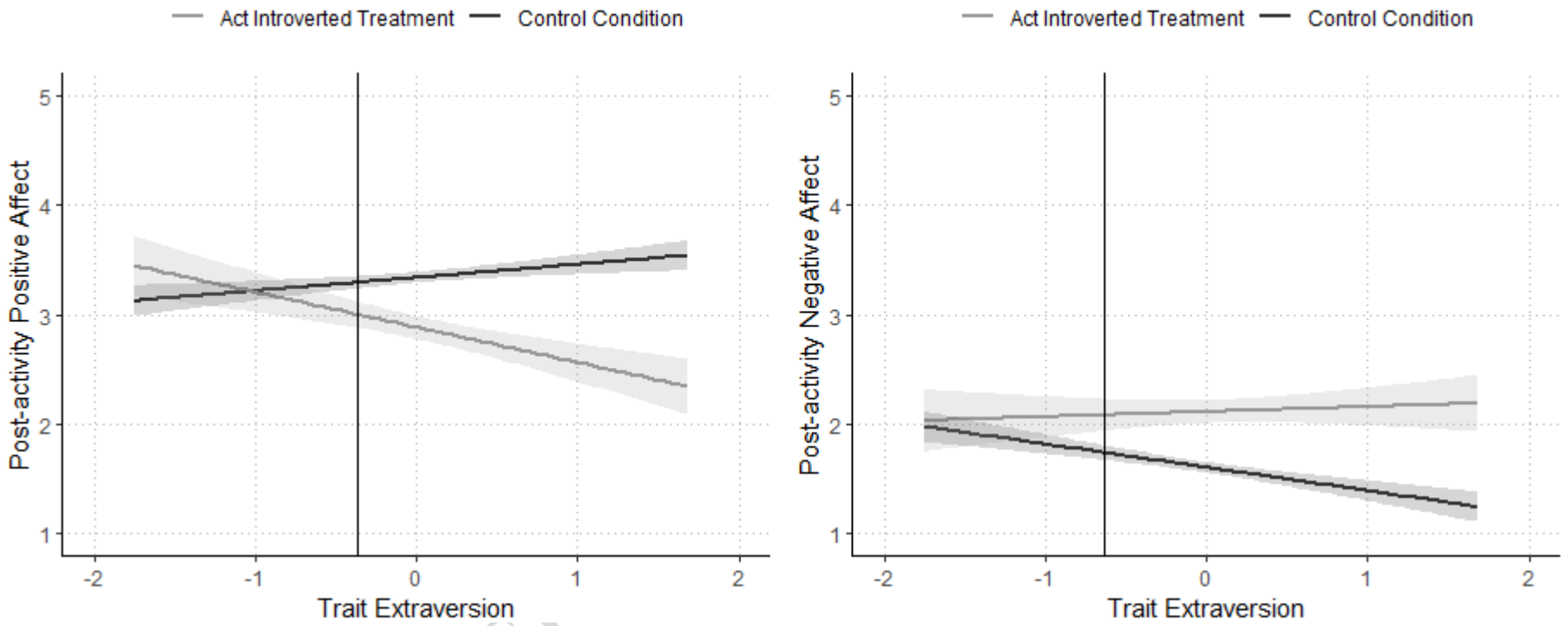
Multivariate model.



Note: X_1X_3 denotes the act extraverted treatment x trait extraversion interaction term and X_2X_3 denotes the act introverted treatment x trait extraversion interaction term. To minimise clutter, control variables (age, female, openness, conscientiousness, agreeableness, neuroticism) are not shown. All variables are free to covary. All relevant variables are modelled as latent variables.

Figure 2.

Johnson-Neyman analysis for post-activity positive affect and post-activity negative affect.



Note: The vertical line indicates the point at which the simple effect between the act introverted treatment and the control condition becomes significant (correcting for false discovery rate) at an alpha of .05. Shaded areas represent ± 1.0 standard error of the respective estimate. Trait extraversion is mean-centred.

Appendix

Appendix 1.

Missing data statistics against each dependent variable.

		Peer-rated emergent leadership			Self-rated emergent leadership			Post-activity positive affect			Post-activity negative affect		
Variable	Group	Missing	Not mis.	*p*	Missing	Not mis.	*p*	Missing	Not mis.	*p*	Missing	Not mis.	*p*
Age	--	18.2 (1.0)	20.0 (3.7)	.357	21.6 (5.5)	19.8 (3.4)	.016	18.3 (1.5)	20.0 (3.7)	.450	18.3 (1.5)	20.0 (3.7)	.450
Female	Male	4	124	.088	20.0	108	.013	1	127	.750	1	127	.750
	Female	0	154		9	145		3	151		3	151	
Openness	--	3.8 (0.4)	3.6 (0.6)	.503	3.6 (0.5)	3.6 (0.6)	.594	3.6 (0.9)	3.6 (0.5)	.804	3.6 (0.9)	3.6 (0.5)	.804
Conscientiousness	--	4.1 (0.6)	3.8 (0.6)	.365	4.0 (0.5)	3.8 (0.6)	.078	4.1 (0.4)	3.8 (0.6)	.258	4.1 (0.4)	3.8 (0.6)	.258
Extraversion	--	3.3 (0.8)	3.3 (0.7)	.918	3.3 (0.7)	3.3 (0.7)	.701	3.4 (0.8)	3.3 (0.7)	.771	3.4 (0.8)	3.3 (0.7)	.771
Agreeableness	--	4.0 (0.5)	3.9 (0.6)	.783	3.9 (0.6)	3.9 (0.6)	.769	3.6 (0.6)	3.9 (0.6)	.286	3.6 (0.6)	3.9 (0.6)	.286
Neuroticism	--	2.3 (0.7)	2.7 (0.5)	.168	2.6 (0.5)	2.7 (0.5)	.322	2.4 (0.3)	2.7 (0.5)	.165	2.4 (0.3)	2.7 (0.5)	.165
E	Control group	4	243	.785	32	215	.094	5	242	.999	5	242	.999
	Treatment group	0	53		2	51		1	52		1	52	
I	Control group	1	244	.022	23	222	.045	4	241	.670	4	241	.670
	Treatment group	3	52		11	44		2	53		2	53	

Note: $n = 300$. E = act extraverted treatment. I = act introverted treatment. No mis. = not missing. The 'Group' column details the levels within the variable if not a continuous variable. For continuous variables, the mean and standard deviation (in parentheses) are shown in the 'Missing' and 'Not Mis.' columns. For categorical variables, the number of participants in each group are shown. *p*-values show whether there is a significant difference in the variable between the missing and not missing participants (based on a Kruskal-Wallis test for continuous variables and a chi-squared test with the Yates correction for categorical variables).

Appendix 2.

Intercorrelations, means, standard deviations and reliability scores (control condition participants only).

#	Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11
1	Age	19.76	3.57	--										
2	Female	0.61	0.49	-.223**	--									
3	Openness	3.64	0.56	.102	-.135	***.72***								
4	Conscientiousness	3.80	0.63	.039	.134	.117	***.83***							
5	Extraversion	3.34	0.69	-.085	-.138	.277**	.020	***.83***						
6	Agreeableness	3.91	0.58	-.001	.227**	.205**	.161*	-.021	***.83***					
7	Neuroticism	2.68	0.50	-.010	.194*	.004	-.116	-.101	-.238**	***.72***				
8	EL (peers)	3.47	0.73	-.031	-.175*	.097	.073	.272**	-.025	-.031	***.72***			
9	EL (self)	3.48	0.83	-.083	-.009	.198*	.139	.148	.059	.103	.562**	***.90***		
10	Post-activity positive affect	3.33	0.70	.076	.029	.166*	.273**	.110	.174*	-.052	.106	.275**	***.82***	
11	Post-activity negative affect	1.59	0.68	.131	-.048	-.056	-.100	-.228**	-.202*	.039	-.307**	-.226**	-.107	***.89***

Note: $n = 157$ after listwise deletion. mc = mean-centred. EL = emergent leadership. SD = standard deviation. Female coded as 0 = male, 1 = female. Cronbach alpha scores are shown in italics on the diagonal except for EL (peers) which shows the inter-rater agreement coefficient.

* $p < .05$, ** $p < .01$.

Appendix 3

Multivariate analysis results and dependent variable covariances after listwise deletion.

		Model 1 – without control variables				Model 2 – full model with control variables			
	Par.	*b* / ψ	SE *b*	*p*	β / *r*	*b* / ψ	SE *b*	*p*	β / *r*
Equation 1 (Y_1 = Peer-rated emergent leadership)									
Act extraverted treatment	b_{11}	0.320	.128	.012	.210	0.270	.138	.049	.176
Act introverted treatment	b_{12}	-0.410	.146	.005	-.242	-0.495	.164	.003	-.279
Trait extraversion	b_{13}	0.229	.086	.008	.323	0.218	.104	.037	.306
Act extraverted treatment x trait extraversion	b_{14}	0.049	.205	.811	.023	0.043	.224	.849	.020
Act introverted treatment x trait extraversion	b_{15}	-0.082	.202	.684	-.041	-0.012	.220	.958	-.006
Age	b_{16}	--	--	--	--	0.000	.018	.982	.002
Female	b_{17}	--	--	--	--	-0.200	.119	.093	-.161
Openness	b_{18}	--	--	--	--	0.008	.067	.905	.013
Conscientiousness	b_{19}	--	--	--	--	0.315	.378	.405	.087
Agreeableness	b_{110}	--	--	--	--	0.086	.143	.547	.067
Neuroticism	b_{111}	--	--	--	--	0.337	.306	.272	.138
Equation 2 (Y_2 = Self-rated emergent leadership)									
Act extraverted treatment	b_{21}	0.261	.143	.069	.122	0.260	.148	.078	.122
Act introverted treatment	b_{22}	-1.066	.172	< .001	-.447	-1.240	.188	< .001	-.506
Trait extraversion	b_{23}	0.146	.095	.125	.147	0.117	.111	.291	.119
Act extraverted treatment x trait extraversion	b_{24}	0.300	.235	.201	.100	0.400	.245	.102	.134
Act introverted treatment x trait extraversion	b_{25}	-0.033	.230	.885	-.012	0.111	.239	.642	.039
Age	b_{26}	--	--	--	--	-0.029	.019	.136	-.101
Female	b_{27}	--	--	--	--	-0.297	.129	.021	-.173
Openness	b_{28}	--	--	--	--	0.014	.073	.849	.016
Conscientiousness	b_{29}	--	--	--	--	0.780	.485	.108	.155
Agreeableness	b_{210}	--	--	--	--	0.195	.156	.212	.111
Neuroticism	b_{211}	--	--	--	--	0.676	.377	.073	.200
Equation 3 (Y_3 = Post-activity positive affect)									
Act extraverted treatment	b_{31}	-0.078	.124	.529	-.048	-0.061	.135	.650	-.037
Act introverted treatment	b_{32}	-0.417	.144	.004	-.231	-0.419	.161	.009	-.221
Trait extraversion	b_{33}	0.017	.082	.834	.023	0.033	.101	.745	.043
Act extraverted treatment x trait extraversion	b_{34}	-0.185	.204	.364	-.081	-0.131	.224	.558	-.057
Act introverted treatment x trait extraversion	b_{35}	-0.281	.202	.164	-.130	-0.360	.221	.103	-.165

Age	b_{36}	--	--	--	--	0.014	.018	.425	.064
Female	b_{37}	--	--	--	--	-0.071	.117	.546	-.053
Openness	b_{38}	--	--	--	--	-0.007	.067	.921	-.010
Conscientiousness	b_{39}	--	--	--	--	0.887	.488	.069	.229
Agreeableness	b_{310}	--	--	--	--	0.108	.142	.448	.079
Neuroticism	b_{311}	--	--	--	--	-0.054	.286	.850	-.021
Equation 4 (Y_4 = Post-activity negative affect)									
Act extraverted treatment	b_{41}	0.031	.124	.805	.018	-0.016	.130	.903	-.009
Act introverted treatment	b_{42}	0.521	.142	< .001	.270	0.613	.155	< .001	.309
Trait extraversion	b_{43}	-0.209	.084	.013	-.260	-0.272	.100	.007	-.341
Act extraverted treatment x trait extraversion	b_{44}	0.049	.204	.810	.020	0.067	.216	.755	.028
Act introverted treatment x trait extraversion	b_{45}	0.591	.203	.004	.257	0.713	.214	.001	.312
Age	b_{46}	--	--	--	--	-0.002	.017	.894	-.010
Female	b_{47}	--	--	--	--	-0.006	.113	.960	-.004
Openness	b_{48}	--	--	--	--	0.106	.065	.101	.154
Conscientiousness	b_{49}	--	--	--	--	0.081	.346	.816	.020
Agreeableness	b_{410}	--	--	--	--	-0.308	.141	.029	-.216
Neuroticism	b_{411}	--	--	--	--	0.144	.279	.606	.053
Covariance with peer-rated emergent leadership									
Self-rated emergent leadership	ψ_{12}	0.282	.053	< .001	.694	0.274	.053	< .001	.730
Post-activity positive affect	ψ_{13}	0.066	.035	.058	.195	0.099	.038	.009	.303
Post-activity negative affect	ψ_{14}	-0.108	.036	.003	-.311	-0.118	.037	.001	-.364
Covariance with self-rated emergent leadership									
Post-activity positive affect	ψ_{23}	0.171	.043	< .001	.373	0.162	.043	< .001	.393
Post-activity negative affect	ψ_{24}	-0.101	.040	.010	-.216	-0.096	.038	.012	-.235
Covariance with post-activity positive affect									
Post-activity negative affect	ψ_{34}	-0.071	.034	.037	-.183	-0.071	.035	.041	-.199

Note: Model 1 n = 264 after listwise deletion. Model 2 n = 243 after listwise deletion. Treatments are coded as 0 = control, 1 = treatment. b = unstandardised regression coefficient, ψ = covariance coefficient, β = standardised regression coefficient, r = correlation.