**Predicting Leadership Initiative and its Success:
A New Perspective on Leadership Emergence**

Mojzisch, Andreas*¹, Prüfer, Johanna*^{2,3}, & Schulz-Hardt, Stefan^{2,3}

*shared first authorship

¹Institute of Psychology, University of Hildesheim, Germany

²Institute of Psychology, University of Goettingen, Germany

³Leibniz Science Campus Primate Cognition, Goettingen, Germany

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Correspondence to: Andreas Mojzisch, Institute of Psychology, University of Hildesheim, Universitätsplatz 1, 31141 Hildesheim, Germany; email: mojzisch@uni-hildesheim.de

Abstract

Research on leadership emergence seeks to identify the mechanisms and variables that determine who will become leader in a group. In this paper, we aim to provide a new perspective on leadership emergence by disentangling two leadership components: (a) leadership initiative and (b) its success in attracting followers. Furthermore, in contrast to previous research on leadership emergence that focused almost exclusively on perceived leadership (usually assessed by questionnaires), we employed behavioral measures of both leadership components. In two large-scale lab studies (overall $N = 754$), we used an extensive set of variables as predictors of both leadership components, including not only a large number of personality traits and general intelligence, but also physical and physiological traits, such as facial attractiveness, height, waist-to-hip ratio, and testosterone. Across both studies, intelligence was the only robust predictor of both leadership components. In addition, leadership initiative was robustly predicted by extraversion and subjective competence, whereas success of leadership initiative was robustly predicted by the accuracy of the proposed answers. Importantly, several variables that were previously found to be related to leadership emergence, such as dominance, self-esteem, self-monitoring, self-efficacy, narcissism, height, and attractiveness, failed to predict any of the two leadership components in our studies.

Predicting Leadership Initiative and its Success: A New Perspective on Leadership Emergence

Over the last 100 years, researchers have been studying extensively which personality traits predict leadership emergence in groups with no formal leader. Early studies conducted during the first decades of the 20th century (e.g., Bingham, 1919; Kohs & Irle, 1920) gave rise to *trait theories* which assumed that leadership depended on the personal traits of the leader. The essence of this idea was captured by Cowley (1931) who argued that “the approach to the study of leadership has usually been and perhaps must always be through the study of traits” (p. 144).

About two decades later, however, this enthusiasm started to vanish. Although several studies had found a relation between personality traits and leadership emergence, Stogdill (1948) concluded in his review: “The findings suggest that leadership is not a matter of passive status or of the mere possession of some combination of traits” (p. 66). Mann (1959) reached a similar pessimistic conclusion. Stogdill’s and Mann’s reviews had a substantial impact on leadership research, resulting in trait theories quickly falling out of favor among leadership scholars (for a historical analysis of the trait approach to leadership, see Day & Zaccaro, 2007). It is the merit of Kenny and Zaccaro (1983) and Lord, De Vader, and Alliger (1986) to having re-established the notion that personality traits are related to leadership emergence. In their meta-analysis of the data used in Mann’s (1959) review, Lord et al. found intelligence, masculinity, and dominance to be significant predictors of leadership emergence.

Today, it is well-established that personality traits are related to leadership emergence. For example, in their meta-analysis, Judge, Bono, Ilies, and Gerhardt (2002) reported that the Big Five traits had a multiple correlation of $R = .53$ with leadership emergence. Since then, a mounting number of studies found personality traits to be predictive of leadership emergence.

These traits include, in addition to the Big Five traits: intelligence, dominance, motivation to lead, self-esteem, self-efficacy, self-monitoring, narcissism, physical fitness, attractiveness, height, and gender (for reviews and meta-analyses, see Acton, Foti, Lord, & Gladfelter, 2019; Badura, Grijalva, Newman, Taiyi Yan, & Jeon, 2018; Ensari, Riggio, Christian, & Carslaw, 2011; Judge, Piccolo, & Kosalka, 2009). Notwithstanding this empirical evidence, the litany of criticisms of the trait approach to leadership emergence remained (e.g., Conger & Kanungo, 1998; House & Aditya, 1997).

In this paper, we join other scholars in criticising the trait approach to leadership emergence. However, we do not argue that this approach is inherently flawed. Rather, we are not convinced of how leadership emergence is typically conceptualized and measured in studies applying the trait approach. We develop an empirical framework on how to address the shortcomings of previous studies on leadership emergence, and we present the results of two large-scale lab studies (overall $N = 754$) in which we applied a revised trait-based approach to leadership emergence.

Disentangling Leadership Initiative and its Success in Attracting Followers

As recently criticized by Acton et al. (2019), in the traditional leader trait paradigm “researchers typically study the outcome of the process” (p. 146). Thus, in a prototypical study applying the trait approach to leadership emergence, researchers measure several traits that could be related to leadership emergence. Leadership emergence is then assessed by asking group members to complete questionnaires requiring them to rate the extent to which each group member, including themselves, served as a leader. As a consequence, the process of leadership emergence remains a black box in these studies (see also Guastello, 2007). In particular, the focus on the outcome of the process neglects the fact that leadership is a mutual *social* influence

process. Thus, it critically neglects the followers' role in the process of leadership emergence.

In this paper, we argue that research on leadership emergence can be substantially advanced by introducing a differentiation between two components of leadership: (a) leadership initiative and (b) its success in attracting followers. This differentiation is based on the notion that leadership necessarily implies followership: In order to emerge as a leader, a group member does not only have to attempt to lead others (i.e., showing leadership initiative), but he or she also has to be successful in attracting followers.

Arguably, the two leadership components are not fully independent from each other: If a group member does not initiate leadership, he or she cannot attract followers. At the same time, however, it is plausible that both components are differently related to personality traits. Thus, variables that predict whether or not a particular group member attempts to lead a group (i.e., leadership initiative) need not necessarily be identical with those variables that affect the success of such attempts (i.e., followership). For example, high narcissism might make it more likely that someone takes initiative and tries to lead a group, but might actually be detrimental to the success of such attempts. In our studies, we hence measured (a) leadership initiative and (b) its success in attracting followers as two separate variables, and then examined whether and to what extent these two variables can be predicted by a large set of traits.

Behavioral measures of Leadership Initiative and its Success

A further contribution of our research is that we measured both leadership components on a strictly behavioral level. This is not only a methodological, but also an important conceptual issue. Strikingly, almost all definitions of leadership emergence refer to whether or not an individual is *perceived* as a leader. For example, according to Judge et al. (2002) "leader emergence refers to whether (or to what degree) an individual is viewed as a leader by others"

(p. 767). Similarly, Acton et al. (2019) referred to leadership emergence as “the process by which individuals become influential in the perceptions of others” (p. 145). In our view, a significant weakness of conceptualizing and measuring leadership emergence in terms of leadership perception is that some of the yet empirically validated predictors of leadership emergence may in fact reflect stereotypes associated with leadership rather than variables that actually promote leadership emergence (for a similar argument, see Kaiser, Hogan, & Craig, 2008). Stated differently, participants might perceive a group member as a leader because he or she matches their stereotype of a leader though this group member is not actually leading the group. For example, the fact that masculinity has been found to be related to leadership emergence (Lord et al., 1986) is unlikely due to masculine-looking individuals having a stronger impact on group processes than feminine-looking individuals. Rather, this finding is likely due to the fact that men are seen as more similar to the leader stereotype than women (Heilman, 2001; Koenig, Eagly, Mitchell, & Ristikari, 2011).

Behavioral measures of leadership emergence have been rarely used (for exceptions, see Brunell et al., 2008; Eby et al., 2003; Foti & Hauenstein, 2007). Hence, we have only limited evidence on whether perceptual and behavioral measurements of leadership emergence correspond to each other. Evidence from the few studies using behavioral measurements shows only partial (Eby et al., 2003) or even no (Brunell et al., 2008) support for accordance of these two types of measures. These results are in line with several other studies showing that group members’ perceptions may differ substantially from the behaviors shown by the assessed person (Courtright, Fairhurst, & Rogers, 1989; Fairhurst, Green, & Courtright, 1995). With these considerations in mind, we decided to measure both (a) leadership initiative and (b) its success in attracting followers on a strictly behavioral level (for details, see below).

Additional Contributions of our Research

In addition to the two main contributions of our research discussed above, we aimed to advance research on leadership emergence in three further ways: First, in almost all previous studies on leadership emergence only a relatively small set of traits (typically about three to seven) were included as predictors. While we are aware of the problem of overfitting, including only a small number of traits entails the risk of detecting spurious correlations. To illustrate, suppose a study measured narcissism as potential predictor of leadership emergence but did not include extraversion as additional predictor. If this study found narcissism to be a significant predictor, we cannot exclude that this result is due to narcissism being related to extraversion which, then, might be the true predictor of leadership emergence (in this sense, we applaud Brunell et al., 2008, for including both narcissism and the Big Five traits in their studies). In our research, we hence decided to include a large set of potential predictors in our regression model.

Second, in addition to the variables typically examined in research on leadership emergence (i.e., the “usual suspects”, such as intelligence and the Big Five traits) we aimed to investigate the effect of several further variables that have been neglected in this area of research – although it is highly likely that they might predict at least one of the two leadership components. These variables are: subjective competence, risk-taking tendency, testosterone, implicit power motive, the dominance, prestige, and leadership motive, and, finally, perceived trustworthiness (a justification for our selection of variables will be given below).

Third, we aimed to examine whether group gender composition moderates the effect of inter-individual differences on leadership emergence. Previous research investigated groups consisting of either both women and men (e.g., Brunell et al., 2008; Lemoine, Aggarwal, & Steed, 2016), only men (e.g. Campbell et al., 2002), especially in military contexts (e.g., Atwater

et al., 1999; Paunonen et al., 2006), or female-only groups (e.g. Gershenoff & Foti, 2003; Gruber et al., 2018). Surprisingly, the effect of group gender composition was rarely investigated in previous research (for an exception, see Lemoine et al., 2016). Hence, it remains unclear whether group gender composition moderates the effect of personality traits on leadership emergence. To fill this gap, we experimentally manipulated group gender composition.

The Present Research

We included 23 variables as predictors of leadership initiative and 25 variables as predictors of success of leadership initiative (the difference between the two numbers will be explained below). Table 1 gives an overview of these variables and the predicted relationships with the two leadership components. It is beyond the scope of the present paper to elaborate on all 46 predicted relationships. Below we will briefly discuss the predicted relationships for those variables that have been neglected by previous research. The predicted relationships for those variables that have been established in previous studies as predictors of leadership emergence were derived from these studies. However, since these studies did not distinguish between leadership initiative and its success, the predicted relationships should be considered as tentative.

The established variables that we included in our studies are: intelligence, the Big Five traits, self-esteem, self-monitoring, dominance, general self-efficacy, narcissism, height, waist-to-hip-ratio, perceived attractiveness, and perceived competence. Furthermore, we included several additional variables that have been neglected in previous research on leader emergence. We will take a deeper look at these variables in the next sections.

First, we included subjective competence. We decided to do so since it is plausible that an individual's own assessment of his or her competence in solving a task makes him/her more likely to show leadership initiative. It is even possible that the relation between intelligence and

leadership emergence found in previous studies (for a meta-analysis, see Judge, Colbert, & Ilies, 2004) might be due to intelligent group members feeling more competent in solving a task and, hence, being more likely to show leadership initiative. We hypothesized that subjective competence is related to leadership initiative (but not to success of leadership initiative).

Second, we included risk-taking tendency as a predictor. Although the act of emerging as a leader involves taking risks (Amos & Klimoski, 2014), the effect of an individual's risk-taking tendency on leadership emergence has so far not been investigated. This is surprising given that in case of groups with no formal leaders, attempts to initiate leadership almost always entail the risk that the other group members will not follow – which is likely to cause a loss of face. We hypothesized that risk-taking tendency is related to leadership initiative but not to its success.

Third, to explore the relation between individual differences in status-seeking and leadership emergence, we measured testosterone, the implicit power motive and the dominance, prestige, and leadership motive. We hypothesized that this set of variables is related to leadership initiative but not to its success. We included testosterone since it has been repeatedly found that testosterone is related to status seeking (for a review, see Eisenegger, Haushofer, & Fehr, 2011). As discussed from an evolutionary perspective (Van Vugt & Smith, 2019), while in human societies leadership and status are often correlated, not all leaders are necessarily high-status individuals, and not all high-status individuals are leaders.

Finally, we included perceived trustworthiness as a predictor variable. Accurately assessing whether or not someone is trustworthy is an important social skill, in particular, when making a decision whether or not to accept someone as leader. In line with this notion, facial trustworthiness has been found to be associated with managers' position within occupational hierarchies (Linke, Saribay, & Kleisner, 2016). In the present study, we expected perceived

trustworthiness to predict success of leadership initiative (but not leadership initiative).

Method

We conducted two large-scale lab experiments to test the robustness of our results across different tasks and different samples. In both studies, we collected data on the predictor variables before measuring the criterion variables during a face-to-face group interaction in the lab.

Because we also wanted to explore to which extent the influence of predictor variables on the two components of leadership emergence might depend on group gender composition, the latter was experimentally manipulated in both studies (mixed-gender vs. male vs. female).

In both studies, participants took part in two sessions. In the first session, we collected data on most of the predictor variables. At least two days later, participants were invited to the laboratory for the measurement of the remaining predictor variables and our criterion variables. Although the “cleanest” solution might have been to measure all predictor variables during the first session, we abstained from doing so due to two reasons: First, we aimed to prevent the first session from becoming too lengthy. Second, since we aimed to maximize the predictive value of testosterone, we decided to take the saliva samples immediately before the group task. In the second session, participants worked in groups on either a series of trials of a quantitative estimation task (Study 1) or a series of trials of a wilderness survival task (Study 2). In each trial, groups had to decide between four (Study 1) or three (Study 2) choice options. Participants were instructed that, in each trial, one of the group members was supposed to propose an answer (i.e., pick one of the choice options), and then explain why he/she considers it to be correct in order to convince the other group members to vote for it. Then, the other group members were supposed to indicate whether they agreed with the proposed answer or not. Leadership initiative was operationalized as the number of times a group member proposed an answer. Success of

leadership initiative was measured by whether or not the proposed answers were followed by the other group members. Hence, we measured both components of leadership emergence on a strictly behavioral level.

Thereafter, participants were asked to answer a set of follow-up questions. All questionnaires and tasks were presented on a computer. All materials can be found on the Open Science Framework (<https://osf.io/f7wj9/>). We obtained ethics approval for both studies from the local ethics committee.

Since we used the same predictor and criterion variables in both studies, we will first describe these variables. Thereafter, we will turn to the specifics of each study.

Predictor variables

General intelligence. To assess general intelligence, we used six subtests from the Intelligence Structure Test 2000 R (Form A; Liepmann, Beauducel, Brocke, & Amthauer, 2007). The test's basic module measures verbal, numerical, and figural intelligence with three subtests. Because of time constraints, we only used two subtests for each of the three dimensions. We conducted a principal component analysis to obtain a general measure of intelligence (g factor) for each participant. Only one factor had an eigenvalue over Kaiser's criterion (> 1), suggesting that there is only one strong first factor. Hence, we extracted the first, unrotated factor and subsequently received the resulting factor score for each participant.

Subjective competence. Before the group interaction, participants individually worked on three items to become familiar with the task. We asked the participants to assess their competence in solving these items on a Likert scale from 1 (not good at all) to 7 (very good).

Big Five. To measure the big five traits, we used the Big Five Inventory (BFI; John, Naumann, & Soto, 2008). The BFI consists of 42 items and measures extraversion (8 items),

agreeableness (8 items), openness for experiences (10 items), conscientiousness (9 items), and neuroticism (7 items). The items were rated on Likert scales from 1 (totally disagree) to 5 (totally agree). For each personality dimension, we calculated mean values.

Narcissism. To measure narcissism, we used the Narcissistic Personality Inventory (NPI; Raskin & Hall, 1979; Raskin & Terry, 1988) which consists of 40 statement pairs. For each pair, participants were asked to choose the statement they identify with the most. According to the selected statements, they received either 0 or 1 point, resulting in a sum score between 0 and 40.

Self-monitoring. Self-monitoring was assessed using the Self-Monitoring Scale (Lennox & Wolfe, 1984). Participants were asked to indicate how often they engage in social situations described by 13 items on Likert scales from 1 (always wrong) to 6 (always true). Total scores (e.g., Ellis, 1988; Foti & Hauenstein, 2007) were computed, with a possible range from 13 to 78.

Self-esteem. Self-esteem was measured with the Rosenberg Self-Esteem Scale (Rosenberg, 1965), consisting of 10 items. Participants answered the items on 4-point Likert scales from 1 (strongly disagree) to 4 (strongly agree). We subsequently calculated mean scores.

General self-efficacy. To assess general self-efficacy, we used the General Self-Efficacy Scale (GSE; Sherer & Adams, 1983). The scale consists of 10 items on 4-point Likert scales from 1 (strongly disagree) to 4 (strongly agree). As prescribed, we calculated a mean score.

Dominance. Dominance was measured using the dominance subscale from the Personality Research Form (PRF; Form KB; Jackson, 1967, 1974). The scale consists of 16 statements. Participants had to disagree or agree with these statements, receiving either 0 or 1 point for each answer. Dominance scores had a possible range from 0 to 16.

Risk-taking tendency. To assess risk-taking tendency, we used the Domain-specific Risk-taking Scale (Johnson, Wilke, & Weber, 2004; Weber, Blais, & Betz, 2002). For 40

different risky behaviors, participants had to indicate how likely they are to engage in each behavior on 5-point Likert scales from 1 (very unlikely) to 5 (very likely). We calculated a mean score over all items (in accordance with Foster, Shenese, & Goff, 2009).

Dominance, prestige, and leadership motive. To assess the dominance, prestige and leadership motive, we used the short version of the dominance, prestige, and leadership motive scales (Suessenbach et al., 2018) which consists of 18 items, six for each facet. The items consist either of statements or goals. Participants indicated their agreement with statements on Likert scales, ranging from 1 (strongly disagree) to 6 (strongly agree). For goal items, participants indicated on Likert scales from 1 (not important at all) to 6 (very important), how important the described goals were for them. We calculated sum scores for each facet.

Implicit power motive. We assessed the implicit power motive using the Picture Story Exercise (PSE). In the PSE, several ambiguous pictures are presented, and participants are asked to write imaginative stories about these pictures. The written stories are scored according to the amount of motive-related imagery, defined as the attribution of an action, wish, concern or internal state to others (Winter, 1994). The amount of imagery related to each motive serves as an approximation for the strength of the implicit motive (Schönbrodt et al., 2018). In general, the PSE can be used to assess the implicit power, affiliation, and achievement motive. Because we focused on the implicit power motive, we followed a recommendation to use pictures aiming at the targeted motive (Schönbrodt et al., 2018) and, hence, chose pictures having a high pull on power imagery. We used two pictures from the standard set (Schultheiss & Pang, 2007) and three new pictures (Schönbrodt et al., 2018). For each picture, participants were given four minutes to write a story. The pictures were presented in a randomized order, and stories were coded according to the standard procedure suggested by Winter (1994). Stories were coded by

one trained coder. The coder reached a high interrater reliability with expert coded material, ICC > .85. In line with Schultheiss and Pang (2007), we controlled for word count by residualizing motive scores for word count and extracting residual scores per person.

Testosterone. Testosterone was measured in pg/ml using saliva samples. Participants were asked to avoid exercising, consuming alcohol, or any kind of drugs the day of the second session, refrain from caffeine three hours before the appointment, brushing their teeth or smoking cigarettes one hour before the appointment (Kordsmeyer, Hunt, Puts, Ostner, & Penke, 2018). Samples were provided between noon and 6 pm to control for circadian fluctuations (Schultheiss & Stanton, 2009). Participants were asked to provide at least saliva via passive drool through a straw (Schultheiss et al., 2012). Samples were stored immediately in an ultra-low temperature freezer at -80°C. After finishing the data collection, samples were analyzed using high sensitivity immunoassay with chemiluminescence detection (CLIA, IBL-International, Hamburg, Germany). The intra-assay and inter-assay coefficients were below 7%. We winsorized outliers to 3 SDs to their gender means (Mehta, Welker, Zilioli, & Carré, 2015). The resulting testosterone values were positively skewed and, therefore, not normally distributed (Shapiro-Wilk test $W < 0.95$, $p < .001$). To normalize the data for subsequent analyses, the testosterone values were log10-transformed (Mehta et al., 2015).

Waist-to-hip-ratio and body height. We created 3D body scans using a Vitus Smart XXL 3D bodyscanner, running Anthroscan software (both Human Solutions GmbH, Kaiserslautern). Each participant was scanned three times. All measures were averaged across the three scans. Waist-to-hip-ratio was calculated by dividing each participant's mean waist girth by their mean hip girth. Reliabilities for the waist and hip girth were high, both ICCs = .99.

Facial attractiveness, perceived competence, and trustworthiness. After data

collection, we ran a rating study to obtain average facial attractiveness, perceived competence, and trustworthiness for each participant. External raters ($N = 94$ in Study 1 and $N = 90$ in Study 2) rated photos of the participants' faces. Each rater saw a subset of the full sample with an equal amount of male, female, and mixed-gender groups. We decided to split the sample into three subsets to give the raters a reasonable number of persons to rate, making sure that each participant was rated by at least $n = 30$ raters. Raters were asked to score each participant's facial attractiveness, competence, and trustworthiness on Likert scales from 1 (not at all) to 7 (a lot). Ratings for each participant and dimension were averaged.

Accuracy of proposed answers. Because it would represent a highly reasonable strategy to follow someone who provides accurate answers, we calculated the mean accuracy of the suggested answers for each participant. Values ranged from 0 (proposed answers were never correct) to 1 (proposed answers were always correct) and were only used for predicting success of leadership initiative.

Follow-up questions

After the group task, participants were asked to answer a number of follow-up questions.

Perceived leadership initiative. We asked participants to rate each group member including themselves with regard to the degree they perceived that this person proposed answers during the group task. Ratings were made on a Likert scale from 1 (*not at all*) to 7 (*a lot*).

General leadership impression. The general leadership impression scale is a classic tool to measure leadership perceptions (Cronshaw & Lord, 1987). We asked participants to assess their group members and themselves on five items according to their appearance as a leader on Likert scales from 1 (*not at all*) to 5 (*a lot*). We calculated sum scores for each participant, with a possible range from 20 to 100.

Leader nomination measure. Another frequently used measure of leadership emergence is the leader nomination measure (Eby et al., 2003; Zaccaro et al., 1991). We asked participants to imagine they would work with their group a second time. Then they should rank their group members, including themselves, with regard to the extent that they would like them to be a leader for the group. Ranks were assigned in decreasing order (i.e., the group member they preferred the most as a group leader was ranked as number 1, and the group member they preferred the least was ranked as number 4). We reversed the item for data analyses, so that higher values indicated that a person is preferred more as a leader. We calculated a mean ranking score for each participant by averaging the rankings participants received from their fellow group members and from themselves.

Criterion variables

Leadership initiative. Leadership initiative was operationalized as the number of times a group member proposed an answer and explained why it is correct in order to convince the other group members to vote for it.

Success of leadership initiative. We measured success of leadership initiative for each trial with values of either 0 (i.e., the proposed answer was rejected as the group's decision) or 1 (i.e., the proposed answer was accepted as the group's decision).

Study 1

Participants and design. Three hundred ninety-six participants took part in exchange for 35€ and an additional performance-based bonus payment of up to 15€ per person. We excluded data from one group because its members disregarded some of the group task instructions. We excluded testosterone values for six participants because they were missing or contaminated; values for perceived attractiveness, trustworthiness, and competence were not available for four

participants because their group's photos were missing; values for waist-to-hip-ratio were not available for three participants; and values for all self-report measures except the big five and the intelligence test were missing for one participant due to an error. The main analyses were based on $N = 378$ participants. Participants' average age was 23.79 years ($SD = 3.87$).

Participants worked in ad-hoc groups of four, either in all male, all female, or mixed-gender groups consisting of two males and two females each. The resulting sample consists of 33 male groups, 32 female groups, and 33 mixed-gender groups. We made sure that participants in a group did not know each other.

Materials. To be able to investigate the effect of our predictors on leadership initiative and its success, the group task had to fulfill several criteria. First, we aimed to measure leadership initiative and its success behaviorally and unambiguously over several trials. Second, participants should not possess professional expertise in the task, since professional expertise might overrule the effect of the predictor variables. In other words, it is highly plausible that participants follow an expert independent of his or her individual characteristics. Third, we aimed at using tasks with an objectively correct answer, enabling us to incentivize participants according to their group's performance. Fourth, participants should be able to explain why their proposed answer is reasonable, but without being able to prove the correct answer.

Given these requirements, we decided to use an estimation task with items from different topics, with four choice options for each trial. For example, participants were asked to estimate the height of a person and had four possible answer options (see Figure 1 for an example item). We developed several items and tested them in a series of pretests. Initially, we developed 52 items. In a first pretest ($N = 47$), we asked participants to individually provide a numerical estimation for each item. For example, in case of the item shown in Figure 1, we asked the

participants to estimate the depicted person's height in cm. In this way, we received a range of values that participants consider plausible. This information was used to develop the four choice options for each item. We conducted three additional pretests, aiming to select (a) difficult items, (b) items for which participants were unable to recognize the correct answer after being proposed by another group member (i.e., we aimed to avoid a eureka-effect), and (c) items for which participants' answers in the pretest were, approximately, distributed equally over at least three of the four choice options. In sum, we selected 15 items meeting our criteria.

Procedure. Both experimental sessions took place at the lab. For the first session, we invited up to twelve participants. When arriving at the lab, participants were welcomed by two experimenters, and signed an informed consent. Then, participants individually completed the self-report personality inventories, starting with the Big Five inventory, followed by the intelligence test. Next, participants worked on all remaining self-report personality inventories. Thereafter, participants were scanned three times, using a 3D body scanner. Finally, we took photos of each participant's face.

During the second session, which took place at least two days after the first session, we invited groups of four participants to the lab. Upon arrival, participants were instructed about the procedure by the experimenter. Participants first individually completed the Picture Story Exercise (for approximately 30 minutes) and the hormone screening questionnaire (Schultheiss & Stanton, 2009), before providing a saliva sample. Subsequently, participants were informed that they were about to solve estimation items in a 4-person group. To become familiar with the task, participants solved three estimation items individually and, thereafter, assessed their own competence in solving these tasks.

During the group task, participants sat in a semi-circle and cooperatively worked on 15

estimation items. We presented the items in randomized order on a TV located approximately two meters in front of the group. Participants received instructions to work on the estimation task as follows: If a group member wanted to propose an answer, he or she was supposed to raise his or her hand, go to the TV screen, state his or her preferred choice option, and explain why he or she thinks this option is correct (this constituted our measure of leadership initiative). Thereafter, the remaining group members were supposed to indicate whether they agreed with the proposed answer by showing either a green card (i.e., following) or a red card (i.e., not following). At least two group members had to agree to the proposed answer to accept it as the group's decision (this constituted our measure of success of leadership initiative). Note that participants had neither the opportunity to choose a different answer option than the one proposed, nor did they receive feedback regarding the accuracy of the proposed answers before the end.

Bonus scheme. To motivate the participants to propose a correct answer and to judge correctly whether a proposed answer was correct, we introduced a twofold bonus scheme: If a group member proposed the correct answer and the group accepted it, the group received a bonus of 1€ for this trial. Additionally, if a group member proposed an incorrect answer and the group dismissed it, the group received a bonus of 0.25€ for that trial. In any other case, the group received no bonus. After completing the group task, participants answered follow-up questions (as described above), were debriefed, thanked, and received their monetary compensation.

Exclusion of trials. If participants did not comply with the instructions in a given trial, we excluded data from this trial from the subsequent analyses. Following this rule, we removed data from 12 trials because, in these trials, participants proposed an answer that they themselves considered as incorrect (in order to get the bonus for the rejection of an incorrect answer).

Study 2

We decided to conduct a second study to test the robustness of our results across different group tasks and different samples. More specifically, we had two main goals. First, we aimed to make the structure of the group task more realistic. Although the highly pre-structured task in Study 1 offered the advantage of having large control over the group interaction and, thereby, unambiguously measuring leadership initiative and its success, this also meant that the group interaction was somewhat artificial. Quite obviously, outside the lab, groups typically discuss propositions made by group members before making a decision. In Study 2, we therefore gave the group members the opportunity to discuss all answers proposed. Second, we aimed to replicate the results of Study 1 with another group task, namely tasks on how to survive in the wilderness. As in Study 1, we conducted two sessions. For pragmatic reasons, the first session took place online. We conducted the second session in the laboratory, including the group phase.

Participants and design. Four hundred and four participants took part in exchange for 35€ and an additional performance-based bonus payment of up to 12€ per person. We excluded data from two groups because these groups did not finish the task. Additionally, we excluded data from four groups due to language problems. The resulting sample consisted of 33 male, 31 female, and 31 mixed-gender groups. Due to missing values, the main analyses are based on $N = 376$ individuals (we excluded testosterone values for four participants because the probes were contaminated). Participants' average age was 22.83 years ($SD = 3.35$). We used the same design as Study 1, that is, a one-factorial between-subjects design with the factor group gender composition (mixed-gender vs. male vs. female).

Materials. We searched for a task which meets the same general criteria as the task described in Study 1. A task on surviving in the wilderness was suitable to our requirements. We used an already existing item set (Pfeiffer & Jones, 1976). Participants worked on 12 items with

three answer options each. For example, participants worked on the following item: “You must ford a river that has a strong current, large rocks, and some white water. After carefully selecting your crossing spot, you should:

- a) leave your boots and pack on.
- b) take your boots and pack off.
- c) take off your pack, but leave your boots on.”

Procedure. The first session took place online. The online questionnaire included the Big five inventory, the Picture Story Exercise, and all remaining self-report questionnaires in the same order as in Study 1. At least two days later, participants were invited in groups of four. In this session, participants completed the intelligence test, and we took anthropometric measures, photos, and saliva samples. Thereafter, participants were informed that they were about to solve items on wilderness survival. We first asked participants to individually solve three wilderness survival items resembling, and then assess their competence in solving these items. During the group task, participants worked on 12 items. Participants sat in a semi-circle around a table where an iPad was placed upright, presenting the items in randomized order. We asked participants to work on the items as follows: If a group member wanted to propose an answer, he or she was supposed to raise his or her hand, reach out to the iPad to log in the proposed answer and explain why he or she thought the proposed answer is correct. Thereafter, group members had the opportunity to engage in a discussion about whether the proposed answer is the correct solution. Following the discussion, every group member except the one who proposed the answer was supposed to raise a green (i.e., following) or red card (i.e., not following) to show agreement or disagreement with the proposed answer. After completing the last item, participants answered follow-up questions, were debriefed, and thanked.

Results

We performed all calculations using the statistic software R, version 3.5.1 (R Core Team, 2018). Additionally, we used the following packages in the analysis: psych 1.8.4 (Revelle, 2018), dplyr 0.7.7 (Wickham, François, Henry, & Müller, 2018), survival 2.43.1 (Therneau, 2015), and ggplot2 3.1.0 (Wickham, 2016).

In order to integrate the evidence from the two studies, all analyses reported are based on the pooled sample of both studies ($N = 754$). In order to test whether the results were robust across studies, we added interaction effects between each predictor and the factor study.

All predictors were centered on their group means and z-standardized. To account for performing multiple hypothesis tests, for each analysis we applied the Benjamini-Hochberg correction (Benjamini & Hochberg, 1995) which offers the advantage of avoiding the inflation of false positives without being overly conservative.

Sensitivity power analysis

Using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007), a sensitivity power analysis, with $\alpha = .05$, and $1 - \beta = .80$, with 23 predictor variables, based on the final sample of both studies, revealed that our sample was able to detect a minimum effect size of $f^2 = .03$.

Leadership Initiative

Descriptive statistics and initial checks. As described above, leadership initiative was operationalized as the number of times a group member proposed an answer and explained why he/she considers it to be correct, in order to convince the other group members to vote for it. Hence, values for leadership initiative could possibly range from 0 to 15 (Study 1) or from 0 to 12 (Study 2). To compare the amount of leadership initiative over both studies, we corrected for the different number of trials in the group task by dividing each participant's leadership initiative

score by the number of trials, resulting in the proportion of leadership initiative a participant showed over all trials. To illustrate, a value of .30 means that in 30% of the trials a participant showed leadership initiative. In both studies, leadership initiative roughly resembled a normal distribution. In the mixed gender groups, men showed significantly more leadership initiative ($M = 0.26$, $SD = 0.15$) than women ($M = 0.24$, $SD = 0.14$), $t(766.76) = 2.49$, $p = .013$, $d = 0.18$, although the effect was rather small.

To check the validity of our operationalization of leadership initiative, we correlated leadership initiative with the traditionally used measure of leadership emergence, the General Leadership Impression Scale (Cronshaw & Lord, 1987). In both studies, the two measures correlated significantly, $r = .78$ in Study 1, and $r = .66$ in Study 2, both $ps < .001$, indicating a substantial convergent validity.

Predicting leadership initiative. Generally, the data structure is hierarchical (individuals are nested in groups, and groups are nested in studies). However, since there are no differences in leadership initiative at the group level (in each group we necessarily find exactly one instance of leadership initiative in every trial), there is no inter-group variance for this variable. Hence, we did not include group as a factor in our analyses.

We next performed a multiple regression analysis. We decided to do so since other methods which might have been also appropriate, for example, conditional logit analyses, do not allow for modelling effects of between-subject factors (i.e., the factor study in our case). Results for the multiple regression analysis predicting leadership initiative can be found in Table 2. Four variables significantly predicted leadership initiative: g factor, $\beta = 0.03$ ($SE = 0.01$), $t = 3.73$, BH-adjusted $p < .001$, subjective competence, $\beta = 0.03$ ($SE = 0.01$), $t = 3.67$, BH-adjusted $p < .001$, conscientiousness, $\beta = 0.03$ ($SE = 0.01$), $t = 3.29$, BH-adjusted $p = .008$, and extraversion,

$\beta = 0.03$ (SE = 0.01), $t = 3.29$, BH-adjusted $p = .008$. All of these effects were in a positive direction. Thus, the more intelligent, the more subjectively competent in solving the task, the more conscientious, and the more extravert a person was compared to the other group members, the more leadership initiative he or she showed. The model had an effect size of $f^2 = .30$, representing a medium effect size (Cohen, 1988).

Interestingly, the effect of conscientiousness was moderated by study, BH-adjusted $p < .001$. Regression analyses on each level of study revealed that conscientiousness was a positive predictor for leadership initiative in Study 1, $\beta = 0.03$, (SE = 0.01), $t = 3.43$, BH-adjusted $p = .005$, but a negative predictor in Study 2, $\beta = -0.02$, (SE = 0.01), $t = -2.69$, BH-adjusted $p = .048$. Thus, the more conscientious a person was in Study 1, the more leadership initiative he or she showed, whereas in Study 2, the relationship was reversed. Other interaction effects failed to reach significance under the BH-adjusted $p < .05$, indicating that the detected effects (and non-effects) were robust across studies.

Robustness checks. Since leadership initiative is dependent within a group (i.e., if one group member shows leadership initiative very often, the other members show it rather rarely), we performed conditional logit analyses as a robust alternative. The conditional logit model is a special case of the logistic regression which accounts for the described dependency in our data. As noted above, the conditional logit model does not allow for modelling effects of between-subject factors (i.e., the factor study in our case). Therefore, we performed separate analyses for each study using the conditional logit model.

Applied to leadership initiative, the conditional logit model predicted whether a person in a group showed leadership initiative in a trial (coded with 1) or did not show leadership initiative (coded with 0). Results for the conditional logit analysis for Study 1 can be found in Table 3. In

Study 1, we found significant main effects for g factor, $\beta = 0.15$ ($SE = 0.03$), $z = 4.40$, $OR = 1.16$, BH-adjusted $p < .001$, subjective competence, $\beta = 0.16$ ($SE = 0.04$), $z = 4.40$, $OR = 1.17$, BH-adjusted $p < .001$, conscientiousness, $\beta = 0.14$ ($SE = 0.04$), $z = 3.73$, $OR = 1.15$, BH-adjusted $p < .001$, extraversion, $\beta = 0.15$ ($SE = 0.04$), $z = 3.67$, $OR = 1.17$, BH-adjusted $p < .001$, and waist-to-hip-ratio, $\beta = 0.10$ ($SE = 0.04$), $z = 2.79$, $OR = 1.11$, BH-adjusted $p = .023$. All effects were in a positive direction. Thus, the more intelligent, the more subjectively competent, the more conscientious, the more extraverted, and the higher the waist-to-hip-ratio of a person was compared to the other group members, the more likely it was that he or she showed leadership initiative. No other tested effects reached significance.

Table 4 shows the results of the conditional logit analyses predicting leadership initiative in Study 2. We found significant main effects for subjective competence, $\beta = 0.17$ ($SE = 0.04$), $z = 4.50$, $OR = 1.19$, BH-adjusted $p < .001$, conscientiousness, $\beta = -0.12$ ($SE = 0.4$), $z = -2.85$, $OR = 0.89$, BH-adjusted $p = .031$, and perceived attractiveness, $\beta = -0.17$ ($SE = 0.05$), $z = -3.55$, $OR = 0.84$, BH-adjusted $p < .001$. The effect of subjective competence was in a positive direction, whereas the effects of conscientiousness and perceived attractiveness were in a negative direction. Thus, the more subjectively competent, the less conscientious, and the less attractive a person was compared to the other group members, the more likely it was that he or she showed leadership initiative. All other tested effects did not reach significance.

Group gender composition. Next, we examined whether the effects of the predictor variables on leadership initiative varied as a function of the groups' gender composition. To avoid overfitting, we aimed at avoiding modelling interaction effects between all possible predictors and group gender composition. Instead, we selected predictor variables with main effects under the BH-adjusted significance level $\alpha < .10$. We established this moderate criterion

in order to address effects that might have been canceled out in the analyses above. To illustrate, suppose the effect of agreeableness on leadership initiative was significant in both female and male groups, but not significant in mixed-gender groups. As a consequence, in an analysis over all groups, the effects of agreeableness might have barely missed the BH-adjusted significance level.

To test the interactions, we dummy-coded interaction contrasts using mixed-gender groups as the baseline category, comparing them with female and male groups. We included gender factor, subjective competence, conscientiousness, extraversion, and waist-to-hip-ratio as predictor variables. Results can be found in Table 5. The model had a medium effect size of $f^2 = .16$. We found a significant interaction of subjective competence and group gender composition, BH-adjusted $p < .001$. Subgroup analyses revealed that subjective competence was not a significant predictor for leadership initiative in mixed-gender groups, $\beta = 0.01$ ($SE = 0.01$), $t = 1.45$, BH-adjusted $p = .178$, whereas it significantly predicted leadership initiative in male groups, $\beta = 0.06$ ($SE = 0.01$), $t = 7.02$, BH-adjusted $p < .001$, and, albeit to a lesser extent, in female groups, $\beta = 0.02$ ($SE = 0.01$), $t = 2.81$, BH-adjusted $p = .010$. All other interaction effects failed to reach significance under the BH-adjusted $p < .05$.

Success of Leadership Initiative

Descriptive statistics and initial checks. According to the rules of the tasks, at least two group members (in addition to the one who had proposed the solution) had to follow the proposed answer to be accepted as the group's decision. We measured success of leadership initiative for each trial with values of either 0 (i.e., the proposed answer was rejected as the group's decision) or 1 (i.e., the proposed answer was accepted as the group's decision).

To maximize validity, we decided to calculate a robust measure of success of leadership initiative. Note that in cases in which participants showed leadership initiative only in one trial during the group task, our measure of success of leadership would be based on only one observation. Therefore, in addition to (necessarily) excluding participants who never showed leadership initiative at all, we excluded all cases in which participants only showed leadership initiative once. We used the resulting variable for all main analyses. For correlation analyses with the other variables used in this study, we calculated each participant's success ratio. To this end, we divided their number of successes by the number of times they showed leadership initiative, with a possible range from 0 (a participant never had success) to 1 (all proposed answers were accepted by the group).

Overall, there was a tendency for men being more successful in their leadership attempts than women. However, this difference was rather small (72.17% vs. 68.77%) and failed to reach significance, $\chi^2(1, N = 2510) = 1.46, p = 0.23$.

Predicting success of leadership initiative. To examine which variables were predictive of success of leadership initiative, we used all 23 variables that were part of our predictor model for leadership initiative, while also adding two additional variables: First, it is conceivable that a group member's success is associated with the accuracy of the answers he or she had previously proposed. In other words, it would be a highly rational strategy of the group members to agree to accurate answers. Hence, we included the accuracy of the proposed answers as a predictor variable of success of leadership initiative. Second, a participant's success of leadership initiative might be due to the number of answers he or she already proposed, that is, the frequency of leadership initiative. This could be due to participants (implicitly) assuming that a group member who already proposed several answers has good reasons to do so. Hence, the

frequency of leadership initiative could be a predictor of success of leadership. Note, however, that a significant regression weight of leadership initiative when predicting success of leadership is also likely due to reverse causality (i.e., experiencing success in attracting followers increases the likelihood of initiating leadership).

Results of the binary logistic regression analysis predicting success of leadership initiative can be found in Table 6. Results revealed main effects for intelligence, $\beta = 0.20$ (SE = 0.07), $z = 2.94$, OR = 1.23, BH-adjusted $p = .031$, accuracy of proposed answers, $\beta = 0.21$ (SE = 0.08), $z = 3.04$, OR = 1.24, BH-adjusted $p = .026$, and leadership initiative, $\beta = 0.26$ (SE = 0.11), $z = 3.50$, OR = 1.30, BH-adjusted $p < .001$. All effects were in a positive direction. Thus, the more intelligent a participant was, the more accurate his or her answers were, and the more answers he or she proposed, the more likely his or her attempts of leadership initiative were successful. We did not find interaction effects involving the factor study, and all other effects also failed to reach significance.

Group gender composition. In order to explore the effect of group gender composition on success of leadership initiative, we applied the same approach as with leadership initiative. Despite our moderate criterion for predictor inclusion, no further variables were included in the analysis in addition to the ones that had become significant in the analyses above. Hence, we tested whether the associations of general intelligence, accuracy, and leadership initiative with success of leadership initiative differed between the three gender group compositions. Table 7 shows the results. Under the BH-adjusted significance level, we did not find any significant interaction effects, all β s ≤ 0.21 (SEs ≤ 0.14), all ORs ≤ 1.23 , all z s ≤ 1.54 , all BH-adjusted p s $\geq .284$. In conclusion, the effects of intelligence, accuracy, and leadership initiative on success of leadership were not moderated by group gender composition.

Discussion

The present research advances our understanding of leadership emergence in five ways: First, instead of conceptualizing leadership emergence as a single, global construct, we aimed to differentiate between two leadership components: leadership initiative and its success in attracting followers. Thereby, our research sheds light on the *process* of leadership emergence. Second, we measured both leadership components on a strictly behavioral level. Third, we included a large set of trait variables as predictors of both leadership components. Forth, we examined several traits that were neglected in previous research on leadership emergence. Fifth, we investigated whether group gender composition moderated the effect of personality traits on both leadership components. In the discussion of our results, we will first focus on predictors of leadership initiative and thereafter turn to success of leadership initiative.

Predicting Leadership Initiative

Leadership initiative was significantly predicted by intelligence, subjective competence, and extraversion. At the one hand, the finding that leadership initiative was predicted by intelligence and extraversion is not surprising given that previous research identified these two variables as two robust predictors of leadership emergence (for reviews and meta-analyses, see Acton et al., 2019; Judge et al., 2002, 2004). On the other hand, it is important to note that we found these two variables to be related to actual leadership behavior instead of only leadership perception. Since previous research focused almost exclusively on leadership emergence in terms of leadership perception, it is possible that predictors of leadership emergence identified in previous studies are unrelated to actual leadership behavior.

It is also interesting that we found both intelligence and subjective competence to be predictors of leadership initiative. This finding implies that the effects of intelligence on

leadership initiative were not mediated by subjective competence. In other words, highly intelligent individuals were not more likely to initiate leadership than less likely individuals because they felt more competent in solving the task. One tentative explanation for this finding is that, throughout their lives, highly intelligent individuals may make the experience that they are successful in solving problems even in cases in which they did not feel competent. Moreover, it is conceivable that more intelligent individuals perceive themselves as having higher communication skills than less intelligent individuals and, hence, they perceive themselves as being more likely to convince others even if they do not feel competent in a particular task. Testing these ideas is an interesting avenue for future research.

Importantly, our finding that extraversion predicted leadership initiative suggests that previous results linking extraversion to leadership emergence (for a meta-analysis, see Judge et al., 2002) are not (only) due to extravert individuals being perceived as leaders independent of whether or not they actually showed leadership behavior. This line of reasoning is particularly important with regard to extraversion since individuals tend to hold stereotypes of leaders as extraverts which is due to extraverted leaders matching the prototypes of charismatic leaders (Grant, Gino, Hofmann, 2011; Lord, De Vader, & Alliger, 1986). Hence, one important implication of our studies is that the relationship between extraversion and leadership emergence is indeed due to extraverted individuals being more likely to show leadership initiative. Again, we can only speculate about the specific psychological underpinnings, but it is conceivable that the relationship between extraversion and leadership initiative is due to extraverted individuals being motivated to get ahead (Barrick, Stewart, & Piotrowski, 2002). Importantly, based on our findings, we are able to rule out that the effects of extraversion on leadership initiative are due to extraverts having higher levels of self-esteem, self-efficacy,

or narcissism, since the latter three variables did not predict leadership initiative.

Finally, whereas previous research identified conscientiousness as a robust predictor of leadership emergence (Ensari et al., 2011; Judge et al., 2002), our results are ambiguous since the effect of conscientiousness was moderated by study, thereby suggesting that conscientiousness might have a more complex relationship with leadership emergence than previously assumed. Thus, conscientiousness was positively related to leadership initiative in Study 1, whereas it was negatively related to leadership initiative in Study 2. This discrepancy is likely to the nature of the different group tasks in our studies. Specifically, it is possible that, in Study 2, conscientious persons hesitated more to propose an answer, because it was more difficult to demonstrate the correctness of the proposed solution. Compared to the estimation tasks of Study 1, the wilderness survival tasks of Study 2 provide a scenario that is more complex and allows for more creative solutions. Thus, in Study 2, less conscientious persons might worry less about how to convince the other group members and, therefore, might be faster to suggest an answer they considered plausible. As a consequence, it is likely that conscientiousness is a positive predictor for leadership initiative in less complex tasks, whereas it is a negative predictor for more complex tasks. This is an interesting hypothesis that deserves further testing.

Success of Leadership Initiative

Across both studies, success of leadership initiative was predicted by intelligence, accuracy of proposed answers, and leadership initiative. The finding that intelligence not only predicted leadership initiative but also its success deserves closer inspection. At first glance, it might be argued that this effect is due to either highly intelligent individuals being perceived as

more competent or highly intelligent individuals proposing more accurate answers than less intelligent individuals. However, both explanations are rather unlikely: First, perceived competence was unrelated to success of leadership initiative. Second, the accuracy of the proposed answers is unlikely to mediate the effects of intelligence on success of leadership initiative since both variables (i.e., intelligence and the accuracy of the proposed answers) turned out to be significant predictors in the regression analyses. Hence, the effect of intelligence on success of leadership initiative cannot be explained by more intelligent individuals giving more accurate answers. Albeit speculatively, it is conceivable that this effect is mediated by more intelligent individuals having higher communications skills and, hence, being more likely to convince others than less intelligent individuals.

The processes underling the finding that success of leadership initiative was predicted by the frequency of leadership initiative are ambiguous and difficult to interpret. On the one hand, frequency of leadership initiative might indeed affect success of leadership initiative since individuals might assume that a person proposing more often answers has good reasons to do so. On the other hand, reverse causality is also likely since experiencing success in attracting followers may increase the likelihood of initiating leadership. Hence, we refrain from further interpreting this result.

Taken together, the fact that leadership initiative and success of leadership initiative were predicted by different variables (with the exception of intelligence) suggests that differentiating between these two leadership components is not only conceptually but also empirically relevant. More generally, our results highlight the importance of the trait perspective on leadership emergence by showing that intelligence and extraversion are not only related to leadership perception but to actual behavior that is relevant for emerging as a leader.

Interpreting the Null Results

Strikingly, several variables that were previously found to be related to leadership emergence failed to predict any of the two leadership components in our studies. These variables are: dominance, self-esteem, self-monitoring, general self-efficacy, narcissism, height, waist-to-hip-ratio, facial attractiveness, and perceived competence.

There are at least three possible explanations for why these variables failed to predict any of the two leadership components in our studies. First, it has to be kept in mind that almost all previous studies measured leadership emergence in terms of leadership perception. Yet, leadership perception might be an expression of the raters' implicit leadership theories instead of being related to actual leadership behavior. Hence, previously significant predictors might reflect which traits match a followers' implicit leader prototypes instead of predicting which person has actually emerged as a leader in a group (Kaiser et al., 2008). To illustrate, suppose a dominant group member is very talkative, but only uses empty phrases without any benefit towards helping the group accomplish the task. In subsequent leadership ratings, this person might receive high scores because the group members hold prototypes that a leader dominates discussions and talks a lot. This idea is also consistent with experimental evidence. For example, Sorrentino and Boutillier (1975) manipulated both the quality and the number of comments given by a confederate in a group discussion. Results showed that the number of comments predicted perceived differences in leadership ability, regardless of how useful the comments were (i.e., the "babble effect", Bass, 1990). To conclude, since we used a strictly behavioral measurement of leadership emergence, we might have found a reduced number of significant predictors that relate to actual leadership emergence instead of leader prototypes.

A second explanation for why we did not find effects regarding many variables

previously identified as predictors of leader emergence might be that we used a broad range of predictors. Previous research mostly focused on assessing a few predictors and studies typically used different sets of predictors. Hence, there might be redundant predictors. Since extraversion was a significant predictor for leadership initiative in our study, we will use this predictor to illustrate our argument. Previous research suggests that extraversion is a broad personality trait that might cover several other, more narrow personality facets (Judge et al., 2002). For example, extraversion is considered to include the tendency to be dominant (Judge et al., 2002), while dominance is often used as a separate predictor for leadership emergence, without measuring extraversion simultaneously (e.g., Foti & Hauenstein, 2007). In our studies, we found that extraversion was strongly correlated with dominance across both studies (averaged $r = .51$, both $ps < .001$). Moreover, extraversion was substantially correlated with narcissism (averaged $r = .46$, both $ps < .001$). Although there is evidence that narcissism predicts leadership emergence beyond the effect of extraversion (e.g., Brunell et al., 2008), a recent meta-analysis shows that the relationship between narcissism and leadership emergence can be explained by the overlap of narcissism with extraversion (Grijalva, Harms, Newman, Gaddis, & Fraley, 2015). These results suggest that extraversion might be sufficient to cover effects from related personality constructs, that is, dominance and narcissism. Because of similar reasons, other predictors might as well not have reached significance.

A third explanation for why we did not find effects regarding many variables previously identified as predictors of leader emergence refers to a limitation of our research design. Since we aimed to measure the two leadership components as unambiguously and as independent from perceptual biases as possible, we decided to use a highly controlled paradigm with a thoroughly pre-structured task in the laboratory. Within this design, we limited leadership

initiative to proposing answers while solving an intellectual problem. Similar, success of leadership was measured by whether or not the proposed answers were followed by the other group members. While this paradigm allows to unambiguously disentangle the two leadership components and measure each component on a behavioral level, it is fair to acknowledge that we measured only a subset of types of leadership behaviors. To illustrate, suppose a person proposed an answer in one of our studies. After she finished her explanation, another group member praised her for her performance. Praising other group members is an important type of relations-oriented leadership behavior (Gerpott, Lehmann-Willenbrock, Voelpel, & van Vugt, 2019; Yukl, Gordon, & Taber, 2002) that might be related to agreeableness. Thus, since we limited our measures of leadership emergence to the facet of task-oriented behaviors, we were unable to identify variables that serve as predictors of relations-oriented leadership behavior.

Conclusion

Our findings contribute to a deeper understanding of leadership emergence by showing that leadership initiative and its success are predicted by different variables. From a broad range of previously identified predictors of leadership emergence, we were able to confirm the effects of at least two variables with a strictly behavioral measurement: intelligence and extraversion. The failure to replicate the effects of the remaining predictors might primarily be due to the fact that these predictors may in fact reflect stereotypes associated with leadership rather than variables that actually promote leadership emergence. We hope that our study will serve as a catalyst spurring others to conduct further studies measuring actual leadership behavior instead of only leadership perception.

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Table 1*Summary of the predicted relationships between predictors and both leadership components*

Predictor		Leadership initiative	Success of leadership initiative
Intelligence		positive	positive
Subjective competence		positive	no
Big 5	Agreeableness	no	no
	Conscientiousness	positive	positive
	Extraversion	positive	positive
	Neuroticism	negative	negative
	Openness to experience	positive	no
Self-esteem		positive	no
Self-monitoring		positive	positive
Dominance		positive	positive
Risk-taking tendency		positive	no
General self-efficacy		positive	no
Narcissism		positive	negative
Implicit power motive		positive	positive
Dominance motive		positive	negative
Leadership motive		positive	positive
Prestige motive		positive	no
Body height		no	positive
Waist-to-hip-ratio		no	positive
Testosterone		positive	no
Perceived attractiveness		no	positive
Perceived competence		no	positive
Perceived trustworthiness		no	positive

Note. positive = positive predictor; negative = negative predictor; no = no relationship hypothesized.

Table 2*Multiple regression analysis predicting leadership initiative over both studies*

Predictor	β	<i>SE</i>	<i>t</i> (706)	<i>p</i>	BH-adjusted <i>p</i>
Intercept	0.25	0.01	36.82	< .001	< .001
<i>g</i> factor	0.03	0.01	3.73	< .001	< .001
Subjective competence	0.03	0.01	3.67	< .001	< .001
Agreeableness	-0.01	0.01	-1.47	.142	.487
Conscientiousness	0.03	0.01	3.29	.001	.008
Extraversion	0.03	0.01	3.29	.001	.008
Neuroticism	0.02	0.01	1.62	.105	.388
Openness	0.01	0.01	1.66	.097	.388
Self-esteem	0.01	0.01	0.53	.598	.844
Self-monitoring	0.00	0.01	-0.58	.562	.843
Dominance	0.01	0.01	0.76	.449	.843
Risk-taking tendency	0.01	0.01	1.31	.191	.536
General self-efficacy	-0.01	0.01	-1.33	.182	.536
Narcissism	0.00	0.01	0.26	.797	.964
<i>n</i> power	0.00	0.02	0.13	.896	.964
Dominance motive	0.00	0.01	0.40	.687	.916
Leadership motive	0.00	0.01	-0.33	.738	.957
Prestige motive	0.00	0.01	-0.05	.963	.964
Body height	0.02	0.01	1.83	.068	.301
Waist-to-hip-ratio	0.02	0.01	2.39	.017	.091
Testosterone	0.01	0.01	1.20	.230	.581
Perceived attractiveness	0.00	0.01	0.05	.964	.964
Perceived competence	0.01	0.01	1.14	.254	.610
Perceived trustworthiness	0.00	0.01	0.08	.936	.964

Table 2 (continued)

Predictor	β	<i>SE</i>	<i>t</i> (706)	<i>p</i>	BH-adjusted <i>p</i>
Study ^a	0.00	0.01	0.11	.911	0.954
Study $\times$ <i>g</i> factor	-0.01	0.01	-1.28	.201	.536
Study $\times$ Subjective competence	0.00	0.01	0.42	.677	.916
Study $\times$ Agreeableness	0.00	0.01	-0.06	.955	.964
Study $\times$ Conscientiousness	-0.05	0.01	-4.30	< .001	< .001
Study $\times$ Extraversion	-0.02	0.01	-1.43	.154	.493
Study $\times$ Neuroticism	-0.01	0.01	-0.98	.327	.747
Study $\times$ Openness	0.00	0.01	0.16	.870	.964
Study $\times$ Self-esteem	0.01	0.01	0.78	.439	.843
Study $\times$ Self-monitoring	0.01	0.01	0.60	.550	.843
Study $\times$ Dominance	0.01	0.02	0.59	.556	.843
Study $\times$ Risk-taking tendency	-0.01	0.01	-0.64	.522	.843
Study $\times$ General self-efficacy	0.00	0.01	0.15	.884	.964
Study $\times$ Narcissism	-0.01	0.02	-0.77	.444	.843
Study $\times$ <i>n</i> power	0.00	0.01	-0.07	.945	.964
Study $\times$ Dominance motive	-0.01	0.01	-0.60	.552	.843
Study $\times$ Leadership motive	0.01	0.02	0.83	.406	.843
Study $\times$ Prestige motive	0.01	0.01	0.53	.598	.844
Study $\times$ Body height	-0.02	0.01	-1.82	.069	.301
Study $\times$ Waist-to-hip-ratio	-0.03	0.01	-3.02	.003	.021
Study $\times$ Testosterone	-0.01	0.01	-0.62	.536	.843
Study $\times$ Perceived attractiveness	-0.03	0.01	-2.54	.011	.066
Study $\times$ Perceived competence	0.00	0.02	0.24	.808	.964
Study $\times$ Perceived trustworthiness	-0.01	0.02	-0.65	.518	.843

Table 3*Conditional logit analysis predicting leadership initiative in Study 1*

Predictor	β	<i>SE</i>	<i>OR</i>	<i>z</i>	<i>p</i>	BH-adjusted <i>p</i>
<i>g</i> factor	0.15	0.03	1.16	4.40	< .001	< .001
Subjective competency	0.16	0.04	1.17	4.43	< .001	< .001
Agreeableness	-0.08	0.04	0.92	-1.89	.058	.164
Conscientiousness	0.14	0.04	1.15	3.73	< .001	< .001
Extraversion	0.15	0.04	1.17	3.67	< .001	< .001
Neuroticism	0.08	0.04	1.08	1.85	.064	.164
Openness	0.07	0.03	1.07	1.89	.059	.164
Self-esteem	0.03	0.05	1.03	0.67	.506	.727
Self-monitoring	-0.03	0.04	0.97	-0.73	.468	.718
Dominance	0.04	0.05	1.05	0.85	.394	.647
Risk-taking tendency	0.05	0.04	1.05	1.45	.147	.282
General self-efficacy	-0.07	0.05	0.93	-1.52	.129	.270
Narcissism	0.02	0.05	1.02	0.34	.731	.877
<i>n</i> power	0.01	0.03	1.01	0.25	.801	.877
Dominance motive	0.02	0.05	1.02	0.47	.636	.860
Leadership motive	-0.01	0.05	0.99	-0.26	.793	.877
Prestige motive	-0.01	0.04	0.99	-0.30	.762	.877
Body height	0.09	0.04	1.09	2.22	.027	.104
Waist-to-hip-ratio	0.10	0.04	1.11	2.79	.005	.023
Testosterone	0.04	0.04	1.04	1.06	.289	.511
Perceived attractiveness	0.00	0.04	1.00	0.02	.986	.986
Perceived competence	0.07	0.05	1.01	1.55	.121	.270
Perceived trustworthiness	0.01	0.05	1.01	0.13	.900	.941

Table 4*Conditional logit analysis predicting leadership initiative in Study 2*

Predictor	β	SE	OR	z	p	BH-adjusted p
g factor	0.08	0.04	1.08	2.12	.034	.161
Subjective competency	0.17	0.04	1.19	4.50	< .001	< .001
Agreeableness	-0.08	0.05	0.92	-1.78	.075	.216
Conscientiousness	-0.12	0.04	0.89	-2.85	.004	.031
Extraversion	0.06	0.05	1.06	1.25	.213	.445
Neuroticism	0.01	0.05	1.01	0.16	.872	.912
Openness	0.08	0.04	1.09	2.11	.035	.161
Self-esteem	0.09	0.05	1.10	1.82	.068	.216
Self-monitoring	0.01	0.04	1.01	0.29	.776	.850
Dominance	0.10	0.06	1.10	1.62	.105	.268
Risk-taking tendency	0.02	0.04	1.02	0.40	.688	.819
General self-efficacy	-0.06	0.06	0.94	-1.13	.259	.496
Narcissism	-0.06	0.06	0.94	-0.98	.328	.567
n power	0.00	0.04	1.00	-0.05	.962	.962
Dominance motive	-0.02	0.05	0.98	-0.40	.687	.819
Leadership motive	0.05	0.06	1.05	0.77	.442	.624
Prestige motive	0.04	0.04	1.04	0.91	.362	.567
Body height	-0.03	0.04	0.97	-0.74	.461	.624
Waist-to-hip-ratio	-0.08	0.04	0.92	-1.94	.052	.199
Testosterone	0.02	0.04	1.02	0.37	.712	.819
Perceived attractiveness	-0.17	0.05	0.84	-3.55	< .001	< .001
Perceived competence	0.08	0.06	1.09	1.50	.134	.308
Perceived trustworthiness	-0.05	0.06	0.95	-0.90	.370	.567

Table 5*Regression analysis predicting effects of group gender composition on leadership initiative*

Predictor	β	<i>SE</i>	<i>t</i> (751)	<i>p</i>	BH-adjusted <i>p</i>
Intercept	0.25	0.01	29.72	< .001	< .001
<i>g</i> factor	0.03	0.01	3.66	< .001	< .001
Subjective competence	0.01	0.01	1.52	.130	.260
Conscientiousness	-0.01	0.01	-0.77	.440	.660
Extraversion	0.02	0.01	2.18	.030	.077
Waist-to-hip-ratio	0.03	0.01	3.88	< .001	< .001
GGC ^a : f vs. b $\times$ <i>g</i> factor	0.00	0.01	-0.37	.708	.910
GGC ^a : m vs. b $\times$ <i>g</i> factor	-0.02	0.01	-1.57	.117	.260
GGC ^a : f vs. b $\times$ Subjective competence	0.01	0.01	0.82	.415	.660
GGC ^a : m vs. b $\times$ Subjective competence	0.05	0.01	3.78	< .001	< .001
GGC ^a : f vs. b $\times$ Conscientiousness	0.02	0.01	1.32	.188	.338
GGC ^a : m vs. b $\times$ Conscientiousness	-0.01	0.01	-0.67	.504	.698
GGC ^a : f vs. b $\times$ Extraversion	0.00	0.01	-0.09	.930	.985
GGC ^a : m vs. b $\times$ Extraversion	0.00	0.01	0.14	.892	.985
GGC ^a : f vs. b $\times$ Waist-to-hip-ratio	-0.03	0.01	-2.41	.016	.058
GGC ^a : m vs. b $\times$ Waist-to-hip-ratio	-0.03	0.01	-2.24	.025	.075

Note. $R^2 = .16$, adjusted $R^2 = .14$, $F(17, 751) = 8.19$, $p < .001$, $N = 769$. BH-adjusted p = Benjamini-Hochberg adjusted p -value. GGC = Group gender composition. All predictors were centered on their group means and z-standardized.

^aThe factor group gender composition was dummy-coded with mixed-gender groups as the baseline (b) category, compared to either female (f) or male groups (m).

Table 6*Binary logistic regression analysis predicting success of leadership initiative*

Predictor	β	<i>SE</i>	<i>OR</i>	<i>z</i>	<i>p</i>	BH-adjusted <i>p</i>
Intercept	0.88	0.07	2.41	12.10	< .001	< .001
<i>g</i> factor	0.20	0.07	1.23	2.94	.003	.031
Subjective competence	-0.07	0.07	0.93	-0.96	.337	.743
Agreeableness	0.04	0.08	1.04	0.45	.655	.921
Conscientiousness	-0.15	0.08	0.86	-1.94	.052	.276
Extraversion	-0.01	0.09	0.99	-0.08	.935	.976
Neuroticism	0.01	0.09	1.01	0.17	.869	.976
Openness	-0.06	0.07	0.94	-0.85	.396	.743
Self-esteem	0.00	0.09	1.00	0.03	.980	.992
Self-monitoring	0.12	0.07	1.13	1.66	.098	.463
Dominance	-0.03	0.10	0.97	-0.31	.753	.923
Risk-taking tendency	0.12	0.07	1.12	1.61	.107	.464
General self-efficacy	-0.06	0.09	0.94	-0.70	.483	.838
Narcissism	-0.04	0.11	0.96	-0.40	.692	.923
<i>n</i> power	0.00	0.06	1.00	0.01	.992	.992
Dominance motive	-0.04	0.10	0.96	-0.37	.713	.923
Leadership motive	-0.03	0.07	0.97	-0.33	.744	.923
Prestige motive	0.04	0.08	1.04	0.57	.566	.866
Body height	-0.10	0.07	0.91	-1.24	.213	.691
Waist-to-hip-ratio	-0.05	0.08	0.95	-0.65	.513	.838
Testosterone	0.13	0.10	1.13	1.53	.126	.504
Perceived attractiveness	-0.08	0.07	0.92	-1.02	.308	.743
Perceived competence	0.06	0.10	1.06	0.66	.512	.838
Perceived trustworthiness	-0.10	0.08	0.91	-0.99	.323	.743
Accuracy	0.21	0.08	1.24	3.04	.002	.026
Leadership initiative	0.26	0.11	1.30	3.50	< .001	< .001

Table 6 (continued)

Predictor	β	SE	OR	z	p	BH-adjusted p
Study ^a	0.62	0.13	1.86	4.88	< .001	< .001
Study $\times$ g factor	-0.01	0.12	0.99	-0.13	.899	.976
Study $\times$ Subjective competence	0.12	0.14	1.12	0.99	.320	.743
Study $\times$ Agreeableness	-0.17	0.12	0.85	-1.21	.226	.691
Study $\times$ Conscientiousness	0.07	0.15	1.07	0.54	.592	.880
Study $\times$ Extraversion	0.12	0.15	1.13	0.84	.400	.743
Study $\times$ Neuroticism	-0.17	0.15	0.85	-1.12	.263	.743
Study $\times$ Openness	0.17	0.12	1.19	1.48	.140	.520
Study $\times$ Self-esteem	-0.14	0.16	0.87	-0.87	.383	.743
Study $\times$ Self-monitoring	-0.12	0.12	0.89	-0.95	.345	.743
Study $\times$ Dominance	0.05	0.18	1.06	0.30	.763	.923
Study $\times$ Risk-taking tendency	-0.01	0.13	0.99	-0.10	.918	.976
Study $\times$ General self-efficacy	0.21	0.17	1.23	1.25	.210	.691
Study $\times$ Narcissism	-0.11	0.18	0.89	-0.63	.532	.838
Study $\times$ n power	0.03	0.11	1.03	0.23	.817	.966
Study $\times$ Dominance motive	-0.07	0.16	0.93	-0.46	.649	.921
Study $\times$ Leadership motive	0.07	0.18	1.07	0.37	.709	.923
Study $\times$ Prestige motive	0.01	0.13	1.01	0.11	.909	.976
Study $\times$ Body height	0.12	0.13	1.12	0.91	.361	.743
Study $\times$ Waist-to-hip-ratio	0.25	0.13	1.28	1.93	.053	.276
Study $\times$ Testosterone	-0.33	0.13	0.72	-2.48	.013	.113
Study $\times$ Perceived attractiveness	0.32	0.14	1.37	2.22	.026	.193
Study $\times$ Perceived competence	0.18	0.17	1.19	1.07	.286	.743
Study $\times$ Perceived trustworthiness	-0.11	0.17	0.90	-0.62	.532	.838
Study $\times$ Accuracy	-0.24	0.12	0.79	-1.99	.047	.276
Study $\times$ Leadership initiative	-0.01	0.13	0.99	-0.08	.938	.976

Note. Hosmer and Lemeshow $R^2 = .05$, Cox and Snell $R^2 = .05$, Nagelkerke $R^2 = .08$. $\chi^2(51) = 129.92$, $p < .001$. $N = 2460$. BH-adjusted p = Benjamini-Hochberg adjusted p -value. All predictors were centered on their group means and z-standardized.

^aStudy: 0 = Study 1, 1 = Study 2.

Table 7

Binary logistic regression analysis predicting effects of group gender composition on success of leadership initiative

Predictor	β	SE	OR	z	p	BH-adjusted p
Intercept	1.11	0.10	3.03	11.22	<.001	<.001
g factor	0.28	0.09	1.32	3.18	.001	.006
Accuracy	0.10	0.09	1.12	1.14	.256	.439
Leadership initiative	0.15	0.09	1.16	1.66	.098	.284
GGC ^a : f vs. b	-0.08	0.14	0.92	-0.59	.555	.666
GGC ^a : m vs. b	-0.03	0.14	0.97	-0.19	.848	.848
GGC ^a : f vs. b $\times$ g factor	-0.20	0.12	0.82	-1.66	.097	.284
GGC ^a : m vs. b $\times$ g factor	-0.18	0.12	0.84	-1.47	.142	.284
GGC ^a : f vs. b $\times$ Accuracy	-0.05	0.12	0.95	-0.40	.696	.759
GGC ^a : m vs. b $\times$ Accuracy	0.13	0.14	1.14	0.97	.333	.500
GGC ^a : f vs. b $\times$ Leadership initiative	0.09	0.14	1.10	0.67	.501	.666
GGC ^a : m vs. b $\times$ Leadership initiative	0.21	0.13	1.23	1.54	.123	.284

Note. Hosmer and Lemeshow $R^2 = .02$, Cox and Snell $R^2 = .02$, Nagelkerke $R^2 = .03$, $\chi^2(11) = 44.79$, $p < .001$. $N = 2510$. BH-adjusted p = Benjamini-Hochberg adjusted p -value. GGC = Group gender composition. All predictors were centered on their group means and z-standardized.

^aThe factor group gender composition was dummy-coded with mixed-gender groups as the baseline (b) category, compared to either female (f) or male groups (m).