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The age of exploration and exploitation: Younger-looking leaders endorsed for change and older-looking leaders endorsed for stability

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ABSTRACT

The current contribution extends theorizing on leadership and the exploration–exploitation dilemma using an evolutionary perspective. A theoretical connection is made between the exploration–exploitation dilemma and age-biased leadership preferences for exploratory change versus stable exploitation. For the majority of human evolution our species was semi- or entirely nomadic and the trade-off between exploration versus exploitation had substantial physical- and experience-based requirements which align with leadership opportunities as moderated by age. Thus, given the consistency and importance of correctly assigning leadership for the exploration–exploitation dilemma, human evolution has likely selected for age-biased leadership endorsement. Across three experiments we find that younger-looking leaders are endorsed for times of exploratory change and older-looking leaders for stable exploitation. Further, our results indicated that older leaders are endorsed for leading conservative exploitation of nonrenewable resources and younger leaders for exploration of renewable alternatives (i.e., green leadership). The results introduce an age-biased leadership endorsement hypothesis.

Introduction

Age is one of the most basic and easily accessible cues of face perception. It can be assessed fairly accurately at first glance and it has major consequences for a range of social goals such as collaboration, competition, leadership, and successful organizational behavior (OB) at large. Consider that while nearly half of the world's political revolutionaries were younger than 35, nearly all political leaders achieve their positions after the age of 40. In addition, most nascent entrepreneurs tend to be younger than 35 whereas more than half of the CEO's of Fortune 500 companies are between 50 and 59 years old (Blondel, 1980; Korunka, Frank, Lueger, & Mugler, 2003; Rejai & Phillips, 1979).

Yet, surprisingly, little attention has been given in the organizational sciences to the role of age in, for instance, leadership emergence and selection (Zacher, Rosing, & Frese, 2011). We believe this is a major oversight, and argue that age cues play a significant role in decisions about who to follow as they have done throughout human evolution. To investigate the importance of age in leadership perceptions, we investigate a common organizational dilemma (i.e., exploration versus exploitation) and study how cues of age embedded in the human face influence leadership endorsement in situations of organizational change versus stability.

Stability and change are respectively associated with the systematic exploitation of existing resources and knowledge versus a switch to the exploration of new resources and knowledge. This dilemma has significant consequences for organizational growth and

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effectiveness and requires continued analysis (see March, 1991). Accordingly, we build theory arguing that in periods of stable exploitation it is adaptive for humans to follow older leaders, whereas in times of exploratory change it is adaptive to follow younger leaders.

These expectations are derived from recent work on the evolution of leadership which suggests these preferences are functional in an evolutionary sense because decisions about who to follow has significant fitness consequences (e.g., Spisak, Nicholson, & Van Vugt, 2011; Van Vugt, Hogan, & Kaiser, 2008). Given the importance of exploration versus exploitation throughout human evolution we expect that age-biased implicit leadership prototypes have been selected for – in the form of if–then decision rules – because taking advantage of diverging leadership capabilities as moderated by age enables us to effectively solve coordination problems in a competitive environment. To test our age-biased leadership endorsement hypothesis we look at how facial cues of age in potential leaders affect their selection in times of organizational stability versus change.

We conclude by testing if this age-biased leadership contingency can be applied to a prevailing organizational concern (i.e., environmental sustainability — an organizations dilemma between conservative exploitation of nonrenewable resources versus exploration of renewable resources). Environmental sustainability can be seen as a dual process to both conserve a limited resource pool and switch to a renewable alternative. These divergent tasks parallel the exploration–exploitation dilemma and, given our theoretical argument, suggest that different leadership prototypes will be activated. That is, older-looking leaders should be associated with encouraging conservative exploitation of nonrenewables whereas entrepreneurial exploration of renewable alternatives is more often the realm of younger-looking leaders. Our results show that age cues are influential in leadership perception and endorsement. This connection expands our boundary of understanding regarding leadership preferences. Specifically, the findings add to the wealth of existing literature on the exploration–exploitation dilemma by uncovering age-biased implicit leader preferences. This also contributes to the relatively understudied area of age and leadership.

The evolution of exploration–exploitation leadership

The issue of exploratory change versus stable exploitation in organizational sciences is nothing new. The trade-off between exploration and exploitation is a commonly cited and frequently researched topic (see Jansen, Vera, & Crossan, 2009). The dilemma is interesting because it requires a coordinated decision for a group to invest in risk-taking and innovation to remain adaptive and competitive in changing environments, or to create stability and minimize negative costs associated with uncertainty by refinement and execution of preexisting systems — the consistent benefits of exploiting best practices versus the exploratory requirements of dynamic environments (March, 1991).

It appears that both coordination strategies are essential for the healthy maintenance and development of social networks. Without exploitation, groups lack the stability required to learn and work toward optimizing their environment putting them at a disadvantage relative to groups that are better able to share information, refine acquired knowledge, and execute coordination. Conversely, groups that cannot effectively explore new opportunities risk becoming obsolete and unable to adapt. This also creates a disadvantage in contrast to groups that have an ability to change quickly and take advantage of new opportunities.

Humans (among other species) have adopted a social group strategy to solve such coordination problems because cohesive units can drastically increase individual fitness (e.g., Pusey & Packer, 1997; Silk, 2007a). One of the primary advantages of our social nature is the ability to gather (explore) and maintain (exploit) resources at an astonishing level (March, 1991; Silk, 2007b). Paradoxically, however, the very thing that has contributed to our success – coordination – is riddled with risk. The dilemma between exploration versus exploitation, for instance, creates an arms race between groups for efficient *and* effective behavior (i.e., to remain relatively successful in a competitive environment organizations must continually find a balance between exploratory change versus stable exploitation).

This sort of group challenge tends to select for an ability to lead and follow (Van Vugt & Spisak, 2008). We know that leadership occurs quickly and automatically (De Cremer & Van Vugt, 2002), it is present in all known cultures (Brown, 1991), and it can hold together unrelated individuals in social networks even at the expense of immediate self-interest (Hammerstein, 2003). All of which highlights the innate importance of leadership for solving coordination problems.

Competition also creates a pressure selecting for leaders who are best suited for different tasks or contexts (e.g., Spisak, Dekker, Krüger, & Van Vugt, 2012). The skills necessary for successful exploration of new resource opportunities are not necessarily optimal for leading group exploitation of an established resource, and an inability to choose suitable leaders, relative to other groups, will severely diminish the benefits of coordination. Consistently following the wrong leader (or not following at all) can be demonstrably maladaptive (Van Vugt et al., 2008). Thus, to remain competitive, contingent endorsement of appropriate leadership is perhaps the most effective strategy.

This is reminiscent of traditional contingency and implicit theories of leadership (e.g., Fiedler, 1964; Lord, Foti, & Phillips, 1982) but differs in a number of respects. First, our framing of situations is fundamentally based on core situation dynamics and coordination problems that have remained vital to our success (Van Vugt et al., 2008). Though the wrapping of a modern context may look considerably different than what has come before, the underlying dynamics that select for particular affective, cognitive, and behavioral responses have remained quite similar (e.g., Spisak et al., 2011). Second, given the evolutionarily consistent presence of these core situations, contingent leadership prototypes will be selected for and remain implicitly active in modern followers provided the underlying dynamic is present (Spisak, Homan, Grabo, & Van Vugt, 2012). Hence, human evolution is of considerable importance when building theory and formulating hypotheses because it provides essential variables and parameters for modeling OB.

Exploration–exploitation and age

In order to properly demonstrate how our theoretical perspective can generate a compelling degree of construct clarity we must first provide a brief history of evolutionary responses to the tensions embedded in exploration versus exploitation.

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From an evolutionary perspective, coordination distinctions between exploratory change and stable exploitation align with leadership opportunities as moderated by age. For the majority of human evolution our species was semi- or entirely nomadic and the trade-off between resource exploration versus exploitation had a substantial physical component — which eventually led to our dispersal on a global scale (see Rolland, 2010). The need to find resources in competitive environments was (and is) a strong selection pressure — as is the need to exploit consistent resource pools to create stable environments (see Spisak et al., 2011).

Interestingly, this resource dilemma parallels ecological strategies of organisms to select food that maximizes their rate of energy intake (e.g., Optimal Foraging Theory; MacArthur & Pianka, 1966). If a resource is readily available and has a high payoff relative to cost of acquisition then it will be exploited. Exploration will occur when resource density decreases to a level that allows for gain (relative to cost) from searching. Indeed, these costs and benefits associated with various alternative resources are a strong predictor of hunter–gatherer decision making (Hill, Kaplan, Hawkes, & Hurtado, 1987) and extends (be it at a proximate level) to contemporary OB decision making (March, 1991). Consequently, it appears this tension between exploration and exploitation is an evolutionarily consistent coordination pressure selecting for a number of distinct adaptations. Below, we provide such landmarks of human evolution necessary for building our hypothesis.

Regarding exploration, our ability to engage in endurance running (ER) is a significant occurrence in the evolution of humans (Bramble & Lieberman, 2004; Carrier, 1984). ER provided our ancestors with a competitive advantage through a number of adaptations such as reduced body hair and sweating which allowed for running extended distances even at relatively high external temperatures (Bramble & Lieberman, 2004). Arguably ER contributed to our membership in the "predator guild" through the practice of persistence hunting (i.e., the ability to run prey animals to exhaustion) as well as competitive scavenging by quickly covering large distances when opportunities arise — particularly during midday when other scavengers are less active (Liebenberg, 2006, 2008). Whatever are the specific benefits of ER, this unique skill provided access to a successful niche of exploration.

However, even though coordinated exploration such as persistence hunting and competitive scavenging enhanced fitness there was also cost in terms of physical energy. Thus, assuming exploration benefited from leadership (as is the case with modern exploratory activities; Jansen et al., 2009) and decision making is in part driven by an optimal resource foraging strategy, certain individuals, with relatively more to gain, would be better suited for this energetic task and likely be endorsed as a leader. One key aspect is the vigor and stamina associated with relatively younger age. In an environment of persistence hunting, competitive scavenging, and other exploratory activities, successful followers should endorse physically fit leaders with the endurance to maximize the benefits of change. The main point being that change very often has a physical component which favors younger leaders. Further, even if it is *not* a matter of physicality, then, as is found in lifespan research, utilizing new knowledge independent of acquired knowledge and displaying creativity to solve problems in novel situations (i.e., fluid intelligence) is more often exhibited by younger individuals (Horn & Cattell, 1967). Developmentally, this form of intelligence peaks and starts to decline from the mid-twenties (see Craik & Bialystok, 2006). Thus cues of younger age are indicative of advantageous physical and cognitive capabilities for addressing the "fitness-relevant" challenges associated with exploratory change. Considering the importance of this association and the pressure for swift and accurate coordination, a contingent heuristic has arguably formed to expedite collective action (i.e., *if* time of change, *then* young leader).

The trade-off to this exploratory tendency is stable exploitation. The requirements of exploitation include increasing the efficiency, refinement, and execution of the processes necessary to systematically harvest the benefit of an established resource (March, 1991). This form of leadership benefits the group by taking advantage of acquired knowledge and best practices stored within an experienced leader that can be transmitted via social learning (e.g., "copy-successful-individuals"; Mesoudi, 2008). For example, in many cultures, older individuals are sought after to settle disputes that may threaten the stability of the community (Nicholson, 2005) and this perhaps relates to the fact that the underlying dynamic of many disputes, such as tensions over resource sharing, are reoccurring. Older, more experienced group members can utilize a higher level of crystallized intelligence – the ability to access long-term memory and use acquired skills, knowledge, and experiences (Horn & Cattell, 1967) – to solve such enduring problems. Indeed, where fluid intelligence peaks in the mid-twenties and then starts to decline, crystallized intelligence continues to increase and remains stable until approximately the age of 70 (see Craik & Bialystok, 2006). Relatedly, older individuals are more likely to maintain status within a well-established and stable political or religious institution, while younger individuals are more likely to take risks on something new (Lehman, 1953). One major difference between younger and older individuals is that older individuals have been shown to be significantly better at reasoning about social conflicts (Grossmann et al., 2010) which is perhaps a reflection of their superior crystallized intelligence. Thus cues of older age can serve as an honest signal of one's ability to secure stable exploitation of established resources and, as with the younger prototypes, can increase the pace of leadership endorsement. In this scenario, however, the follower heuristic shifts (i.e., *if* need for stability, *then* old leader).

It is also important to note that even in "premodern" populations the human body was adapted for approximately 7 decades of operation with an "average modal adult lifespan of about 72 years" (Gurven & Kaplan, 2007: 334) – which corresponds with the observed decline in crystallized intelligence and also exceeds the typical retirement age in modern organizations. This means that age ranges in human social groups have remained sufficiently consistent for evolution to select for these age-biased leadership prototypes.

The proposed heuristics reflect distinct implicit prototypes of exploration and exploitation leadership and consequently adds to the existing research on evolved situation–trait contingencies (Spisak, Dekker, et al., 2012; Spisak, Homan, et al., 2012). In addition to the dynamic currently under investigation, a number of fitness-relevant coordination problems such as intergroup relations contingently select for context-specific leadership prototypes (see Fig. 1). It is important to understand such biases as they can impact who is likely to emerge as a leader.

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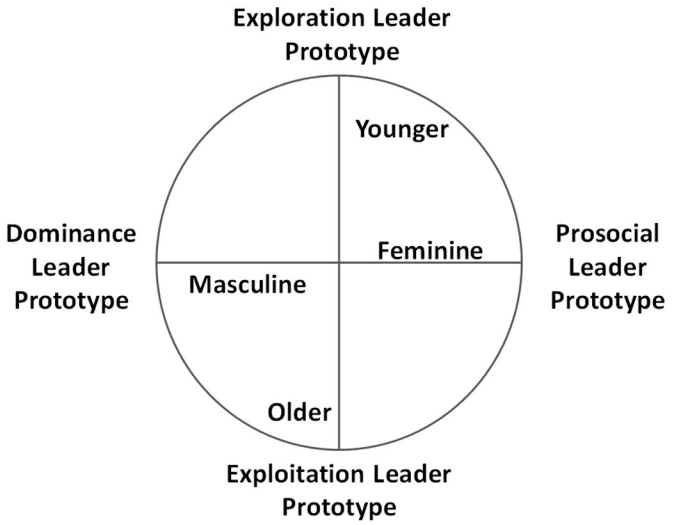

Fig. 1. Leadership prototypes and associated individual traits.*. *Dominance and prosocial prototypes based on Spisak, Homan, et al. (2012).

Hypothesis

Given the fitness-relevant nature of the exploration–exploitation dilemma it is argued that followers will contingently prefer leaders based on the diverging qualities of young age and old age. These cognitive prototypes increase group cohesion by facilitating rapid emergence of appropriate leadership (e.g., Spisak, 2012; Spisak, Homan, et al., 2012; Van Vugt & Spisak, 2008). Those groups that can maximize the benefits of leadership will win and those that cannot will perish. Thus:

H1a. Hypothesis 1a Given the inherent functional differences between exploration and exploitation and the developmental differences associated with aging, we expect younger-looking leaders to be endorsed for exploratory change and older-looking leaders for stable exploitation.

H1b. Hypothesis 1b To display the versatility and practical value of our expectations, we also hypothesize these leader prototypes will have an impact on leading sustainability initiatives — "green leadership." Specifically, faces of older-looking leaders will be endorsed for stable exploitation of nonrenewable resources and younger-looking leaders will be preferred for exploring renewable alternatives.

To test our hypotheses we used age cues embedded in the human face. A facial cue is one of the most robust and psychological real factors of age perception. Children as young as four months can recognize age differences in the human face (Fagan, 1972; Lasky, Klein, & Martinez, 1974; McCall & Kennedy, 1980). Age recognition is a persistent neurological mechanism and remains even when other important recognition capabilities such as identifying faces and interpreting emotions are impaired due to brain injury (Montepare & Zebrowitz, 1998). Also, in general, the human face is predictive of actual leadership emergence (Todorov, Mandisodza, Goren, & Hall, 2005). Even children, as young as five years old, can predict election outcomes better than chance just by looking at the candidates faces (Antonakis & Dalgas, 2009). Consequently, the human face as a proxy for age is a valuable method for testing our hypotheses.

To properly isolate our variables of interest and test our age-biased leadership endorsement hypothesis we conducted three lab experiments. Great care was taken to maintain "psychological realism" (Colquitt, 2008) of our independent and dependent variables. First, as mentioned, we used the human face as one of our independent variables because of its "real" quality. Next, we made sure to prime participants with a variety of actual business scenarios of exploratory change versus stable exploitation. Finally, we measured ratings of leadership endorsement. This dependent variable is fundamental to a number of important group practices such as democratic elections (i.e., voting behavior; Sharpanskykh & Spisak, 2011) and CEO succession (e.g., Zajac & Westphal, 1996).

Experiment 1 methods

Participants

Sixty undergraduate participants from the VU University Amsterdam (32 males, 28 females; $M_{age} = 22.43$, $SD = 6.74$) participated in the experiment for either money or credit.

Materials and procedure

Using facial composite software which morphs together a number of real faces (Gibson, Solomon, Maylin, & Clark, 2009) we created seven unique sets of four face-types which diverged on age and sex. This method yielded 7 different younger male faces, 7 different

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older male faces, 7 different younger female faces, and 7 different older female faces (i.e., 28 different faces in total; see Fig. 2 for an example of the four face-types). The use of seven different faces in each face category minimizes the idiosyncratic effect of any one specific face and the use of male and female faces was to serve as a distracter variable.

The experimental design was within-subjects, with each participant viewing all 28 faces and completing the same questions for each face. This design allowed us to embed the variable of interest (age) within a distracter variable (sex) for which we had no particular hypothesis. Participants completed a pen-and-paper survey in which they were presented with the faces from each face category — one face per page. The order in which the faces were presented was counterbalanced to control for potential order effects. Participants were asked to rate each face in two scenarios (stability versus change) as: "A leader who could maintain stability during financially difficult times" and "A leader during times of technological change." Participants answered these two questions for each face using 7-point Likert-type scales (1 = *very much no*, 7 = *very much yes*). Rating scales were also counterbalanced. Following the leader ratings, participants were debriefed and thanked.

Results and discussion

In order to test our hypothesis we conducted a 2 (context: exploratory change vs. stable exploitation) × 2 (age: old versus young) repeated-measures model. As expected, we found an interaction between situation and age ($F[1, 56] = 11.82$, $p = .001$, $\eta^2 = .17$), demonstrating that participants endorsed older leaders ($M = 4.32$, $SD = .65$) over younger leaders ($M = 4.17$, $SD = .68$) for maintaining stability and younger leaders ($M = 4.13$, $SD = .66$) over older leaders ($M = 3.87$, $SD = .80$) for facilitating change.

In order to investigate the effects of participant sex on leadership preferences, we conducted a repeated-measures analysis with participant sex as the between-subjects factor. The results showed *no* significant interaction with participant sex ($F[1,58] = 2.87$, $p = .10$, $\eta^2 = .05$). Finally, we analyzed the effect of our distracter variable (i.e., sex of the leader) on leadership endorsement by conducting two repeated-measures analyses. These results indicated that male faces were preferred over female faces for leadership roles in both change ($F[1,57] = 32.02$, $p < .001$, $\eta^2 = .36$) and stability conditions ($F[1,57] = 4.88$, $p = .03$, $\eta^2 = .08$) regardless of age. This is consistent with prior research on the global nature of managerial sex-typing (Schein, Müller, Lituchy, & Liu, 1996) and aligns with potentially evolved sex differences for leadership and coordination when responding to threat (Van Vugt, De Cremer, & Janssen, 2007). For this reason, in the subsequent experiments we focused on the faces of male leader candidates to eliminate possible confounds and further isolate our variable of interest (i.e., age).

The results of Experiment 1 support the hypothesis that followers prefer younger faces for leadership in the context of change, and older faces in the context of stability (H1a). Next, we wanted to replicate this in a second experiment in which the older versus younger faces were treated as a between-subjects rather than within-subjects factor so as to avoid participants being influenced by relative judgments. We also used different management scenarios of exploratory change versus stable exploitation rather than specific financial and technological problems to look at the generalizability of the results across various OB domains.

Experiment 2 methods

Pilot

Faces of leader candidates were taken from the neutral expression pose of the Computer Vision Laboratory face database (Solina, Peer, Batagelj, Juvan, & Kovac, 2003). In a separate online pilot, 40 of these faces were used to determine which would be rated as most neutral in terms of attractiveness, age, and masculinity–femininity. The faces were posted in an online survey hosted by Qualtrics (www.qualtrics.com) and presented individually accompanied by two 7-point scales and an age slider. Scale ends were labeled 1 (*very unattractive/very feminine*), 5 (*neutral*), 7 (*very attractive/very masculine*). Those faces that did not differ significantly from the neutral rating were used as the base-faces for morphing ($M_{age} = 26.43$, $SD = 1.41$). These faces were then symmetrized, cropped, and morphed using Psychomorph software (Chen & Tiddeman, 2010) toward either the old-male or young-male prototypes created in Experiment 1 (see Fig. 3).

Fig. 2. Example of composite images of old/young–male/female faces used in Experiment 1.

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Participants

Thirty-eight undergraduate participants from the VU University Amsterdam (10 males, 26 females; $M_{age} = 20.94$, $SD = 1.56$) participated in the experiment for either money or credit.

Materials and procedure

The participants in the experiment (separate from the pilot group) were led to individual cubicles where the experiment was conducted on a computer running Macromedia Authorware. Following a brief introductory screen, the participants were randomly assigned to a 2 (facial age: older versus younger faces) between-subjects × 2 (message: exploratory change versus stable exploitation messages) within-subjects design.

Participants in both conditions were then presented with a cover story explaining that they would be viewing the faces of potential leader candidates for an international organization with offices in the local region. They were told that each leader candidate had submitted a short statement describing their general views about organizational decisions from which we had removed all identifying information to protect anonymity except only a cropped photo of the leader's face. Participants were then asked to give their opinion about how well each individual's viewpoint matched their appearance as well as how likely they would be to follow that person given the combination of these factors.

Following these instructions, participants were shown 8 faces of potential group leaders. Underneath each face was one of 8 possible messages. Half of the statements expressed a desire for stable exploitation (e.g., "We should avoid taking risks and maximize the advantages that we already have"). The other half expressed a desire for exploratory change (e.g., "We should look for new and cutting-edge options for success"). To control for potential idiosyncratic effects of individual faces, the face-statement pairings were randomized across all participants so that no one face was paired consistently with either a congruent (e.g., old/stability) or incongruent (e.g., old/change) statement.

Participants were then asked to rate how likely they would be to follow each leader individually using 7-point scales (1 = *very much no*, 7 = *very much yes*). Finally, demographic information was collected and participants were thanked and debriefed.

Results and discussion

In order to verify that the facial morphing of age was effective, we conducted a one-way ANOVA using participants' ratings of the morphed faces as a manipulation check and found that the older faces were rated as significantly older ($M = 4.57$, $SD = .93$) than younger faces ($M = 3.66$, $SD = .67$; $F[1, 35] = 11.62$, $p < .01$). We then conducted a repeated-measures analysis with the facial age condition (young versus old) as a between-subjects factor and statement (exploration versus exploitation) as a within-subjects factor. In line with our hypothesis (H1a), the interaction of condition by statement was significant ($F[1,34] = 4.78$, $p = .04$, $\eta^2 = .13$) such that, as in Experiment 1, older leaders ($M = 3.84$, $SD = 1.07$) were endorsed over younger leaders ($M = 3.15$, $SD = 1.08$) for stable exploitation and younger leaders ($M = 4.07$, $SD = 1.01$) over older leaders ($M = 3.90$, $SD = .81$) were endorsed for exploratory change.

Condition did not have a statistically significant effect on the leader rating ($F[1, 34] = .91$, $p = .30$, $\eta^2 = .03$), indicating that participants did not simply prefer younger or older faces. However, there was a significant effect of statement ($F[1,34] = 6.32$, $p = .02$, $\eta^2 = .16$), such that participants preferred the change statements ($M = 3.98$, $SD = .91$) over the stability statements ($M = 3.51$, $SD = 1.12$). Interestingly, the interaction of condition by statement was not significant for the question "How well do you think this leader's photo matches his stated strategy?" ($F[1,34] = .001$ $p = .95$, $\eta^2 = .000$) such that older leaders ($M = 4.89$, $SD = .91$) were not match more than younger leaders ($M = 4.63$, $SD = 1.15$) with the exploitation strategy and younger leaders ($M = 4.03$, $SD = 1.07$) were not

Fig. 3. Example of young face cropped and morphed to appear old used in Experiment 2.

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matched more than older leaders ($M = 4.26$, $SD = 1.02$) with the exploration strategy. This suggests that although participants implicitly followed the expected contingency pattern they did not make the explicit connection. Also, as in Experiment 1, sex of participant had no effect ($F[1,34] = .27$, $p = .87$, $\eta^2 = .001$). Overall, findings from Experiment 2 further indicate that followers implicitly endorse older leaders for stable exploitation and younger leaders for exploratory change even when the ability to make relative comparisons between old and young faces is inhibited.

Across two experiments we find support for our hypothesis (H1a) in both specific and general contexts of exploration versus exploitation. Next, we wanted to investigate how our theoretical analysis of the exploration–exploitation dilemma could be applied to issues of sustainability — specifically, the dual process of exploring renewable alternatives and encouraging stable exploitation of nonrenewables.

If younger leaders are preferred for change and older leaders for stability then perhaps this knowledge can be utilized to encourage "green OB" initiatives. Specifically, we suspect that younger leaders may be implicitly associated with the exploratory advancement of renewable resources whereas older leaders may emerge for conservative exploitation of nonrenewable resources (H1b). Such a finding would emphasize the importance of specific leadership prototypes for encouraging sustainability.

Experiment 3 methods

Participants

Sixty-six undergraduate participants from the VU University Amsterdam (21 males, 45 females; $M_{age} = 21.59$, $SD = 4.14$) participated in the experiment for either money or credit.

Materials and procedure

For this experiment, rather than relying on smaller pilot samples to ensure that our base faces were equivalent in terms of attractiveness and masculinity, we used a sample of faces taken from a dataset in our lab of 150 male and female faces which included observer ratings of masculinity, femininity, and attractiveness. We created z-scores for each of these three ratings, and selected only those faces which were within .5 *SD* of the mean for all three. The result yielded 22 candidates, from which we used only the male faces leaving a total of six. Further, two more faces were removed so that all faces would be of the same ethnicity. Since these initial faces were university students, they were used as the young condition, and then morphed using Psychomorph (Chen & Tiddeman, 2010) toward an older male prototype established in Experiment 1 to create the old condition (see Fig. 4). Finally, to ensure that the morphing process was effective, we ran a small separate pilot study (N = 18) using Amazon's Mechanical Turk. The morphed faces were shown in randomized order with a perceived age slider ranging from 18 to 99. The morphed faces were perceived to be approximately 42 years old, compared to 26 years old for the un-morphed faces which was established from ratings in the original database.

For this 2 (leader age: old vs. young) × 2 (message: exploratory change vs. stable exploitation) within subject design, participants were shown to individual cubicles in which a computer was running the experiment via Qualtrics Survey Software. Following a brief introductory screen, participants were presented with a cover story explaining that they would be viewing the faces of potential leader candidates for an organization that "wants to develop a program for encouraging people and other organizations to behave more environmentally friendly using effective leadership." They were told that each leader candidate had submitted a short statement describing their views on conservation and green initiatives, but that "a number of different leaders have come to the same conclusion." The cover story went on to state that however, "The organization can only afford to select one person who is going to be most effective at leading conservation of nonrenewable resources, and one person who is going to be most effective at leading transition to renewable resources."

Fig. 4. Example of original face and age-morphed version used in Experiment 3.

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Participants were then presented with the task, which read as follows: "On the next page you will be shown a random pairing of cropped photographs of leaders who have endorsed the same ideas. You will first read what they have to say about conservation and green initiatives. After reading their shared statement, you will be asked which leader you would choose to follow, and then to give ratings of leader traits based on how they appear." Following these instructions, participants viewed the faces of two leader candidates (one older and one younger) side-by-side, above a shared statement endorsing either stability or change (e.g., "At this moment it is most important that we focus on stability and conservation of nonrenewable resources such as oil and natural gas", or "At this moment it is most important that we work on change and transition to new, innovative, and renewable resources such as wind and solar energy"). At the bottom of this page was a slider which ranged from 0 to 100 with which participants could indicate who they preferred to follow for each statement. The slider was labeled: "Please indicate which person you would prefer to follow by moving the slider toward one candidate" with scale ends "Leader 1 (Left)" or "Leader 2 (Right)."

After indicating their preference participants were shown each of the faces individually, counterbalanced to eliminate the possibility of order effects, and asked to rate them in terms of femininity–masculinity, and age. Finally, on a 7-point Likert-style scale we asked participants to rate the leader's faces on various traits (e.g., attractiveness and charisma). This process was repeated 3 more times over the course of the experiment, so that each participant viewed a total of 8 faces (4 old, 4 young) paired with 4 statements (2 exploratory change, 2 stable exploitation). The order of the faces was counterbalanced to ensure that no one face was consistently displayed on either the left or right, and that all possible combinations of older and younger pairings were equally likely to be shown. Finally, demographics were collected, and participants were thanked and debriefed.

Results and discussion

Main effect

To test the green version of our age-biased leadership endorsement hypothesis we conducted a paired-samples *T*-test comparing preferences for older versus younger leaders in the renewable and nonrenewable conditions. Our dependent variable was a scale from 0 to 100, where 0 indicated a higher preference for the younger leader and 100 indicated a higher preference for the older leader. We found a significant difference ($t[65] = 6.68$, $p < .001$, $r = .64$) in the preference scores between the renewable resource condition ($M = 29.97$, $SD = 24.15$) and nonrenewable resource condition ($M = 57.26$, $SD = 26.85$). This confirms our hypothesis that older leaders would be endorsed when encouraging stable conservation of nonrenewables, and younger leaders would be endorsed when encouraging renewable exploration (H1b). It is also important to note that both leader scores differed significantly from the scales midpoint of 50 (young, $t[65] = -6.74$, $p < .001$; old, $t[65] = 2.20$, $p < .05$).

In order to control for potential gender effects, we created a difference score for our dependent variable — meaning that we calculated the change in leader preference between renewable and nonrenewable levels, and regressed it onto gender and condition (first step) and their interaction variable (second step) to investigate if participant gender could predict the change in response patterns we observed. The results indicated only a main effect for condition ($\beta = -.357$, $t[33] = -2.19$, $p = .036$, $r^2 = .13$), indicating that the gender of the participant had *no* statistically significant effect.

Trait measures

In addition to a context-specific preference for older versus younger leaders, we also investigated whether participants would differentially attribute trait characteristics to the faces of these leaders depending on their shared statement. To test for these potential differences, we conducted separate 2 (message: exploratory change vs. stable exploitation) × 2 (leader age: old vs. young) repeated-measures GLMs for each of the rated traits. The results of these analyses indicated significant two-way interactions for attractiveness ($F[1,65] = 8.14$, $p < .01$, $\eta p^2 = .11$), masculinity ($F[1,65] = 24.19$, $p < .001$, $\eta p^2 = .20$), trustworthiness ($F[1,65] = 14.18$, $p < .001$, $\eta p^2 = .18$) and charisma ($F[1,65] = 7.33$, $p < .01$, $\eta p^2 = .10$), but not for competence ($F[1,65] = 1.06$, $p > .05$, $\eta p^2 = .02$).

This means that leader faces conveying a congruent message pairing (e.g., an older leader endorsing conservation of a nonrenewable energy resource) were rated as more attractive, charismatic, trustworthy, and surprisingly less masculine than when the same face was paired with an incongruent message (e.g., an older leader endorsing transition to a renewable energy source).

These findings suggests that 1) follower heuristics cause us to immediately view the right person in the right place as better in these leader-like qualities and 2) these person–context pairings have an effect on social cognition. For instance, prototypic congruence between context and leader (e.g., exploratory change and young leaders) appears to have a halo effect on a number of attributions we assign to a potential leader. This information processing bias can subsequently impact how we think and ultimately behave when choosing a leader. The means of these interactions are shown in Table 1.

Discussion

Using various scenarios and adjustments to experimental design, we replicated results across three experiments to support our age-biased leadership endorsement hypothesis. First, younger leadership is preferred when followers are looking for a leader in times of exploratory change. Second, when followers are focused on the need for stable exploitation they look to older leaders. Third, replication across three diverse experiments suggests we have reasonable justification for our hypothesis. These results, consequently, help to clarify how leadership selection is biased by a leader's age — especially as it relates to the exploration and exploitation dilemma. This is potentially a significant insight given that all organizations face this dilemma and who we endorse as a leader can have a dramatic impact on organizational fitness.

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Table 1
Means (and standard deviations) of facial trait ratings (age × situation) gathered in Experiment 3.

Trait rating	Age of face	Situation	
		Change	Stability
Attractiveness*	Old	3.21 (1.00)	3.71 (0.97)
	Young	4.29 (0.91)	4.20 (1.00)
Charisma*	Old	4.17 (1.34)	4.71 (1.27)
	Young	4.79 (1.35)	4.52 (1.21)
Competence	Old	4.79 (1.14)	5.00 (0.99)
	Young	4.80 (1.07)	4.73 (1.13)
Trustworthiness**	Old	3.94 (1.29)	4.65 (1.21)
	Young	5.38 (1.12)	4.99 (1.33)
Masculinity**	Old	5.44 (0.84)	4.79 (1.01)
	Young	3.64 (1.09)	3.82 (1.09)

* $p < .01$.
** $p < .001$.

Hence we observe the value of applying the logic of evolution (i.e., the ability to provide new insight and parsimony). We can make novel predictions about leadership endorsement for the exploration–exploitation dilemma based on age by considering the evolved psychology of group behavior and the ubiquity of leadership to address challenges in our environment. Indeed, it has been shown that the dilemma is an evolutionarily consistent balancing act between change and stability, and to address these coordination problems different leadership prototypes tend to emerge.

Some may suggest, however, that these age-biased preferences are merely a product of stereotypes. We oppose such claims and encourage the reader to do the same. Stereotypes diminish the functional relevance of leadership contingencies whereas our theoretical perspective highlights the importance of age-biased leadership endorsement. The evolutionary pressure to balance exploration versus exploitation is the ultimate reason why we hold such *functional* leadership prototypes. Conversely, a stereotype (without functional consideration) is at such a proximate level of interpretation that it lacks clarity and is easily overcome when a more prototypic alternative is provided. Kurzban, Tooby, and Cosmides (2001: 15382) found that classifying people by race (a stereotype) is a "reversible byproduct of cognitive machinery that evolved to detect coalitional alliances" — it took less than 4 min to start inducing such a switch.

Using their example, the underlying functional value is identifying who is part of your in-group and racial stereotyping is an over-generalized proxy of group affiliation. Similarly, functional age-biased prototypes can be considered "cognitive machinery" that evolved to detect leaders for the exploration–exploitation dilemma whereas age stereotypes are superficial labels which also tend to be over-generalized. Thus, a prototypic explanation is a superior alternative because it not only accounts for observed differences of leadership endorsement, but also explains *where* these leadership prototypes originate, *why* they are important, and *how* various theories are connected. Appreciating the overall functional value of leadership for exploration versus exploitation is what generates this clarity and allows us to develop and confirm our hypotheses. The results have a number of implications.

By establishing an implicit association between age perception and leadership the findings extend our understanding of the exploration–exploitation dilemma. The results, for instance, address coordination risks associated with an unsustainable imbalance between resource exploration versus exploitation. Competition drives a cycle of status *gaining* exploration and status *maintaining* exploitation. This loop, however, can be perturbed by a hierarchy's overreliance on resource exploitation to maintain status. Established leaders may actively work to maintain an exploitation phase (and suppress the rise of exploration) if their individual benefit of remaining static is greater than the cost of a phase shift. Unfortunately, excessive resource exploitation can set the stage for terminal resource depletion and group atrophy. Conversely, an entrepreneurial leader initiating a shift to resource exploration prematurely to *gain* status can leave a group ill-equipped relative to groups that have maximized their return on an exploitation investment prior to the exploratory switch. Therefore a sustainable group strategy is one that most effectively cycles between exploration and exploitation relative to other groups with which they are in competition. Our data suggests that a competitive (and sustainable) advantage can be achieved by utilizing younger leaders for encouraging a shift to exploration (e.g., a transition to renewable resources) and employing older leaders when controlled exploitation is necessary (e.g., conserving nonrenewable resources).

As for environmental concerns, perhaps one problem with sustainability in a modern context is the degree of global disconnectivity between manufacturing and consumer groups. The use of fossil fuels and access to cheap goods is highly beneficial to consumers regardless of how it may negatively affect those tasked with cheap manufacturing. Thus, the proximity of cost has been lost through the spread of globalization. Another concern is insufficient (or delayed) feedback regarding the cost of our actions and the subsequent inability to induce exploration of sustainable alternatives due to the lack of incentive for change. The complexity of the natural and social environments can make it extremely difficult to see long-term cost relative to short-term benefit. This is especially true if the initial costs are accrued out of sight in developing regions. Utilizing these older and younger leadership biases can help design more effective marketing campaigns for simultaneously encouraging conservation of nonrenewable resources as well as switching to renewable alternatives.

Another implication is in the realm of political leadership. Analogous to the masculine-war and feminine-peace prototypes (Spisak, Dekker, et al., 2012; Spisak, Homan, et al., 2012), it would benefit older candidates to emphasize the "value of stability"

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with voters, while younger leaders should attempt to make salient the "prosperity of change." At an organizational level, our findings can anticipate how group dynamics and followership behavior will shift with leadership age. For example, followers may be more likely to buy into change and innovation initiatives when led by younger-looking leaders. Conversely, when group goals are, to say, highlight and refine best practices, an older-looking leader may elicit increased followership endorsement.

It is also reassuring that our approach potentially helps to clarify and connect a number of proximate findings. Previous work has shown that transformational leadership is preferred for exploration and transactional for exploitation (Jansen et al., 2009). This is not surprising considering that transformational leadership fosters vision, ingenuity, and risking-taking whereas active transactional leadership elicits reliability, regulation, and ultimately stability (Denison, Hooijberg, & Quinn, 1995; Gibson & Birkinshaw, 2004; Vera & Crossan, 2004). This corresponds nicely to effects of the aging process (i.e., exploration requires stamina and an abundance of energy and therefore selects for younger and more energetic leaders whereas exploitation tends to favor experienced older leaders with a wealth of acquired knowledge to manage uncertainty). Thus, our perspective can account for the proposed age differences between transformational and transactional leadership (Doherty, 1997).

This brings us to limitations and future work. First, to the best of our knowledge, there is no published research explicitly investigating age differences of leadership emergence and performance during pressures of exploration versus exploitation. Future work is necessary to reinforce our preliminary findings. One start is incorporating decision making models regarding exploration and exploitation, such as the "multi-armed bandit problem", into a group environment and test for leadership emergence and performance factors, including leader age. Second, although our findings are novel and innovative, we do appreciate the concern for potential discrepancies between lab and field but nonetheless feel confident given the high degree of generalizability between the two (i.e., a correlation of .73; Anderson, Lindsay, & Bushman, 1999). Another apprehension some may derive from lab research is a lack of participant heterogeneity. Indeed, this may be true, but previous research finds similar homogeneity in the field (Dipboye & Flanagan, 1979) and this is without the benefit of improved internal validity offered by the lab.

Continued investigation and replication should therefore diversify using a broader age range of participants. However, a meta-analysis of findings gathered in the lab and the field (the latter representing an older sample) indicate a consistent and significant perception of older group member as stable and reliable and younger members as more open to change and adaptable in *both* settings (Gordon & Arvey, 2004). This suggests our findings will hold across a diverse landscape of demographics and situations — including an increased age range. In further support that these evolved decision rules remain constant across context and individual, diverging neural substrates are preferentially activated for managing exploration and exploitation (e.g., Daw, O'Doherty, Dayan, Seymour, & Dolan, 2006) indicating specific circuitry has been selected for to help us quickly manage the dilemma. Thus, given our social nature for problem solving and the selection pressure for leadership, perhaps embedded within these decision-making neural systems are context-specific leadership prototypes. Future work in neuroscience will make for an interesting addition.

It will also be valuable to further clarify the underlying functional information perceptions of age represent and how these factors rank in importance across changing coordination problems. For example, is it more so perceived fluid intelligence (e.g., exhibiting increased creativity independent of acquired knowledge) or perceived physical capability that benefits younger leaders during exploration? Another variable for future consideration is attractiveness. Recent findings indicate that attractiveness is an important predictor of electoral success (Berggren, Jordahl, & Poutvaara, 2010) and our data reveals a positive impact of leader–situation congruence on perceived attractiveness. It will be beneficial for future models to explore the casual nature of this relationship. Finally, to advance this research, we encourage others adopting a more proximate approach to test alternative explanations. One of the advantages of an evolutionary lens is the ability to undercover previously unseen connections. However, replication is the true test.

What this work offers is a parsimonious alternative unifying various theories to better explain leadership endorsement. Incorporating human evolution integrates a number of proximate mechanisms to form a more complete picture of leadership, the exploration–exploitation dilemma, and the importance of age. With increasing age in certain parts of the world, younger populations elsewhere, and globalization everywhere, this topic will remain continually worthy of exploration.

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