© *Academy of Management Perspectives*
2017, Vol. 31, No. 1, 63–81.
https://doi.org/10.5465/amp.2015.0163

A R T I C L E S

PUPPET MASTER: POSSIBLE INFLUENCE OF THE PARASITE *TOXOPLASMA GONDII* ON MANAGERS AND EMPLOYEES

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The article reviews recent literature on the effects of host manipulation by the parasite *Toxoplasma gondii* (prevalent in about a third of the world's population) on perception, cognition, and behavior of humans, and on the changes in their physical appearance and personality characteristics. I argue that the mind-affecting parasite paradigm offers many research opportunities for management sciences, especially for organizational psychology and neuroscience. The article summarizes the parasite's physiological mechanisms of affecting the host; highlights important behavioral effects of the infection in humans; and speculates on the possible impacts on skills and careers of employees and managers, organizational dynamics, intercultural management, and gender work roles. The conclusion shows limitations of the presented speculations and possible directions for future research on *Toxoplasma*'s effect on organizational dynamics.

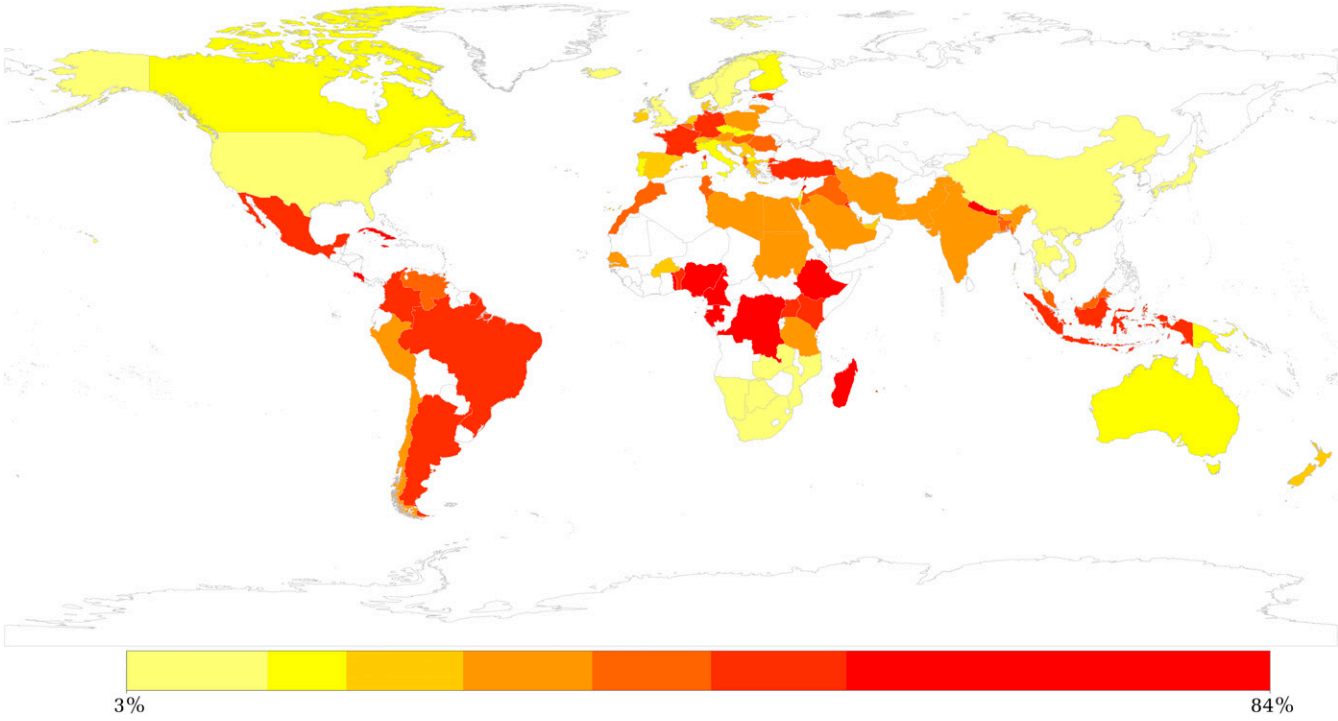
Toxoplasmosis is a disease caused by the unicellular parasite *Toxoplasma gondii*. This infection afflicts 30% to 40% of worldwide human population, and the prevalence of toxoplasmosis, unlike most other pathogens, is high even in some developed countries (Tenter, Heckeroth, & Weiss, 2000) (see Figure 1). The disease is clinically latent, and infected people usually do not show any visible symptoms, so most afflicted people are unaware of their infection. Nevertheless, knowing the life cycle and effects of the parasite is useful for organizational researchers and practicing managers, because *Toxoplasma* is able to covertly alter cognition and personal characteristics of infected individuals. It systematically changes their physical appearance, their health, and ultimately their ability to perform at work (Flegr, 2013a, 2013b; Webster, Kaushik, Bristow, & McConkey, 2013). The aim of this paper is to show how toxoplasmosis might influence the cognitive and personality characteristics of employees and managers, and offer speculations on the possible impacts of these changes on the careers of the infected people and on organizational dynamics.

Toxoplasma affects behavior of infected humans by manipulating the central nervous system (see Figure 2), so it can serve as a source of natural case studies of how and why the hypotheses of organizational neuroscience are useful in studying organizational processes and employees' and managers' decision-making. So far such specific studies have not been conducted, although using the paradigm of a mind-affecting parasite does not share the methodological limitations for which organizational neuroscience is frequently criticized (Ashkanasy, Becker, & Waldman, 2014; Butler, O'Broin, Lee, & Senior, 2016; Cropanzano & Becker, 2013; Lindebaum & Jordan, 2014).

Ashkanasy and colleagues (2014, pp. 909–910) pointed out four main issues of contention regarding the application of neuroscience to organizational behavior theory and practice: "fear of reductionism, that organizational neuroscience seeks to reduce organizational behavior to activity in particular brain regions or even neurons;

I am very grateful to Jaroslav Flegr, Ludmila Hadincová, Julie Nováková, Petr Koblovský, Daniel Šťastný, Marek Vranka, *Academy of Management Perspectives* editor Phillip Phan and two anonymous reviewers, and participants at workshops at J. E. Purkyně University, the University of Economics in Prague, and Charles University for their inspiring comments and helpful feedback. This research received support from the grant VŠE IP300040.

FIGURE 1
Prevalence of Toxoplasmosis (Seroprevalence) Per Country in Percent of Population

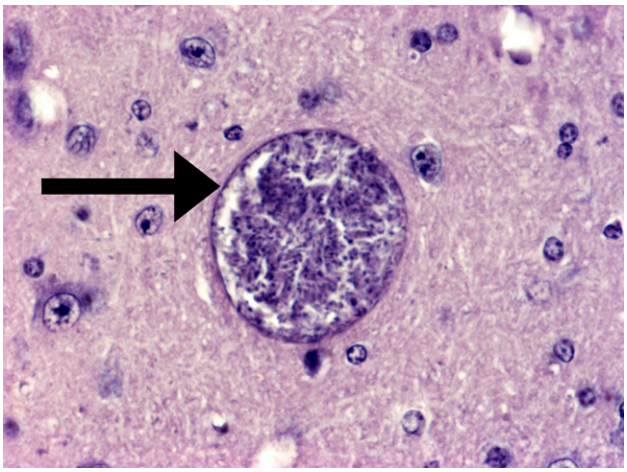


There is no data for the countries that are not shaded in the map. The source of country-level statistics is Flegr and Dama (2014). Toxoplasmosis is typically diagnosed by serological tests, which measure levels of antibodies—immunoglobulin G (IgG) or immunoglobulin M (IgM)—in the blood of the tested people. Most of the seroprevalence data comes from women of childbearing age (the seroprevalence is therefore adjusted to a standard age of 22 years). Nevertheless, the seroprevalence reported in the epidemiological literature varies enormously (Chemoh et al., 2013), and in many countries it is now dramatically decreasing, possibly due to a shift in hygiene habits

legitimate concerns with limitations of the methods and technologies that underlie neuroscience research; [that] practical applications of neuroscience may be inappropriate or meaningless, and the potential for application to issues beyond individuals (e.g., team-based phenomena) is nonexistent; and that some applications of neuroscience ... have all the characteristics of (yet) another management fad."

I address each of these potential problems in turn. First, the parasite affects the neural and hormonal systems directly, so it's necessary to use reductionist, "mechanistic" physiological explanations of perception, decision-making, and behavior in studying its impact on human behavioral patterns. Nevertheless, the infected people remain at their workplaces, in everyday situations instead of artificial laboratory experiments. We can therefore apply predictions from the mechanistic/physiological explanations to actual behavior of employees in firms. As *Toxoplasma* alters primarily cognitive and personality characteristics, affected individuals' relationships with other people are affected too. Second, the effects of infection are connected to teamwork and organizational management, not just decisions and behavior of an individual as is typical for neuroscience laboratory studies. Third, if the parasite's influence is truly genuine, in some cases more so than in others, then knowledge of its impacts enriches organizational behavioral theory and holds highly practical insights for human resources management and organizational management in general. Finally, although *Toxoplasma* infection generally affects people negatively, under some circumstances it can also have a positive impact (e.g., some *Toxoplasma*-positive people have more pronounced extroversion, which is a predictor of higher status in team contexts; DesJardins, Srivastava, Küfner, & Back, 2015), and so it could enable organizational scholars to observe the

FIGURE 2
A *Toxoplasma* Tissue Cyst in the Brain of a Chronically Infected Mouse



Width of the cyst is about 50 μm; small darker bodies around the cyst are brain cells. During its life cycle, *Toxoplasma gondii* converts into various stages with different morphology. There are many *Toxoplasma* strains, but the majority in the United States and Europe fall into three distinct lineages (Saeij, Boyle, & Boothroyd, 2005). Printed by permission of Jaroslav Flegr.

selection of *Toxoplasma*-infected individuals with induced change of personality for specific organizational positions or roles.

Furthermore, due to a possibility that the parasite affects the forms of human cultures and economic institutions as well (Lafferty, 2006; Maseland, 2013), the findings about the parasite could be also used in the field of intercultural or international management. (*Toxoplasma,* as this article will show, can cause infected people to act impulsively, and toxoplasmosis is quite widespread in France, for example.) Moreover, the findings can also be used in general research on decision-making errors and biases of managers.

While all these research propositions seem to be long shots (and some of them are truly just speculations, as I highlight later in the review), I believe that in the area of organizational neuroscience it is true "that a study of latent toxoplasmosis . . . has its best years ahead" (Flegr, 2013a, p. 161).

Yet methodological and ethical problems prevail in this paradigm as well. First, it's not possible to infect humans in randomized experiments. Therefore, most evidence of the influence of toxoplasmosis on human personality and cognition is of a correlational nature, and as we all know, correlation does not mean causation. Second, although the effects of toxoplasmosis are not pathological, the latent infection is chronic and typically incurable in people. The disease can create a stigma in infected persons and lead to discrimination against them.

With this as the backdrop, the article proceeds as follows: I present some basic information on the protozoan parasite *Toxoplasma gondii* and the physiological mechanisms that affect its hosts. The first part of this systematic review of the parasite's influence on humans is focused on changes in the cognitive abilities of infected people and the possible impacts of their impaired cognition on their jobs. The second part of the review concerns permanent changes in personality characteristics and traits (as conceptualized by the five-factor model; Goldberg, 1990) or appearance that infected people may undergo. I then speculate how toxoplasmosis may influence work performance and careers of infected employees through these changes in personality traits. This section is followed by a short speculation on the possible influence of the parasite on cultures. The conclusion shows the limitations of the presented inferences and possible future courses of research on *Toxoplasma*'s impact on organizational dynamics.

TOXOPLASMA GONDII, THE MASTER

The objective of *Toxoplasma* is to make its way from its intermediate hosts (typically rodents, but probably all warm-blooded animals) to its final hosts—cats and other felines (members of the family *Felidae*). Only in the digestive system of cats can the parasite sexually reproduce and spread (through the cat's excrement). If an intermediate host is infected by *Toxoplasma,* the parasite quickly reproduces asexually and its oocytes settle in the host's brain and other tissues and begin altering the host's behavior. These manipulations are sometimes very specific—for example, infected rats are no longer afraid of cat odor, but they don't lose fear of other predatory species (Lamberton, Donnelly, & Webster, 2008). Other manipulations are straightforward: The reaction time of infected animals increases; vigilance and motor activity deteriorate. Nonetheless, the infected rats show further risky behavior (Webster, 2007). The chances of a cat catching an infected rat increase drastically, which means that *Toxoplasma* reaches its final destination (where it sexually reproduces) faster, and the cycle repeats. The manipulation of hosts increases with the length of the infection, indicating a causal influence of the parasite on the changes in its intermediate host's

behavior. They could not be merely the side effects of an acute infection, which would rather induce a more pronounced behavioral change at the beginning. It cannot be ruled out completely that the manipulation by the parasite is a wide-ranging consequence of a chronic disease—tissue destruction and the host's immune system activity (Flegr, 2013a). Nevertheless, Webster, Lamberton, Donnelly, and Torrey (2006) showed that anti-parasite medications are efficient in preventing related behavioral alterations (moreover, medications used to treat psychiatric diseases possess anti-parasitic properties, too).

Any warm-blooded animal can be infected by *Toxoplasma*, including humans. The infection is most frequently contracted by consuming poorly washed vegetables or fruits from places contaminated with feline excrement, coming into direct contact with the excrement, or consuming insufficiently cooked meat of infected animals (e.g., pork, lamb, or turkey). That may be the reason why countries with a tradition of eating undercooked meat have a higher prevalence of toxoplasmosis (as do countries with more people working in agriculture, poor hygienic standards, and cats as common pets).

After a short acute stage that resembles the flu, the infection quickly enters a latent stage characterized by the permanent presence of the parasite's cysts in the muscles and central nervous system. The chronic disease is seemingly asymptomatic in most people. Serious health complications are rare and appear primarily in prenatal infections (a congenital infection can cause miscarriage or severe impairments in the newborn) or in patients with weakened immunity from HIV/AIDS or immunosuppressants (after organ transplantation).

Toxoplasma cannot recognize in which host it is present, so its manipulation affects behavioral patterns not only in rodents but also in its atypical hosts, including humans (Webster et al., 2013). For example, infected men rate the smell of cat urine as more pleasant than uninfected individuals do (Flegr, Lenochová, Hodný, & Vondrová, 2011).

Physiological Mechanisms of Manipulations

Cysts containing *Toxoplasma* are distributed relatively randomly across the brain (but see McConkey, Martin, Bristow, & Webster, 2013); in rodents, cysts are found especially in the olfactory bulbs, the amygdala, the nucleus accumbens, the cerebral cortex, the cerebellum, the medulla oblongata, the basal ganglia, and the septohippocampal and perihippocampal regions (Webster & McConkey, 2010). Cysts can cause direct neurodegeneration (see similar effects of cytomegalovirus; Novotná et al., 2005), but these pathological processes alone are unlikely to be responsible for the observed behavioral changes. This is because important behavioral characteristics are left intact, except for the observed specific behavioral alterations.

The placement of the cysts in the olfactory bulbs and in the amygdala is not surprising because the change in the perception of cat odor is a common manipulation of *Toxoplasma*, and because the amygdala handles stimuli that cause fear. Similarly, a strong candidate for the location of the parasite in the brain of a host is the nucleus accumbens, which has demonstrated a role in a range of behaviors regarding rewards, expectations, pleasure, and fear (Cauda et al., 2011). However, any direct effect of the parasite in the selected regions relies on the premise that parasites can locate these regions and then implement their manipulation with surgical precision—which does not seem probable. The handling mechanism is rather an indirect neurotransmitter modulation. *Toxoplasma* causes chemical changes in its immediate surroundings and thereby influences certain neurons playing a role in the "targeted" behavior. Thus, it can strengthen or weaken certain neuronal pathways and make some physiological and behavior effects more likely than others (Webster & McConkey, 2010).

The parasite can change the concentration level of the neurotransmitter dopamine in the brain by local inflammation of certain neuronal areas. This was observed physiologically in mice and indirectly in humans. Infected people are characterized by reduced novelty seeking (Flegr et al., 2003; Skallová, Kodym, Frynta, & Flegr, 2006), which is a personality trait significantly associated with the dopaminergic system (Cloninger, Svrakic, & Przybeck, 1993). Moreover, the genome of *Toxoplasma* also contains genes for key enzymes of dopamine synthesis (Gaskell, Smith, Pinney, Westhead, & McConkey, 2009). Because there is no simple explanation for why *Toxoplasma* should have similar enzymes for itself, it is expected that the parasite induces a release of dopamine into hosts' tissues to manipulate them (Prandovszky et al., 2011). Dopamine is involved in behavior related to getting rewards and avoiding loss, impulsivity, learning, novelty seeking, and risk taking (Jocham, Klein, & Ullsperger, 2011; Pine, Shiner, Seymour, & Dolan, 2010; Sharot, Shiner, Brown, Fan, & Dolan, 2009). These characteristics

undoubtedly have effects in many aspects of organizational life.

The impact of the infection could be significant with regard to outbreaks of several neurological and psychiatric diseases associated with a biased function of the dopaminergic system. For example, having toxoplasmosis was found to increase the risk of schizophrenia 2.7 times, which is approximately equal to the increased risk of a cannabis user (Torrey, Bartko, & Yolken, 2012). The influence of toxoplasmosis was even identified at the onset of personality disorders, Parkinson's disease, Alzheimer's disease, obsessive-compulsive disorder, recurrent migraines, autism, brain tumors, and even depression (for reviews see Flegr, 2013a; Webster et al., 2013). The rate of prevalence of toxoplasmosis is correlated with countries' suicide rates (Ling, Lester, Mortensen, Langenberg, & Postolache, 2011); women infected with toxoplasmosis are twice as likely to commit or attempt suicide than uninfected women (Pedersen, Mortensen, Norgaard-Pedersen, & Postolache, 2012). This effect is concentrated closer to the moment of infection (it doesn't intensify with the duration of infection), so it appears to be an immediate reaction rather than a cumulative impact of latent disease.

Many of the above-mentioned psychiatric disorders are associated with depressive states, showing the possible effect of *Toxoplasma* on the metabolism of serotonin. Serotonin is synthesized from tryptophan, an amino acid that is a basic nutrient for many parasites, including *Toxoplasma*. Stemming from this, depression thus could be caused by a fattening parasite (Flegr, 2013a, but see also Healy, 2015). If it is true that the *Toxoplasma* is involved in the onset of depression, it may worsen infected employees' life satisfaction, and there is no doubt that employees' psychological well-being heavily influences their work-related outcomes (Luthans & Youssef, 2007; Youssef & Luthans, 2007).

Toxoplasmosis may also affect testosterone levels. *Toxoplasma*-positive men have a higher concentration of testosterone and *Toxoplasma*-positive women have a lower concentration of testosterone than *Toxoplasma*-free controls (Flegr, Lindová, & Kodym, 2008). The opposite direction of the testosterone shifts can explain the observed gender specificity of behavioral and personal alterations in *Toxoplasma*-positive participants (see more in the following sections). These results could be caused by the immunosuppressive nature of testosterone, making men more likely to be infected. On the other hand, a study (Lim, Kumar, Hari Dass, & Vyas, 2013) showed that *Toxoplasma* infection enhances expression of genes involved in facilitating synthesis of testosterone, resulting in greater testicular testosterone production in male rats. The same mechanism could work also in humans.

How Do the Puppets Behave? Effects on Cognition and Working Memory

A manager's performance (as is most workers') is undoubtedly related to his or her mental abilities (Eggers & Kaplan, 2013; Teece, 2007). General cognitive abilities largely predict both academic and occupational levels attained and work performance, and do so better than any other trait or disposition (Kuncel, Hezlett, & Ones, 2004; Schmidt & Hunter, 2004). It's not surprising that a third to half of CEOs attended an elite school, which placed them in the top 1% of cognitive abilities (Wai & Rindermann, 2015). Current research on cognitive ability and performance in the workplace focuses on finding out which emotional and cognitive processes—such as bounded attention and perception, memory, and problem solving—are active in managerial and strategic decision making or which (un)successful "cognitive climates" are prevalent within organizations (Baron, 2006; Foss & Lindenberg, 2013; Hodgkinson & Healey 2011; Houdek, 2016).

Although there aren't many studies on the impact of toxoplasmosis on job-related cognition, published studies thoroughly confirm that even in humans, toxoplasmosis generally impairs basic cognitive functions (see Table 1 for a systematic review). The infected humans aren't in danger of being caught by a cat, obviously, though their slower reactions can cause death or injury. Studies have shown that *Toxoplasma*-positive people are more likely to be involved in traffic accidents and workplace accidents (see Table 1), although the latter relationship was demonstrated only in small subsamples of workers from a low social class, so a generalization of these findings remains questionable. The preferred explanation of the results is that the negative impacts of toxoplasmosis will mainly be manifested in already prone groups or situations and/or contexts where the basal cognitive strength is weak. This explanation stems from the finding that there is more frequent and earlier manifestation of Alzheimer's disease in people with low cognitive reserves (Stern, 2009).

Just like mice, infected humans have slower reactions. In a simple double-blind experiment (Havlíček, Gašová, Smith, Zvára, & Flegr, 2001), the

TABLE 1
Studies on *Toxoplasma*'s Influence on Human Cognitive Functions

Study	Country	Type of study [specific group]	N (*Toxoplasma*-positive/control)	Methods	Findings
Ferreira et al. (2013)	Brazil	Survey of hospital patients [children 6–13 years old]	8/92	Scholastic performance test	Infected subjects had lower results on the mathematics subtest of the scholastic performance test.
Flegr, Havlíček, Kodym, Malý, & Smahel (2002)	Czech Republic	Survey of subjects involved in traffic accidents (case-control)	146/446	Correlation between relative risk of traffic accidents and *Toxoplasma* infection	Infected subjects had increased risk of traffic accidents.
Flegr, Klose, Novotná, Berenreitterová, & Havlíček (2009)	Czech Republic	Prospective cohort study design [male draftees]	Of 3,890 subjects 29.7% were *Toxo*-positive	Correlation between relative risk of traffic accidents and *Toxoplasma* infection	Infected subjects (but only RhD negative) had increased risk of traffic accidents.
Flegr, Novotná, Lindová, & Havlíček (2008)	Czech Republic	Behavioral study	58/278	Reaction time test (psychomotor performance)	Infected subjects (but only women) had lower psychomotor performance.
Havlíček, Gašová, Smith, Zvára, & Flegr (2001)	Czech Republic	Double-blind behavioral study	60/56	Reaction time test (psychomotor performance)	Infected subjects had decreased psychomotor performance.
Lanchava, Carlson, Šebánková, Flegr, & Nave (2015)	Czech Republic	Behavioral study [women]	39/40	Financial decision-making experiment	Infection was not associated with financial decision making in females.
Novotná et al. (2008)	Czech Republic	Behavioral study	1st study 41/73; 2nd study 151/288; 3rd study 95/220	Reaction time test (psychomotor performance)	Infected subjects (but only RhD negative) had decreased psychomotor performance.
Příplatová, Šebánková, & Flegr (2014)	Czech Republic	Double-blind behavioral study	44/192	Test of acoustic prepulse inhibition of simple reaction times	Infected subjects had prolonged reaction times to acoustic signals.
Beste, Getzmann, Gajewski, Golka, & Falkenstein (2014)	Germany	Behavioral study [seniors, 63+]	36/36	Auditory distraction paradigm	Infected subjects had compromised attentional allocation and disengagement.
Gajewski, Falkenstein, Hengstler, & Golka (2014)	Germany	Double-blind behavioral study [seniors, 65+]	42/42	Battery of neuropsychological tests	Infected subjects had an impairment of various aspects of memory.
Stock, Heintschel von Heinegg, Köhling, & Beste (2014)	Germany	Double-blind behavioral study	18/18	Stop–change paradigm	Infection was not associated with cognitive control processes (infected subjects were better at these tasks).
Alvarado-Esquivel et al. (2014)	Mexico	Cross-sectional survey (convenience sampling)	71/143	Correlation between clinical characteristics and *Toxoplasma* infection	Infection was associated with memory impairment.
Alvarado-Esquivel, Torres-Castorena, Liesenfeld, Estrada-Martínez, & Urbina-Álvarez (2012)	Mexico	Survey of subjects involved in work accidents (case-control)	Of 133 subjects involved in accidents, 12 were *Toxo*-positive; of 266 control, 20 were *Toxo*-positive	Correlation between relative risk of work accidents and *Toxoplasma* infection	Infected subjects (but only those with low socioeconomic status) had an increased risk of work accidents.

TABLE 1
(Continued)

Study	Country	Type of study [specific group]	N (*Toxoplasma*-positive/control)	Methods	Findings
Galván-Ramírez et al. (2013)	Mexico	Survey of subjects involved in traffic accidents (case-control)	Of 159 subjects involved in accidents, 54 were *Toxo*-positive; of 164 control, 59 were *Toxo*-positive	Correlation between relative risk of traffic accidents and *Toxoplasma* infection	Infected subjects had an increased risk of traffic accidents.
Sugden et al. (2016)*	New Zealand	Population-representative birth-cohort study	236/601	Correlation between various phenotypes and *Toxoplasma* infection	Infection was not associated with poor impulse control or neurocognitive impairment.
Guenter et al. (2012)	Poland	Behavioral study	26/44	Battery of neuropsychological tests	Infection was not associated with any cognitive impairments.
Kocazeybek et al. (2009)	Turkey	Survey of subjects involved in traffic accidents (case-control)	Of 243 subjects involved in accidents, 130 were *Toxo*-positive; of 200 control, 56 were *Toxo*-positive	Correlation between relative risk of traffic accidents and *Toxoplasma* infection	Infected subjects had an increased risk of traffic accidents.
Yereli, Balcioğlu, & Özbilgin (2006)	Turkey	Survey of subjects involved in traffic accidents (case-control)	Of 185 subjects involved in accidents, 60 were *Toxo*-positive; of 185 control, 16 were *Toxo*-positive	Correlation between relative risk of traffic accidents and *Toxoplasma* infection	Infected subjects had an increased risk of traffic accidents.
Gale, Brown, Erickson, Berrett, & Hedges (2015)	USA	Population-representative study	Of 4,178 subjects, 19.1% were *Toxo*-positive	Battery of neuropsychological tests	Infected subjects (but only those with low socioeconomic status and in certain racial-ethnic groups) had various impairments of cognitive functions.
Mendy, Vieira, Albatineh, & Gasana (2015a)	USA	Population-representative study [children 12–16 years old]	Of 1,755 subjects, 7.7% were *Toxo*-positive	Battery of neuropsychological tests	Infection was associated with lower reading skills and memory capacities.
Mendy, Vieira, Albatineh, & Gasana (2015b)	USA	Population-representative study [seniors, 60+]	Of 4,485 subjects, 41% were *Toxo*-positive	Memory tests	Infection was associated with lower immediate memory.
Pearce, Kruszon-Moran, & Jones (2014)	USA	Population-representative study	Of 4,234 subjects, 20.9% were *Toxo*-positive	Battery of neuropsychological tests	Infected subjects (but only those with low socioeconomic status) had various impairments of cognitive functions.

Note: The above-mentioned studies were selected through the Google Scholar and PubMed databases. Laboratory and field studies, case studies, and surveys estimating the influence of toxoplasmosis on the cognition of otherwise healthy people were included. The databases were searched using the following keywords: human, *Toxoplasma*, toxoplasmosis, cognition, cognitive, memory, attention, perception, reaction, and problem solving. Articles from 1950 to May 2016 were included. The results comprised more than 14,000 references. After excluding unsuitable articles (reviews; conceptual papers; animal studies; in vivo studies; studies on psychiatric, neurological, and other diseases; cross-country comparative studies; and unpublished studies, typically theses), 41 remained. Another 19 studies were excluded because they didn't relate directly to cognitive abilities; they monitored the prevalence of toxoplasmosis in different professions and other groups, or they were duplicates referred to in Table 2. The number of *Toxo*-positive participants is an estimate across different serological analyses (i.e., acute and latent infections).

* The study is presented in both systematic reviews.

first of its kind, participants had to press a designated key as quickly as possible after a certain shape appeared on the screen. In the first minute of the experiment, there was no difference in the reaction times of infected and uninfected participants. After the first minute, the infected people started getting significantly slower, which suggests that *Toxoplasma* weakens long-term ability to concentrate. Other studies have indicated that infected people are more easily tired or not able to concentrate on longer-lasting tasks (see Table 1).

Of these studies (see Table 1), 12 found a negative influence of toxoplasmosis on various cognitive functions, six found a negative influence only in certain subgroups of subjects, and four found either no effect or an opposite effect. However, most of these studies are conducted in convenience samples and test multiple variables and thus do bear a large risk of false positives (Bettis, 2012; Simmons, Nelson, & Simonsohn, 2011). (On the other hand, as mentioned earlier, there exists some suspicion that *Toxoplasma* increases testosterone levels and thus stimulates competitiveness in men, so many tests' results can be skewed away from identifying negative influence of toxoplasmosis on cognition in men, because infected men could work harder in the competitive environment of an experiment.)

The results presented in this section show that *Toxoplasma*-positive people have longer reaction times, they are more easily distracted from their long-term tasks, and their working memory is worse (Table 1). Good working memory and ability to exercise cognitive control are of course crucial for predicting job performance on a number of measures (Ackerman, Beier, & Boyle, 2005; Tang & Posner, 2009). The infection also appears to be linked with recklessness (Lindová, Příplatová, & Flegr, 2012). In sum, it is expected that during prolonged tasks that require concentration, infected people will achieve worse outcomes than uninfected individuals.

Nevertheless, the correlative nature of the analyses allows the interpretation that certain unfavorable socioeconomic conditions are related to both low cognitive abilities and a higher risk of being infected with toxoplasmosis (such as eating unwashed vegetables or uncooked meat, living in the countryside, etc.). The association between infection and cognitive deficits is usually weaker or even disappears when the covariates of age, socioeconomic status, and gender are controlled for (Gale, Erickson, Berrett, Brown, & Hedges, 2016). Cross-sectional surveys, however, cannot exactly show whether toxoplasmosis has a direct impact on cognition (although there is strong evidence that the difference in personality traits between infected subjects and controls increases with time since the moment of infection; see below). The relationship between cognition and toxoplasmosis is reversible and modulated by many other factors: Low socioeconomic status can lead to cognitive difficulties (Mullainathan & Shafir, 2013) and a higher risk of being infected with toxoplasmosis, or infection can lead to cognitive difficulties and subsequent low social status.

CHANGES IN PERSONAL CHARACTERISTICS AND PHYSICAL APPEARANCE

Management research has shown that in organizational practice, people with different personality profiles hold different beliefs and react differently to work challenges (George, 1992; Raja, Johns, & Ntalianis, 2004). The first large meta-analysis (Barrick & Mount, 1991), the results of which have been corroborated by subsequent meta-analyses (Judge, Heller, & Mount, 2002; Judge, Higgins, Thoresen, & Barrick, 1999), used a five-factor model (Goldberg, 1990), which has a long influential history of explaining organizational behavior and will also be used below in a demonstration of how toxoplasmosis may affect the discussed personality traits in humans. Barrick and Mount's (1991) study found that the trait of conscientiousness—a persistent, planful, responsible, and hardworking personality—consistently positively correlates with various indices of a worker's productivity (job proficiency, training proficiency, and personnel data) across different professions. Furthermore, the trait of extroversion—a sociable, gregarious, assertive personality craving reward and status—influences productivity in positions with substantial social interactions, such as managers and sales. Extroversion and conscientiousness are also the strongest predictors of leadership (Judge, Bono, Ilies, & Gerhardt, 2002). The personality construct "openness to experience" correlates with performance in training proficiency but not anywhere else. On the other hand, other studies conclude that openness to experience is strongly related to innovation and creativity of workers and with intrinsic motivation not only at workplaces (George & Zhou, 2001; Shalley, Zhou, & Oldham, 2004).

Conversely, neuroticism—a personality manifesting emotional instability, anxiety, and lack of psychological adjustment—correlates positively with dissatisfaction at work, low productivity, and inability to lead (Judge, Heller, & Mount, 2002; Judge, Higgins, Thoresen, & Barrick, 1999).

Of the 15 studies listed in Table 2, 14 found some influence of toxoplasmosis on various personality traits; only one (large) study found no effect (again, a number of studies bear a large risk of false positives). The personality characteristics of infected individuals change and the impact generally becomes more severe the longer they are infected, so it is unlikely that subjects with certain personality profiles are more prone to *Toxoplasma* infection (nevertheless, without human infection experiments—which are clearly unethical—it is not possible to decide whether a genuine causal relation exists between *Toxoplasma* infection and personality and other changes). However, there are disparities in the findings, and toxoplasmosis generally explains only a small part of the variability.

For example, Skallová et al. (2005) found that *Toxoplasma*-positive participants, both men and women, had lower scores in the psychobiological factor novelty seeking than *Toxoplasma*-free participants, and that infected subjects had little or no need for novel stimulation and preferred familiar places, people, and situations; these results largely confirmed results obtained by Flegr et al. (2003). Also, *Toxoplasma*-positive subjects scored significantly lower on the test of verbal intelligence than *Toxoplasma*-free subjects (although this characteristic might be explained by different backgrounds of infected and uninfected individuals). As indicated above, lower novelty seeking is expected to be associated with an increased concentration of dopamine in the brain tissue, a product of the increased synthesis of dopamine due to *Toxoplasma* tissue cysts. These studies also show that *Toxoplasma*-positive subjects tend to be more organized and methodical and prefer activities with strict rules and regulations. In contrast, Lindová et al. (2012) observed lower conscientiousness in *Toxoplasma*-infected subjects, particularly in men. The relationship between the pathogen and conscientiousness-related traits is thus unclear.

Toxoplasma-infected male and female subjects showed higher extroversion than *Toxoplasma*-free subjects (Lindová et al., 2012). *Toxoplasma*-infected men tend to be suspicious and jealous, they break the social rules more often, and they suffer from low superego strength, but these results are not consistent across studies (see Table 2). As personal qualities significantly influence workplace relations, leadership, and management skills as well as teamwork performance (Barrick, Stewart, Neubert, & Mount, 1998; Bradley, Klotz, Postlethwaite, & Brown, 2013), one should expect that changes in personality characteristics (or altered levels of them) may also be reflected in corporate practice.

The exact effect of the infection on work performance or career growth is difficult to predict because it is demonstrated on many levels. Moreover, personality traits and individual skills are linked to their respective organizational contexts, and their dis/advantageousness may depend on situational conditions, tasks, and team composition (further discussion of the topic would be out of the scope of this article). For example, toxoplasmosis increases extroversion (i.e., social dominance and sociability), which would be particularly beneficial for salespeople, managers, and team leaders, but it reduces cognitive abilities and willingness to try new things. As it has been proven that leadership skill correlates with extroversion even more than with intelligence (Judge, Bono, Ilies, & Gerhardt, 2002; Judge, Colbert, & Ilies, 2004), the net impact of toxoplasmosis could be positive for a manager or a leader. Because toxoplasmosis lowers conscientiousness, we can speculate that infected people would more frequently fail at their tasks, so that their career dynamics would look like a supernova, burning bright but perishing young. *Toxoplasma*-infected managers can also reduce the work satisfaction and productivity of their subordinates because of their negligence or lack of a coherent managing system. Infected team members can limit the performance of the whole team.

The unique questionnaire Toxo94, based on a pilot study conducted by Flegr (2010), uncovered even more specific differences between *Toxoplasma*-positive and -negative individuals. For example, infected men and women were more likely to agree with the statements "My instinctive (reflexive) behavior under imminent danger is rather slow and passive. In a situation where most people get alarmed and instinctively jump aside, I am slow to react," and "I believe that some people have the power to impose their will on others under hypnosis or otherwise." *Toxoplasma*-positive men also agreed more with the statement "When I am attacked, physically or otherwise, or when I should fight for something important, I stop fighting at that moment. It is not a result of a rational decision not to fight, as in fact I know that I should continue fighting and I would like to do so, but my own subconscious betrays me and I lose the will to fight back."

The cited statements have many complex meanings; conclusions gained from these questionnaires are therefore questionable from a psychometric point of view. Despite that, I would speculate that *Toxoplasma*-positive people may manifest paranoid notions about

TABLE 2
Studies on *Toxoplasma*'s Influence on Human Personality Traits

Study	Country	Type of study	N (*Toxoplasma*-positive/control)	Methods	Findings
Flegr (2010)	Czech Republic	Convenience samples	113/330; 68/242; 55/136; 47/276	Unique questionnaire (Toxo94)	Infected subjects expressed various personality aberrations (see citations in the main text).
Flegr & Havlíček (1999)	Czech Republic	Convenience sample of women	55/136	Cattell's 16 Personality Factor Questionnaire	Infected women had higher intelligence, lower guilt proneness, and possibly also higher ergic tension.
Flegr & Hrdý (1994)	Czech Republic	Convenience sample	90/248	Cattell's 16 Personality Factor Questionnaire	*Toxoplasma*-positive men had lower superego strength and protension.
Flegr, Kodym, & Tolarová (2000)	Czech Republic	Convenience sample of women	230/0; 55/0	Cattell's 16 Personality Factor Questionnaire	Affectothymia, surgence, high superego strength, parmia, and protension were correlated with the length of the infection.
Flegr, Preiss, & Klose (2013)	Czech Republic	Survey of military personnel	154/337	N-70 and NEO-PI-R Questionnaire; Wiener Matrizen-Test of intelligence	Infected subjects expressed lower levels of potentially pathognomic factors, measured with the N-70 questionnaire, and neuroticism. *Toxoplasma*-infected subjects expressed lower intelligence score (while RhD-negative).
Flegr et al. (2003)	Czech Republic	Survey of military personnel	229/628	Cloninger's Temperament and Character Inventory	*Toxoplasma*-positive subjects had lower novelty seeking, impulsiveness, extravagance, and disorderliness scores. Infected subjects also had lower IQs.
Flegr, Zitková, Kodym, & Frynta (1996)	Czech Republic	Convenience sample	103/291	Cattell's 16 Personality Factor Questionnaire	Infection in men was positively correlated with low superego strength, protension, guilt proneness, and group dependency. For women, the prevailing traits were affectothymia, alaxia, and untroubled adequacy and self-sufficiency.
Lindová et al. (2010)	Czech Republic	Convenience sample	56/239	Experimental economic games	Infected men were less cooperative and infected women were more cooperative compared to their uninfected counterparts.
Lindová et al. (2006)	Czech Republic	Double-blind testing (convenience sample)	49/214	Cattell's 16 Personality Factor Questionnaire	Infected men scored significantly lower in conscientiousness and self-control than uninfected men; a trend in the opposite direction was observed in women. Infected men scored lower in warmth than uninfected men, whereas there was no difference in women.
Lindová, Příplatová, & Flegr (2012)	Czech Republic	Convenience sample	47/276	NEO-PI-R Questionnaire	*Toxoplasma*-infected male and female subjects had higher extroversion and lower conscientiousness.
Novotná et al. (2005)	Czech Republic	Survey of military personnel	Of 533 subjects, 25.0% were *Toxo*-positive	Cloninger's Temperament and Character Inventory; Eysenck's lie scale	*Toxoplasma*-positive subjects had lower novelty-seeking scores.

TABLE 2
(Continued)

Study	Country	Type of study	N (*Toxoplasma*-positive/control)	Methods	Findings
Skallová et al. (2005)	Czech Republic	Survey of blood donors	Of 290 subjects, 61.2% were *Toxo*-positive	Cloninger's Temperament and Character Inventory; Eysenck's lie scale	*Toxoplasma*-positive subjects had lower novelty-seeking scores.
Cook et al. (2015)	Germany	Survey of healthy controls as a part of a case-control study	475/474	Questionnaire for Measuring Factors of Aggression; Disinhibition subscale of the Sensation Seeking Scale	Infection was associated with higher reactive aggression scores among women but not among men. Infection was also associated with higher impulsive sensation-seeking among younger men.
Khademvatan et al. (2013)	Iran	Convenience sample	112/125	Cattell's 16 Personality Factor Questionnaire	Infected women had higher apprehension, privateness, and tension scores and lower openness-to-change scores. Infected men had higher vigilance and mistrust scores.
Sugden et al. (2016)*	New Zealand	Population-representative birth-cohort study	236/601	Correlation between various tests and questionnaires and *Toxoplasma* infection	Infection was not associated with any personality aberrations.

Note: The above-mentioned studies were selected through the Google Scholar and PubMed databases. Laboratory and field studies, case studies, and surveys estimating the influence of toxoplasmosis on the personality traits of otherwise healthy people were included (studies estimating influence on psychiatric and mental diseases and personality disorders were not targeted, as they are outside the scope of this paper). The databases were searched using the following keywords: human, *Toxoplasma*, toxoplasmosis, personality, and traits. Articles from 1950 to May 2016 were included. The results comprised more than 12,000 references. After excluding unsuitable articles (reviews; conceptual papers; animal studies; in vivo studies; studies on psychiatric, neurological, and other diseases; cross-country comparative studies; and unpublished studies, typically theses), 42 remained. Another 27 were excluded because they didn't relate directly to personality traits; they monitored the prevalence of toxoplasmosis in different professions and other groups, or they were duplicates referred to in Table 1. The number of *Toxo*-positive participants is an estimate across different serological analyses (i.e. acute and latent infections).

* The study is presented in both systematic reviews.

processes in organizations and consequently fall victim to an abusive supervisor (Chan & McAllister, 2014). As noted by De Vries and Miller (1986, p. 271): "[F]eelings of guilt, worthlessness, and inadequacy are pervasive. Individuals downgrade themselves; they are self-deprecating and feel inferior to others, claiming a lack of ability and talent. They abdicate responsibility. A sense of helplessness and hopelessness prevails. External sources for sustenance are needed to combat insecurity."

Effects on Work Performance

In studying the impact of personality characteristics on workplace behavior, leadership, and productivity, organizational neuroscience can use the quite specific influence of toxoplasmosis on the production of the sex hormone testosterone. Its impacts on personality characteristics (decision making and behavior) and appearance are well documented (Zitzmann & Nieschlag, 2001). Some studies have found that *Toxoplasma*-positive men had higher testosterone levels than non-infected men (Flegr, Lindová, & Kodym, 2008; Zghair, Al-Qadhi, & Mahmood, 2015). Infected women, on the other hand, had lower levels of the hormone (but see Shirbazou, Abasian, and Meymand, 2011).

High levels of testosterone have been closely linked to perceived social status (Eisenegger, Haushofer, & Fehr, 2011). It plays a significant role in willingness to take risks, leadership, and entrepreneurship (Apicella et al., 2008; Brañas-Garza & Rustichini, 2011; Garbarino, Slonim, & Sydnor, 2011) and, based on other evidence, also in impulse control, an increase in planning and executive abilities (Dreber, Gerdes, Gränsmark, & Little, 2013), and willingness to engage in antisocial and/or corrupt behavior (Bendahan, Zehnder, Pralong, & Antonakis, 2015). High levels of testosterone are also negatively related to the accuracy with which people infer the thoughts and feelings of others (Ronay & Carney, 2013).

Toxoplasma-positive men also appear more masculine and dominant to women (Hodková, Kolbeková, Skallová, Lindová, & Flegr, 2007). For a person who wants to be a successful leader, it could be more important to just *appear* authoritative and convincing than to actually possess such personality traits, because specific physical traits are robustly associated with aggressive and self-interested behavior (Haselhuhn, Wong, Ormiston, Inesi, & Galinsky, 2014; Spisak, Homan, Grabo, & Van Vugt, 2012). Manipulative effects of *Toxoplasma* are related to an increase in facial masculinity, and studies have confirmed that managers who have more masculine facial features indeed have higher salaries and work for more successful companies (Rule & Ambady, 2008; Wong, Ormiston, & Haselhuhn, 2011).

In the case of testosterone, two contradictory effects of *Toxoplasma* on behavior make the final impact difficult to predict. For example, better performance (in the sense of higher profitability) for a broker depends on his (only men were studied) higher level of testosterone (Coates & Herbert, 2008), which is boosted by *Toxoplasma*, but as the disease also slows down reaction times, the real-life influence would be mixed. In summary, we can speculate that *Toxoplasma*-positive people can achieve high positions, but their performance may decline due to a decrease in conscientiousness, increased neuroticism, and possible health risks. Because of the different effect of toxoplasmosis on testosterone in men (increased levels) and women (decreased levels), it's even possible that toxoplasmosis may be a partial culprit in the inequality of men and women in leading positions (see the next section for more information on toxoplasmosis and gender work roles).

I believe that toxoplasmosis offers an informative variable in the psychological and neuroscientific model of the effects of personality, cognitive traits, and even physical appearance on human capital and thus on organizational outcomes. It can help improve identification methods in research on the impact of personality characteristics on career outcomes and on teams' and firms' inner workings (Borghans, Duckworth, Heckman, & Ter Weel, 2008; Daly, Harmon, & Delaney, 2009; Heckman, 2011). If it is true that the parasite gradually and significantly alters certain aspects of personality characteristics by manipulating neural and hormonal systems of humans, it should be possible to observe differences in decision making and actions of infected employees and managers in the organizational environment compared to those not infected.

These observations should be identifiable at the firm, region, state, and country levels, as the prevalence of toxoplasmosis varies significantly between and within countries. For example, in the United States age-adjusted seroprevalence is higher in the Northeast (29.2%) than in the South (22.8%), Midwest (20.5%), or West (17.5%) (Jones et al., 2001).

INTERCULTURAL MANAGEMENT

On a national level, a higher proportion of the population infected with toxoplasmosis is associated

with stronger neuroticism (Lafferty, 2006). Lafferty also showed associations between a prevalence of toxoplasmosis and uncertainty avoidance and masculine sex roles, but those results were not robust. It is possible that cultural dimensions alter individual personality through situational or educational conditioning and/or experience and that an aggregate national personality might be created through the collective behavior of individuals with a specific personality (Hofstede & McCrae, 2004). The same way that infected individuals systematically show evidence of certain personality characteristics, nations where toxoplasmosis is more frequent demonstrate these same tendencies as well. What are the characteristics of nations with higher prevalence of toxoplasmosis? Lafferty concluded:

> Individuals in populations that are "masculine" in the sex-role cultural dimension reinforce traditional gender work roles gender differentiation, and have a higher focus on ego, ambition, money, material possessions, self-achievement, and work than on relationships, people, social support, and quality of life. Individuals in populations that rate high in the cultural dimension of uncertainty avoidance feel threatened by uncertain or unknown situations, leading to a rule oriented society geared to reduce uncertainty. (2006, p. 2753; inner references omitted)

However, similar cross-country analyses suffer from a strong endogeneity problem in the causality direction and in operating variables (moreover, the associations between personality shifts and *Toxoplasma*-infected individuals differ between men and women). Nevertheless, after carefully controlling for determinants of the prevalence of toxoplasmosis in the population, such as climate, urbanization, level of sanitation, the consumption of meat, and religion (in some countries religions promote vegetarianism and toxoplasmosis is rare), the prevalence of *Toxoplasma* may be a suitable instrument for monitoring the impact of cultural patterns on organizations' inner workings, business practices, or economics institutions (Maseland, 2013), and it might help to explain a huge variation in management practices across organizations in different countries (Bloom, Genakos, Sadun, & Van Reenen, 2012). As the prevalence of toxoplasmosis is high even in some developed countries (its prevalence is largely independent from the economic well-being of nations), it can be used to decrease the risk of misidentifying the influence of other biological factors on economic, cultural, or business variables (Bonds, Dobson, & Keenan, 2012).

Research focusing on whether varying prevalence of toxoplasmosis within a country can explain the specifics of regional (business) cultures would be methodologically purer and more useful. This data, however, is currently lacking.

CONCLUSION

The cited literature suggests that *Toxoplasma*-positive individuals have specific personality differences compared with the non-infected population, and that such differences could be caused by physiological manipulation by the parasite (although in some cases there is still a probability that people with certain personalities have a higher likelihood of getting infected). *Toxoplasma*-positive individuals have slower reaction times, they are more easily distracted, and their working memory is worse. *Toxoplasma* may decrease an individual's life satisfaction. Infected people more often believe that their instinctive behavior under imminent danger is rather slow and passive, and that some people have the power to impose their will on others. They also believe that when they are attacked, they stop fighting because their own subconscious betrays them. Infected men have higher levels of testosterone, and their physical appearance is portrayed as more masculine and dominant. *Toxoplasma* thus could offer a suitable model for research on the influence of personality traits and cognitive skills on individual work performance and on organizational outcomes. At present, however, there are no studies on the effects of toxoplasmosis in the context of an organizational environment.

Utilization of the *Toxoplasma* model in organizational neuroscience (or in organizational research in general) certainly has several limitations. Even though some impacts of the disease on physiological mechanisms of dopamine, serotonin, and testosterone have been demonstrated (Flegr, 2013b), further research on exactly which chemical and physiological processes *Toxoplasma* uses to manipulate its human victims is only at its beginning. For example, manifestation of the disease depends on the RhD blood group (Novotná et al., 2008). A recent study (Hari Dass & Vyas, 2014) found that *Toxoplasma* is able to cause specific epigenetic changes in medial amygdala circuits. Amygdala circuits are, inter alia, responsible for the sexual behavior of animals; apparently, cats are no longer perceived as a threat by an infected rat, but instead become a sexually attractive stimulus.

Furthermore, Tan et al. (2015) showed that infection with *Toxoplasma* increases the propensity of infected rats to make more impulsive choices. Their study concludes: "*T. gondii* infection . . . represents a behavioural syndrome consisting of reduced innate fear, increased sexual attractiveness and greater delay aversion; all hallmarks of a 'carpe diem' animal personality" (Tan et al., 2015, p. 5). As of now there is only one study that has tested the parasite's impact on sexual and/or mating behavior of humans (Flegr & Kuba, 2016). Although this is just speculation, toxoplasmosis could influence the quality of relationships between men and women in workplaces or the prevalence of sexual harassment in firms (as infected men have higher testosterone levels and infected women tend to exhibit more warmth).

It is not evident whether toxoplasmosis influences other personality traits such as creativity, selfishness, honesty, personal integrity, and the dark triad personality traits (narcissism, Machiavellianism, and psychopathy). It can also be expected (as many of the cited studies indicate) that with controls on covariates such as personal background, demographics, education, and training, the effects of the parasite on personality are not that strong, especially not in the corporate environment. Also, the reviewed literature presents contradictory findings, some of which could be false positives due to publication bias. More replications of relevant studies are necessary (see Byington and Felps, 2016, for a more general review of the credibility crisis in management sciences).

Research on the behavioral demonstration of the impacts of toxoplasmosis also uses specific groups of participants (usually students, seniors, pregnant women, or soldiers), which makes it difficult to generalize the findings to the general population or specifically to the business world (although this issue is common in neuroscientific research). Psychological and cognitive tests are relatively context-specific, and in most cases questionnaire-based with an absence of real incentives or trade-offs. It is not possible to predict how the proposed findings would end up in the high-stakes multitasking environment of firms.

Obviously, there are ethical problems as well (Lindebaum, 2013). *Toxoplasma*-positive people could be discriminated against when their infection becomes known. Nevertheless, knowledge of one's own infection should lead to higher awareness of systematic biases and tendencies that are connected to toxoplasmosis. Mindfulness training or cognitive behavioral therapy sessions would be advisable for some infected individuals. Conversely, if people knew about their disease and outcomes connected with it, it could make them adopt an "infected identity," and they might start rationalizing their own mistakes, failures, and lapses (Dijksterhuis & van Knippenberg, 1998; Vranka & Houdek, 2015). Another open question is whether toxoplasmosis should be treated as a preexisting condition in the realm of legal matters (insurance, health, tort and criminal law, etc.).

There are many other microorganisms that can affect some aspects of the human mind and/or behavior (Kramer & Bressan, 2015). For instance, the cytomegalovirus may alter the personality of infected subjects (Novotná et al., 2005), and gut bacteria may play a role in anxiety and depression (Mayer, Knight, Mazmanian, Cryan, & Tillisch, 2014) or in processing emotions and sensations (Tillisch et al., 2013). There is even a (small) possibility that the influenza virus could modify human social behavior before the onset of symptoms (Reiber et al., 2010). Future studies should verify the robustness of these observed effects and investigate their relevance to organizational and management research.

REFERENCES

Ackerman, P. L., Beier, M. E., & Boyle, M. O. (2005). Working memory and intelligence: The same or different constructs? *Psychological Bulletin*, *131*(1), 30–60.

Alvarado-Esquivel, C., et al. (2014). Seroprevalence of *Toxoplasma gondii* infection and associated risk factors in huicholes in Mexico. *Parasites & Vectors*, *7*(1), 1–7.

Alvarado-Esquivel, C., Torres-Castorena, A., Liesenfeld, O., Estrada-Martínez, S., & Urbina-Álvarez, J. (2012). High seroprevalence of *Toxoplasma gondii* infection in a subset of Mexican patients with work accidents and low socioeconomic status. *Parasites & Vectors*, *5*(1), 1–6.

Apicella, C. L., Dreber, A., Campbell, B., Gray, P. B., Hoffman, M., & Little, A. C. (2008). Testosterone and financial risk preferences. *Evolution and Human Behavior*, *29*(6), 384–390.

Ashkanasy, N. M., Becker, W. J., & Waldman, D. A. (2014). Neuroscience and organizational behavior: Avoiding both neuro-euphoria and neuro-phobia. *Journal of Organizational Behavior*, *35*(7), 909–919.

Baron, R. A. (2006). Opportunity recognition as pattern recognition: How entrepreneurs "connect the dots" to identify new business opportunities. *Academy of Management Perspectives*, *20*(1), 104–119.

Barrick, M. R., & Mount, M. K. (1991). The big five personality dimensions and job performance: A meta-analysis. *Personnel Psychology*, *44*(1), 1–26.

Barrick, M. R., Stewart, G. L., Neubert, M. J., & Mount, M. K. (1998). Relating member ability and personality to work-team processes and team effectiveness. *Journal of Applied Psychology*, *83*(3), 377–391.

Bendahan, S., Zehnder, C., Pralong, F. P., & Antonakis, J. (2015). Leader corruption depends on power and testosterone. *Leadership Quarterly*, *26*(2), 101–122.

Beste, C., Getzmann, S., Gajewski, P. D., Golka, K., & Falkenstein, M. (2014). Latent *Toxoplasma gondii* infection leads to deficits in goal-directed behavior in healthy elderly. *Neurobiology of Aging*, *35*(5), 1037–1044.

Bettis, R. A. (2012). The search for asterisks: Compromised statistical tests and flawed theories. *Strategic Management Journal*, *33*(1), 108–113.

Bloom, N., Genakos, C., Sadun, R., & Van Reenen, J. (2012). Management practices across firms and countries. *Academy of Management Perspectives*, *26*(1), 12–33.

Bonds, M. H., Dobson, A. P., & Keenan, D. C. (2012). Disease ecology, biodiversity, and the latitudinal gradient in income. *PLoS Biology*, *10*(12), e1001456.

Borghans, L., Duckworth, A. L., Heckman, J. J., & Ter Weel, B. (2008). The economics and psychology of personality traits. *Journal of Human Resources*, *43*(4), 972–1059.

Bradley, B. H., Klotz, A. C., Postlethwaite, B. E., & Brown, K. G. (2013). Ready to rumble: How team personality composition and task conflict interact to improve performance. *Journal of Applied Psychology*, *98*(2), 385–392.

Brañas-Garza, P., & Rustichini, A. (2011). Organizing effects of testosterone and economic behavior: Not just risk taking. *PLoS One*, *6*(12), e29842.

Butler, M. J. R., O'Broin, H. L. R., Lee, N., & Senior, C. (2016). How organizational cognitive neuroscience can deepen understanding of managerial decision-making: A review of the recent literature and future directions. *International Journal of Management Reviews*, *18*, 542–559.

Byington, E., & Felps, W. (2016). Solutions to the credibility crisis in management science. *Academy of Management Learning & Education*, doi:10.5465/amle.2015.0035.

Cauda, F., Cavanna, A. E., D'Agata, F., Sacco, K., Duca, S., & Geminiani, G. C. (2011). Functional connectivity and coactivation of the nucleus accumbens: A combined functional connectivity and structure-based meta-analysis. *Journal of Cognitive Neuroscience*, *23*(10), 2864–2877.

Chan, M. E., & McAllister, D. J. (2014). Abusive supervision through the lens of employee state paranoia. *Academy of Management Review*, *39*(1), 44–66.

Chemoh, W., et al. (2013). *Toxoplasma gondii* infection: What is the real situation? *Experimental Parasitology*, *135*(4), 685–689.

Cloninger, C., Svrakic, D. M., & Przybeck, T. R. (1993). A psychobiological model of temperament and character. *Archives of General Psychiatry*, *50*(12), 975–990.

Coates, J. M., & Herbert, J. (2008). Endogenous steroids and financial risk taking on a London trading floor. *Proceedings of the National Academy of Sciences*, *105*(16), 6167–6172.

Cook, T. B., et al. (2015). "Latent" infection with *Toxoplasma gondii:* Association with trait aggression and impulsivity in healthy adults. *Journal of Psychiatric Research*, *60*, 87–94.

Cropanzano, R., & Becker, W. J. (2013). The promise and peril of organizational neuroscience: Today and tomorrow. *Journal of Management Inquiry*, *22*(3), 306–310.

Daly, M., Harmon, C. P., & Delaney, L. (2009). Psychological and biological foundations of time preference. *Journal of the European Economic Association*, *7*(2–3), 659–669.

DesJardins, N. M. L., Srivastava, S., Küfner, A. C. P., & Back, M. D. (2015). Who attains status? Similarities and differences across social contexts. *Social Psychological & Personality Science*, *6*(6), 692–700.

De Vries, M. F. R. K., & Miller, D. (1986). Personality, culture, and organization. *Academy of Management Review*, *11*(2), 266–279.

Dijksterhuis, A., & van Knippenberg, A. (1998). The relation between perception and behavior, or how to win a game of Trivial Pursuit. *Journal of Personality and Social Psychology*, *74*(4), 865–877.

Dreber, A., Gerdes, C., Gränsmark, P., & Little, A. C. (2013). Facial masculinity predicts risk and time preferences in expert chess players. *Applied Economics Letters*, *20*(16), 1477–1480.

Eggers, J. P., & Kaplan, S. (2013). Cognition and capabilities: A multi-level perspective. *Academy of Management Annals*, *7*(1), 295–340.

Eisenegger, C., Haushofer, J., & Fehr, E. (2011). The role of testosterone in social interaction. *Trends in Cognitive Sciences*, *15*(6), 263–271.

Ferreira, É. C., Marchioro, A. A., Guedes, T. A., Mota, D. C. G. A., Guilherme, A. L. F., & de Araújo, S. M. (2013). Association between seropositivity for *Toxoplasma gondii,* scholastic development of children, and risk factors for *T. gondii* infection. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, *107*(6), 390–396.

Flegr, J. (2010). Influence of latent toxoplasmosis on the phenotype of intermediate hosts. *Folia Parasitologica*, *57*(2), 81–87.

Flegr, J. (2013a). How and why *Toxoplasma* makes us crazy. *Trends in Parasitology*, *29*(4), 156–163.

Flegr, J. (2013b). Influence of latent *Toxoplasma* infection on human personality, physiology and morphology: Pros and cons of the *Toxoplasma*–human model in studying the manipulation hypothesis. *Journal of Experimental Biology*, *216*(1), 127–133.

Flegr, J., & Dama, M. (2014). Does the prevalence of latent toxoplasmosis and frequency of Rhesus-negative subjects correlate with the nationwide rate of traffic accidents? *Folia Parasitologica*, *6*, 485–494.

Flegr, J., & Havlíček, J. (1999). Changes in the personality profile of young women with latent toxoplasmosis. *Folia Parasitologica*, *46*(1), 22–28.

Flegr, J., Havlíček, J., Kodym, P., Malý, M., & Smahel, Z. (2002). Increased risk of traffic accidents in subjects with latent *toxoplasmosis*: A retrospective case-control study. *BMC Infectious Diseases*, *2*, 1–6.

Flegr, J., & Hrdý, I. (1994). Influence of chronic toxoplasmosis on some human personality factors. *Folia Parasitologica*, *41*(2), 122–126.

Flegr, J., Klose, J., Novotná, M., Berenreitterová, M., & Havlíček, J. (2009). Increased incidence of traffic accidents in *Toxoplasma*-infected military drivers and protective effect RhD molecule revealed by a large-scale prospective cohort study. *BMC Infectious Diseases*, *9*(1), 72–78.

Flegr, J., Kodym, P., & Tolarová, V. (2000). Correlation of duration of latent *Toxoplasma gondii* infection with personality changes in women. *Biological Psychology*, *53*(1), 57–68.

Flegr, J., & Kuba, R. (2016). The relation of *Toxoplasma* infection and sexual attraction to fear, danger, pain, and submissiveness. *Evolutionary Psychology*, *14*(3). Retrieved from http://journals.sagepub.com/doi/full/10.1177/1474704916659746

Flegr, J., Lenochová, P., Hodný, Z., & Vondrová, M. (2011). Fatal attraction phenomenon in humans—cat odour attractiveness increased for *Toxoplasma*-infected men while decreased for infected women. *PLoS Neglected Tropical Diseases*, *5*(11), e1389.

Flegr, J., Lindová, J., & Kodym, P. (2008). Sex-dependent toxoplasmosis-associated differences in testosterone concentration in humans. *Parasitology*, *135*(4), 427–431.

Flegr, J., Novotná, M., Lindová, J., & Havlíček, J. (2008). Neurophysiological effect of the Rh factor: Protective role of the RhD molecule against *Toxoplasma*-induced impairment of reaction times in women. *Neuroendocrinology Letters*, *29*(4), 475–481.

Flegr, J., Preiss, M., & Klose, J. (2013). Toxoplasmosis-associated difference in intelligence and personality in men depends on their Rhesus blood group but not ABO blood group. *PLoS One*, *8*(4), e61272.

Flegr, J., Preiss, M., Klose, J., Havlicek, J., Vitakova, M., & Kodym, P. (2003). Decreased level of psychobiological factor novelty seeking and lower intelligence in men latently infected with the protozoan parasite *Toxoplasma gondii*. Dopamine, a missing link between schizophrenia and toxoplasmosis? *Biological Psychology*, *63*(3), 253–268.

Flegr, J., Zitková, Š., Kodym, P., & Frynta, D. (1996). Induction of changes in human behaviour by the parasitic protozoan *Toxoplasma gondii*. *Parasitology*, *113*(1), 49–54.

Foss, N. J., & Lindenberg, S. (2013). Microfoundations for strategy: A goal-framing perspective on the drivers of value creation. *Academy of Management Perspectives*, *27*(2), 85–102.

Gajewski, P. D., Falkenstein, M., Hengstler, J. G., & Golka, K. (2014). *Toxoplasma gondii* impairs memory in infected seniors. *Brain, Behavior, and Immunity*, *36*, 193–199.

Gale, S. D., Brown, B. L., Erickson, L. D., Berrett, A., & Hedges, D. W. (2015). Association between latent toxoplasmosis and cognition in adults: A cross-sectional study. *Parasitology*, *142*(04), 557–565.

Gale, S. D., Erickson, L. D., Berrett, A., Brown, B. L., & Hedges, D. W. (2016). Infectious disease burden and cognitive function in young to middle-aged adults. *Brain, Behavior, and Immunity*, *52*, 161–168.

Galván-Ramírez, M. d. l. L., Sánchez-Orozco, L. V., Rodríguez, L. R., Rodríguez, S., Roig-Melo, E., Troyo Sanromán, R., . . . Armendáriz-Borunda, J. (2013). Seroepidemiology of *Toxoplasma gondii* infection in drivers involved in road traffic accidents in the metropolitan area of Guadalajara, Jalisco, Mexico. *Parasites & Vectors*, *6*(1), 1–9.

Garbarino, E., Slonim, R., & Sydnor, J. (2011). Digit ratios (2D:4D) as predictors of risky decision making for both sexes. *Journal of Risk and Uncertainty*, *42*(1), 1–26.

Gaskell, E. A., Smith, J. E., Pinney, J. W., Westhead, D. R., & McConkey, G. A. (2009). A unique dual activity amino acid hydroxylase in *Toxoplasma gondii*. *PLoS One*, *4*(3), e4801.

George, J. M. (1992). The role of personality in organizational life: Issues and evidence. *Journal of Management*, *18*(2), 185–213.

George, J. M., & Zhou, J. (2001). When openness to experience and conscientiousness are related to creative behavior: An interactional approach. *Journal of Applied Psychology*, *86*(3), 513–524.

Goldberg, L. R. (1990). An alternative "description of personality": The big-five factor structure. *Journal of Personality and Social Psychology*, *59*(6), 1216–1229.

Guenter, W., et al. (2012). Does *Toxoplasma gondii* infection affect cognitive function? A case control study. *Folia Parasitologica*, *59*(2), 93–98.

Hari Dass, S. A., & Vyas, A. (2014). *Toxoplasma gondii* infection reduces predator aversion in rats through

epigenetic modulation in the host medial amygdala. *Molecular Ecology*, *23*(24), 6114–6122.

Haselhuhn, M. P., Wong, E. M., Ormiston, M. E., Inesi, M. E., & Galinsky, A. D. (2014). Negotiating face-to-face: Men's facial structure predicts negotiation performance. *Leadership Quarterly*, *25*(5), 835–845.

Havlíček, J., Gašová, Z., Smith, A. P., Zvára, K., & Flegr, J. (2001). Decrease of psychomotor performance in subjects with latent "asymptomatic" toxoplasmosis. *Parasitology*, *122*(5), 515–520.

Healy, D. (2015). Serotonin and depression. *British Medical Journal*, *350*, doi:10.1136/bmj.h1771.

Heckman, J. J. (2011). *Integrating personality psychology into economics* (NBER Working Paper No. 17378). Cambridge, MA: National Bureau of Economic Research.

Hodgkinson, G. P., & Healey, M. P. (2011). Psychological foundations of dynamic capabilities: Reflexion and reflection in strategic management. *Strategic Management Journal*, *32*(13), 1500–1516.

Hodková, H., Kolbeková, P., Skallová, A., Lindová, J., & Flegr, J. (2007). Higher perceived dominance in *Toxoplasma* infected men—a new evidence for role of increased level of testosterone in toxoplasmosis-associated changes in human behavior. *Neuroendocrinology Letters*, *28*(2), 110–114.

Hofstede, G., & McCrae, R. R. (2004). Personality and culture revisited: Linking traits and dimensions of culture. *Cross-Cultural Research*, *38*(1), 52–88.

Houdek, P. (2016). What comes to a manager's mind: Theory of local thinking. *Journal of Management Inquiry*, *25*(4), 359–366.

Jocham, G., Klein, T. A., & Ullsperger, M. (2011). Dopamine-mediated reinforcement learning signals in the striatum and ventromedial prefrontal cortex underlie value-based choices. *Journal of Neuroscience*, *31*(5), 1606–1613.

Jones, J. L., Kruszon-Moran, D., Wilson, M., McQuillan, G., Navin, T., & McAuley, J. B. (2001). *Toxoplasma gondii* infection in the United States: Seroprevalence and risk factors. *American Journal of Epidemiology*, *154*(4), 357–365.

Judge, T. A., Bono, J. E., Ilies, R., & Gerhardt, M. W. (2002). Personality and leadership: A qualitative and quantitative review. *Journal of Applied Psychology*, *87*(4), 765–780.

Judge, T. A., Colbert, A. E., & Ilies, R. (2004). Intelligence and leadership: A quantitative review and test of theoretical propositions. *Journal of Applied Psychology*, *89*(3), 542–552.

Judge, T. A., Heller, D., & Mount, M. K. (2002). Five-factor model of personality and job satisfaction: A meta-analysis. *Journal of Applied Psychology*, *87*(3), 530–541.

Judge, T. A., Higgins, C. A., Thoresen, C. J., & Barrick, M. R. (1999). The big five personality traits, general mental ability, and career success across the life span. *Personnel Psychology*, *52*(3), 621–652.

Khademvatan, S., Khajeddin, N., Saki, J., & Izadi-Mazidi, S. (2013). Effect of toxoplasmosis on personality profiles of Iranian men and women. *South African Journal of Science*, *109*, 1–4.

Kocazeybek, B., et al. (2009). Higher prevalence of toxoplasmosis in victims of traffic accidents suggest increased risk of traffic accident in *Toxoplasma*-infected inhabitants of Istanbul and its suburbs. *Forensic Science International*, *187*(1–3), 103–108.

Kramer, P., & Bressan, P. (2015). Humans as superorganisms: How microbes, viruses, imprinted genes, and other selfish entities shape our behavior. *Perspectives on Psychological Science*, *10*(4), 464–481.

Kuncel, N. R., Hezlett, S. A., & Ones, D. S. (2004). Academic performance, career potential, creativity, and job performance: Can one construct predict them all? *Journal of Personality and Social Psychology*, *86*(1), 148–161.

Lafferty, K. D. (2006). Can the common brain parasite, *Toxoplasma gondii,* influence human culture? *Proceedings. Biological Sciences*, *273*(1602), 2749–2755.

Lamberton, P. H. L., Donnelly, C. A., & Webster, J. P. (2008). Specificity of the *Toxoplasma gondii*-altered behaviour to definitive versus non-definitive host predation risk. *Parasitology*, *135*(10), 1143–1150.

Lanchava, L., Carlson, K., Šebánková, B., Flegr, J., & Nave, G. (2015). No evidence of association between *Toxoplasma gondii* infection and financial risk taking in females. *PLoS One*, *10*(9), e0136716.

Lim, A., Kumar, V., Hari Dass, S. A., & Vyas, A. (2013). *Toxoplasma gondii* infection enhances testicular steroidogenesis in rats. *Molecular Ecology*, *22*(1), 102–110.

Lindebaum, D. (2013). Pathologizing the healthy but ineffective: Some ethical reflections on using neuroscience in leadership research. *Journal of Management Inquiry*, *22*(3), 295–305.

Lindebaum, D., & Jordan, P. J. (2014). A critique on neuroscientific methodologies in organizational behavior and management studies. *Journal of Organizational Behavior*, *35*(7), 898–908.

Lindová, J., et al. (2010). Pattern of money allocation in experimental games supports the stress hypothesis of gender differences in *Toxoplasma gondii*-induced behavioural changes. *Folia Parasitologica*, *57*(2), 136–142.

Lindová, J., et al. (2006). Gender differences in behavioural changes induced by latent toxoplasmosis. *International Journal for Parasitology*, *36*(14), 1485–1492.

Lindová, J., Příplatová, L., & Flegr, J. (2012). Higher extraversion and lower conscientiousness in humans infected with *Toxoplasma*. *European Journal of Personality*, *26*(3), 285–291.

Ling, V. J., Lester, D., Mortensen, P. B., Langenberg, P. W., & Postolache, T. T. (2011). *Toxoplasma gondii* seropositivity and suicide rates in women. *Journal of Nervous and Mental Disease*, *199*(7), 440–444.

Luthans, F., & Youssef, C. M. (2007). Emerging positive organizational behavior. *Journal of Management*, *33*(3), 321–349, doi:10.1177/0149206307300814.

Maseland, R. (2013). Parasitical cultures? The cultural origins of institutions and development. *Journal of Economic Growth*, *18*(2), 109–136.

Mayer, E. A., Knight, R., Mazmanian, S. K., Cryan, J. F., & Tillisch, K. (2014). Gut microbes and the brain: Paradigm shift in neuroscience. *Journal of Neuroscience*, *34*(46), 15490–15496.

McConkey, G. A., Martin, H. L., Bristow, G. C., & Webster, J. P. (2013). *Toxoplasma gondii* infection and behavior—location, location, location? *Journal of Experimental Biology*, *216*(1), 113–119.

Mendy, A., Vieira, E. R., Albatineh, A. N., & Gasana, J. (2015a). *Toxoplasma gondii* seropositivity and cognitive functions in school-aged children. *Parasitology*, *142*(9), 1221–1227.

Mendy, A., Vieira, E. R., Albatineh, A. N., & Gasana, J. (2015b). Immediate rather than delayed memory impairment in older adults with latent toxoplasmosis. *Brain, Behavior, and Immunity*, *45*, 36–40.

Mullainathan, S., & Shafir, E. (2013). *Scarcity: Why having too little means so much*. London: Penguin Group.

Novotná, M., et al. (2005). Probable neuroimmunological link between *Toxoplasma* and cytomegalovirus infections and personality changes in the human host. *BMC Infectious Diseases*, *5*(1), 54–64.

Novotná, M., et al. (2008). *Toxoplasma* and reaction time: Role of *Toxoplasmosis* in the origin, preservation and geographical distribution of Rh blood group polymorphism. *Parasitology*, *135*(11), 1253–1261.

Pearce, B., Kruszon-Moran, D., & Jones, J. (2014). The association of *Toxoplasma gondii* infection with neurocognitive deficits in a population-based analysis. *Social Psychiatry and Psychiatric Epidemiology*, *49*(6), 1001–1010.

Pedersen, M. G., Mortensen, P., Norgaard-Pedersen, B., & Postolache, T. T. (2012). *Toxoplasma gondii* infection and self-directed violence in mothers. *Archives of General Psychiatry*, *69*(11), 1123–1130.

Pine, A., Shiner, T., Seymour, B., & Dolan, R. J. (2010). Dopamine, time, and impulsivity in humans. *Journal of Neuroscience*, *30*(26), 8888–8896.

Prandovszky, E., Gaskell, E., Martin, H., Dubey, J. P., Webster, J. P., & McConkey, G. A. (2011). The neurotropic parasite *Toxoplasma gondii* increases dopamine metabolism. *PLoS One*, *6*(9), e23866.

Příplatová, L., Šebánková, B., & Flegr, J. (2014). Contrasting effect of prepulse signals on performance of *Toxoplasma*-infected and *Toxoplasma*-free subjects in an acoustic reaction times test. *PLoS One*, *9*(11), e112771.

Raja, U., Johns, G., & Ntalianis, F. (2004). The impact of personality on psychological contracts. *Academy of Management Journal*, *47*(3), 350–367.

Reiber, C., Shattuck, E. C., Fiore, S., Alperin, P., Davis, V., & Moore, J. (2010). Change in human social behavior in response to a common vaccine. *Annals of Epidemiology*, *20*(10), 729–733.

Ronay, R., & Carney, D. R. (2013). Testosterone's negative relationship with empathic accuracy and perceived leadership ability. *Social Psychological & Personality Science*, *4*(1), 92–99.

Rule, N. O., & Ambady, N. (2008). The face of success: Inferences from chief executive officers' appearance predict company profits. *Psychological Science*, *19*(2), 109–111.

Saeij, J. P. J., Boyle, J. P., & Boothroyd, J. C. (2005). Differences among the three major strains of *Toxoplasma gondii* and their specific interactions with the infected host. *Trends in Parasitology*, *21*(10), 476–481.

Schmidt, F. L., & Hunter, J. (2004). General mental ability in the world of work: Occupational attainment and job performance. *Journal of Personality and Social Psychology*, *86*(1), 162–173.

Shalley, C. E., Zhou, J., & Oldham, G. R. (2004). The effects of personal and contextual characteristics on creativity: Where should we go from here? *Journal of Management*, *30*(6), 933–958.

Sharot, T., Shiner, T., Brown, A. C., Fan, J., & Dolan, R. J. (2009). Dopamine enhances expectation of pleasure in humans. *Current Biology*, *19*(24), 2077–2080.

Shirbazou, S., Abasian, L., & Meymand, F. T. (2011). Effects of *Toxoplasma gondii* infection on plasma testosterone and cortisol level and stress index on patients referred to Sina Hospital, Tehran. *Jundishapur Journal of Microbiology*, *4*(3), 167–173.

Simmons, J. P., Nelson, L. D., & Simonsohn, U. (2011). False-positive psychology: Undisclosed flexibility in data collection and analysis allows presenting anything as significant. *Psychological Science*, *22*(11), 1359–1366.

Skallová, A., Kodym, P., Frynta, D., & Flegr, J. (2006). The role of dopamine in *Toxoplasma*-induced behavioural alterations in mice: An ethological and ethopharmacological study. *Parasitology*, *133*(5), 525–535.

Skallová, A., et al. (2005). Decreased level of novelty seeking in blood donors infected with *Toxoplasma*. *Neuroendocrinology Letters*, *26*(5), 480–486.

Spisak, B. R., Homan, A. C., Grabo, A., & Van Vugt, M. (2012). Facing the situation: Testing a biosocial contingency model of leadership in intergroup relations using masculine and feminine faces. *Leadership Quarterly*, *23*(2), 273–280.

Stern, Y. (2009). Cognitive reserve. *Neuropsychologia*, *47*(10), 2015–2028.

Stock, A.-K., Heintschel von Heinegg, E., Köhling, H.-L., & Beste, C. (2014). Latent *Toxoplasma gondii* infection leads to improved action control. *Brain, Behavior, and Immunity*, *37*(0), 103–108.

Sugden, K., Moffitt, T. E., Pinto, L., Poulton, R., Williams, B. S., & Caspi, A. (2016). Is *Toxoplasma gondii* infection related to brain and behavior impairments in humans? Evidence from a population-representative birth cohort. *PLoS One*, *11*(2), e0148435.

Tan, D., Soh, L. J. T., Lim, L. W., Daniel, T. C. W., Zhang, X., & Vyas, A. (2015). Infection of male rats with *Toxoplasma gondii* results in enhanced delay aversion and neural changes in the nucleus accumbens core. *Proceedings of the Royal Society B: Biological Sciences*, 282(1808). Retrieved from http://rspb.royalsocietypublishing.org/content/282/1808/20150042

Tang, Y.-Y., & Posner, M. I. (2009). Attention training and attention state training. *Trends in Cognitive Sciences*, *13*(5), 222–227.

Teece, D. J. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, *28*(13), 1319–1350.

Tenter, A. M., Heckeroth, A. R., & Weiss, L. M. (2000). *Toxoplasma gondii:* From animals to humans. *International Journal for Parasitology*, *30*(12–13), 1217–1258.

Tillisch, K., et al. (2013). Consumption of fermented milk product with probiotic modulates brain activity. *Gastroenterology*, *144*(7), 1394–1401.

Torrey, E. F., Bartko, J. J., & Yolken, R. H. (2012). *Toxoplasma gondii* and other risk factors for schizophrenia: An update. *Schizophrenia Bulletin*, *38*(3), 642–647.

Vranka, M. A., & Houdek, P. (2015). Many faces of bankers' identity: How (not) to study dishonesty. *Frontiers in Psychology*, *6*(302). Retrieved from http://journal.frontiersin.org/article/10.3389/fpsyg.2015.00302/full

Wai, J., & Rindermann, H. (2015). The path and performance of a company leader: A historical examination of the education and cognitive ability of Fortune 500 CEOs. *Intelligence*, *53*, 102–107.

Webster, J. P. (2007). The effect of *Toxoplasma gondii* on animal behavior: Playing cat and mouse. *Schizophrenia Bulletin*, *33*(3), 752–756.

Webster, J. P., Kaushik, M., Bristow, G. C., & McConkey, G. A. (2013). *Toxoplasma gondii* infection, from predation to schizophrenia: Can animal behaviour help us understand human behaviour? *Journal of Experimental Biology*, *216*(1), 99–112.

Webster, J. P., Lamberton, P. H. L., Donnelly, C. A., & Torrey, E. F. (2006). Parasites as causative agents of human affective disorders? The impact of antipsychotic, mood-stabilizer and anti-parasite medication on *Toxoplasma gondii*'s ability to alter host behaviour. *Proceedings. Biological Sciences*, *273*(1589), 1023–1030.

Webster, J. P., & McConkey, G. A. (2010). *Toxoplasma gondii*-altered host behaviour: Clues as to mechanism of action. *Folia Parasitologica*, *57*(2), 95–104.

Wong, E. M., Ormiston, M. E., & Haselhuhn, M. P. (2011). A face only an investor could love: CEOs' facial structure predicts their firms' financial performance. *Psychological Science*, *22*(12), 1478–1483.

Yereli, K., Balcioğlu, I. C., & Özbilgin, A. (2006). Is *Toxoplasma gondii* a potential risk for traffic accidents in Turkey? *Forensic Science International*, *163*(1–2), 34–37.

Youssef, C. M., & Luthans, F. (2007). Positive organizational behavior in the workplace: The impact of hope, optimism, and resilience. *Journal of Management*, *33*(5), 774–800.

Zghair, K. H., Al-Qadhi, B. N., & Mahmood, S. H. (2015). The effect of toxoplasmosis on the level of some sex hormones in male blood donors in Baghdad. *Journal of Parasitic Diseases: Official Organ of the Indian Society for Parasitology*, *39*(3), 393–400.

Zitzmann, M., & Nieschlag, E. (2001). Testosterone levels in healthy men and the relation to behavioural and physical characteristics: Facts and constructs. *European Journal of Endocrinology*, *144*(3), 183–197.

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