

Why Don't Americans Accept Evolution As Much As People in Peer Nations Do?

A Theory (Reinforced Theistic Manifest Destiny) and Some Pertinent Evidence

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Abstract. Prior speculations about why Americans don't embrace evolution—as much as comparable nations' residents do—are generally dated and not well assessed. In contrast, I introduce a more obviously predictive theory that focuses on spiritually-linked feedback regarding the U.S.'s military (and industrial) prowess: Reinforced Theistic Manifest Destiny (RTMD). It joins analysis of individuals' (a) motivations, emotions, and epistemologies, with (b) intra- and inter-national historical narratives. RTMD is assessed in the light of prior cross-national evidence regarding evolution-related beliefs, new data from the U.S. and Canada, and many empirical hypotheses. The North American findings largely cohere with the relevant set of RTMD's predictions, given the variety of associations observed among beliefs regarding afterlife, theism, nationalism, global warming, and the origins of species. Such studies offer implications regarding how evolution might be better conveyed in both formal and informal settings—and why we should teach evolution in the first place (e.g., preserving Earth' biosphere).

How people understand and learn about biological evolution has been the source of many productive theoretical and empirical perspectives, as well as considerable informative pedagogical research (e.g., Bereiter, 2002; Ferrari & Chi, 1998; Reiser, et al., 2001; Sinatra, Brem, & Evans, 2008). For a variety of reasons, many of these perspectives focus on residents of North America's most populous nation (the U.S.), namely “Americans.”

One reason is because Americans apprehend evolution differently than do those in comparable nations. For instance, Ranney and Thanukos (in press) mention two visiting Japanese professors who each spent a semester or two in my Reasoning Research group. Although they visited a number of years apart, each was

greatly surprised that not all U.S. residents accept evolution—especially when I indicated that polls show that fewer than half of American adults do (e.g., a recent 2009 Gallup poll: only 39% “believe in the theory of evolution,” while 25% do “not believe in evolution,” and 36% have no opinion either way). Such foreign visitors sometimes need to be reminded of the Genesis stories when they are puzzled about “the” alternative to evolution. When asked about Shinto creation stories, Japanese visitors often labor to recall any specifics at all; consider the contrast with Americans recalling Genesis stories. Such instances illustrate what I term the *divergence question* (e.g., Ranney & Thanukos, in press), an empirical conundrum that others have also mused about, as noted below. In short, the query is: Regarding the public’s acceptance of evolution, why are peer nations so far beyond the U.S.? A new, evidence-based conjecture—a nascent theory—is herein offered to answer this question. I call the theory Reinforced Theistic Manifest Destiny (RTMD) for reasons that will emerge as this chapter progresses.

Surveys and biological cognition research (e.g., Bishop & Anderson, 1990; Brem, Ranney, & Schindel, 2003) both exhibit America’s rather diminutive evolutionary attachment. Perhaps most strikingly, Miller, Scott, and Okamoto (2006; which we will return to) reported that the U.S. ranked next-to-last, of 34 nations surveyed, in evolutionary acceptance. Non-Americans occasionally find this tenuous acceptance entertaining, but the divergence question transcends jokes about the median U.S. IQ or even more proximal science-pedagogy questions; as this chapter attempts to explain, the question may even engage the paramount international problem of global warming.

I hope to complicate—then help clarify—aspects of how and why people comprehend and/or accept evolution. The approach is considerably theoretical, but one empirically oriented in that it is inductive and that disconfirmable hypotheses, extant data, and some new findings are presented. Addressing chunks of the cognitive science of evolution, the work is broadly interdisciplinary, melding elements of psychology, geopolitics, philosophy, history, anthropology, military studies, biological cognition, and sociology (e.g., how groups impact encompassed individuals’ identities; Stets & Burke, 2003). Many past empirical results, from our laboratory and elsewhere, are consistent with RTMD’s conjecture about the rather diminutive U.S. acceptance of evolution—and especially regarding *human* evolution (e.g., Coyne, 2009).

Ranney and Thanukos (in press), for instance, reported a “human reticence effect¹,” as U.S. college students accepted human evolution less than evolution for some other organisms, such as plants. Other reticence-related beliefs were found in such students’ stances about if and/or how evolution and creation ought to be taught in American schools (e.g., results from Schindel & Ranney, 2001). In these studies, many students exhibited a desire for self-determination (e.g., free will), which represents a part of both this piece’s main conjecture *and* another view that seems to be the dominant theory of U.S. divergence, which I’ll call the “received view.” Let us start with that received view. It will be followed by RTMD’s account, which is also intended to help explain why the U.S. population deems itself a unique one (and the U.S. is indeed an outlier nation; e.g., Paul, 2005)—as well as why Americans are so likely to consider the teaching of *both* creation and evolution in public classrooms (e.g., Ranney & Thanukos, in press).

The Received View of U.S. Divergence

Evolution is, oftentimes, about history. Given four-billion-year videotape recordings (e.g., from parts of Africa), much about evolution (e.g., “What happened?”) would likely be resolved. It seems fitting, then, that responses to the divergence question posed above engage historical analysis: Although often implicit (cf. Scott, 2004 & 2006), the “received view” of U.S. divergence roughly suggests that: U.S. society, resulting from (a) the necessities of isolated frontier development and (b) colonizers desiring spiritual (and expressive) autonomy, yielded (c) markedly localized control by religions and/or governments (e.g., school districts), leading to both (d₁) considerable Christian fundamentalism and (d₂) antievolutionism regarding instruction, and—due to (d₁), etc.—(e) a modest U.S. acceptance of evolution (contra comparable nations).

Five or more difficulties, however, attend the received view account: Structurally, aside from (a), it focuses largely on religion—but accounts of the U.S.’s religious assortment and unusual religious zeal (given its prosperity and safety; Norris & Inglehart, 2004) are murky and susceptible to alternative explanations. (Norris & Inglehart also undermine received-view-amicable notions—that religious pluralism

¹ The effect is modulated by item character and one’s attitude toward evolution, but it coheres with others’ data; e.g., only 27% of the U.S. see evolution as at least a “mostly accurate” account for humans (People For the American Way Foundation, 2000).

and a paucity of national regulation produce more religiousness; the reverse is more often true, with the U.S. again an outlier; also see Paul, 2005.) Second, U.S. society has also had an unusual geopolitical and commercial development (as elaborated upon below) that transcends frontier religiosity differences with peer nations; for instance, Canadians and New Zealanders have frontier roots, yet they accept human evolution more than do Americans (Paul, 2005). Third, the received view invokes a fundamentalist religious framing that leaves off roughly 100 years ago (e.g., *The Twelve Fundamentals*; Scott, 2006). Fourth, fundamentalism (e.g., creationism, to the extent they overlap) is hardly the only font of opposition toward scientific reasoning; individuals frequently try to satisfy *affective* epistemic goals (e.g., Griffin, 2007), rather than goals to be accurate, revealing the interaction between a person's emotional and scientific propositions (cf. those who think them overwhelmingly separable realms; on emotions and evolution, also see Sinatra, Brem, & Evans, 2008, and Thagard & Findlay, in press, etc.). Lastly, the received view mostly fixates on the U.S.—not on more evolution-accepting peers—essentially overlooking other ways to account for America's divergence/lag; we ought to complementarily inquire as to why other developed nations accept evolution more enthusiastically—and not just about the U.S. public's apparently backward standing.

Reinforced Theistic Manifest Destiny (RTMD)

A modest part of an answer to this U.S. divergence question was briefly suggested earlier (Ranney, 1998); that essence is much more fully explicated herein, as space permits. I do not mean to replace wholly the received view, but to incorporate, augment, and transform it—and to yield predictiveness. Bluntly, in explaining the U.S.'s (relative) arrested development, the received view mainly lacks a modernized international political vantage—one that includes countrywide feedback regarding deities and manifest destiny, and especially reinforcements about military and (somewhat) industrial successes. This conjecture, herein introduced as RTMD theory (Reinforced Theistic Manifest Destiny), concentrates on how nations incorporate feedback (militarily, economically, etc.) regarding their implicit desires to dominate one or more other nations—and on how these reinforcements represent feedback that affects nations' theistically-related communal beliefs. World War II (WWII) and its “prelude,” WWI, jointly embody RTMD's main

historical event(s), given the wars' dramatic effects on practically all 34 nations in the Miller et al. evolution survey (2006; which included 18 of the 21 postindustrial nations and 16 industrial nations, as classified by Norris & Inglehart, 2004). As the U.S. ranked 33rd of 34 in accepting evolution (between the only two surveyed countries with major Islamic presences—Cyprus and lastly Turkey), the results of this survey represent core RTMD data as it seeks to accommodate prominent dimensions over which the nation diverges from its otherwise more analogous societal peers (e.g., Paul, 2005).

Let us now move to the heart of RTMD's theory, to be followed by a few exemplars. In short, RTMD posits that: (1) Between 1859 (i.e., Darwin introducing the notion of natural selection) and April, 1917 (America's WW I entry) America may already have been more reluctant than Europe to accept evolution—as per the received view—but it was probably not alone in its sluggishness.² (2) By 1945 the U.S. was (and arguably still is), relative to other nations, maximally reinforced as a military/economic winner—which helped increase its residents' inter-bolstering cognitions about God, afterlife beliefs, and national manifest destiny (as elaborated upon below). (3) Consequentially, advances in the U.S.'s evolutionary acceptance rate further slowed, and such reinforcements may even be retarding America's acceptance of (especially anthropogenic) global warming. RTMD is elaborated below from this gist, but it generally reflects Figure 1's diagram of five main relationships (four positive and one negative) between six constructs:

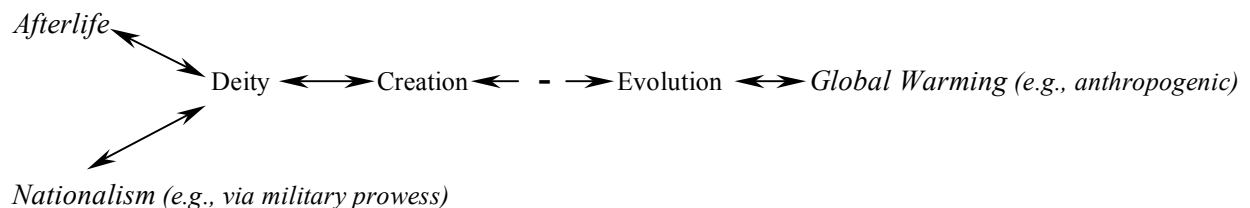


Figure 1. The main relationships hypothesized by RTMD (Reinforced Theistic Manifest Destiny theory; note: the negative association between Creation and Evolution is the sole main negative relationship—indicated with a “-”). Constructs that extend the Received View are *italicized*.

² America was also likely distracted from natural selection's articulations by descending toward devastating secessions and Civil War. See more below regarding how the Civil War relates to RTMD theory.

The deity-creation-evolution trio toward the diagram's center incorporates the Received View's essence (with its fundamentalist and pioneer-mentality mechanisms implicitly facilitating the links from "Creation"). Figure 1's other three (italicized) constructs represent RTMD additions to the received view, with "*Afterlife*" (related to immortality; Thagard & Findlay, in press) yielding a main motivation for a "Deity," which supports both "*Nationalism*" and "Creation," with the latter inhibiting "Evolution" acceptance—and indirectly or directly, "*Global Warming*." The afterlife-deity-creation-nationalism sub-complex generally characterizes a more spiritual realm, with the nationalistic spirit proposed to result from the hopes and reinforcements regarding theistically supported manifest destiny. The sub-complex subsuming "Evolution" and "Global Warming" represents mutually supportive scientific beliefs (re: nonlinearities, small-change accumulations, etc.) that are each predicted to be anti-associated with the elements of the more spiritual part, due to the negative (i.e., competitive) association between creation and evolution. This mutual evolution-warming support occasionally surfaces in U.S. society, as when Arizona state senator Sylvia Allen recently promoted a uranium mine (e.g., on June 25, 2009, she said "this Earth's been here 6,000 years... long before anybody had environmental laws, and somehow it hasn't been done away with;" Benson, 2009). Indeed, as RTMD might have predicted, those who would like creation to be taught in classrooms are now explicitly linking evolution with global climate change (Kaufman, 2010).

RTMD comes with qualifications: The theory employs some intentionally informal, analogical, and probabilistic conceptions, such as (a) a nation incorporating "war feedback" rather like an individual would (as explicated more shortly), (b) a nation's "deity" being credited for victories (e.g., the "U.S. god" vs. the "German god" from 1917-1945), and (c) the odds that a given resident will follow a nation's central trend. Naturally, reinforcements regarding a national narrative is hardly identical to a rat receiving (or not receiving) a shock or a treat, and a sovereign state might recognize a number of religions and/or "gods." (NB. It may be apt to think about a nation's "god" as its general "supernatural spirit.") Furthermore, RTMD is caveated and qualified as (like evolution itself) both a significantly historical and induced theory and, as for all theoretical accounts (e.g., a specific atomic theory), it is likely to prove flawed in some details if not in its core. Time will tell; one hopes that it will (continue to) productively generate testable hypotheses.

Please recall the Japanese visitors' surprise at the U.S.'s divergence. Recently, another visiting Japanese psychologist—who could not even recall Shintoism's *human*-creation story—reported that Japanese textbooks deleted origin myths after 1945, once Emperor Hirohito (posthumously called “Showa”) essentially repudiated the throne-divinity link. (Imperial Shinto was strongly tied to nationalism from 1868-1945.) According to RTMD, Japan comprehended that at least one of its most salient gods had been defeated, and Japan's people were massively negatively reinforced regarding its aspirational, emperor-god-facilitated, manifest destiny. In essence, one might caricature part of the Japanese (and German, etc.) reinforcement in propositional logic with the premises (A) “If there is a God, then we win WW II” and (B) “We lost WW II” (with an *unconditional* surrender, like Germany)—leading to the *modus-tollens*-esque conclusion: (C) “There is no God.” This outcome feedback “B” (losing) and the resultant creation-myth vacuum facilitated greater evolutionary acceptance, according to RTMD—among other collective inferences.³⁴ Japan now ranks fourth in public evolutionary acceptance, of Miller et al.'s (2006) 34 (largely European) nations. (Naturally, alternative explanations for evolution's more rapid acceptance in Japan may emerge—explanations that may include, overlap, or exclude RTMD. E.g., Japanese religious philosophies⁵ often have notably more inclusive, syncretistic, and dialectical aspects, compared to the U.S.)

Near the start of our lab's research about college students' perceptions of evolution, I asked people, “Would you prefer the biological evolution theory to be false—that is, would you prefer a universe that has *not* experienced biological evolution?” Surprisingly, most respondents—including postbaccalaureate biology diplomates—preferred evolution (often sheepishly) to be “false.” The prototypical response to my “Why?” follow-up was, colloquially: “Duh! Because ‘God!’—Who wants to just end up as worm food?” In essence, although not directly contradictory, an afterlife-facilitating creator competes with evolution in explaining speciation, as parsimony suggests that either one or the other is in force (and less likely both).

³ Outcome feedback such as this is incorporated in various cognitive models, such as models of when people choose to vote (e.g., Bendor, Diermeier, & Ting, 2003).

⁴ Evolution was not unknown in pre-war Japan; Edward S. Morse promoted evolutionary ideas among Japanese intellectuals there by 1877—and, pre-war, Hirohito was an avid marine biologist (Rosenstone, 1988).

⁵ Other cultural reasons may play a role, too. For instance, Inagaki and Hatano obtained preliminary data suggesting that Japanese elementary students often believe that humans evolved from monkeys—perhaps due to familiarity with

This “simplicity” principle (from computational modeling; e.g., Harman, Ranney, Salem, Döring, Epstein, & Jaworska, 1988; Ranney & Schank, 1998; Thagard, 1992) indicates that evolution’s plausibility competes, at least indirectly, with a deity’s plausibility and the plausibility of an afterlife (etc.)—resulting in the inhibition of the attractiveness of an evolving universe. The majority in this informal survey thus desired evolution to be false—perhaps as wishful thinking—because it unpleasantly coheres with blatant mortality. The survey led to Brem, Ranney, and Schindel’s (2003) related findings that undergraduates considered evolution (assuming it accurate) to be a relative “bummer” for each of five potential areas: negatively impacting one’s sense of spirituality, free will, and purposefulness, while undesirably enhancing paradise-hindering selfishness and racism (e.g., toward the “less evolved”—possibly suggesting eugenics or that the powerful are most deserving, etc.). These results suggest tacit connections to the reward of a life after death—and an evolutionary implication of a lack of self-control may conflict with one’s decision-making history—what Ranney and Thanukos (in press) call “human agential experience.” Combined with Ranney and Thanukos’s aforementioned human reticence effect highlighting human exemption (or specialness—much as pre-Copernicans preferred Earth at the universe’s center), these findings mark an affective note in those Americans who “root” for evolution to be “false.”

The inter-belief competition aspects of RTMD cohere with even more extant data and some logical analyses. For instance, I noted that 13 countries (Japan, America, and the rest European) were common to Norris and Inglehart (2004) and Miller et al. (2006), and found that those higher in evolutionary acceptance are lower in accepting either God or life after death (r ’s = $-.8$; $p < .001$; note that all p ’s herein are for the more conservative two-tailed tests). Paul (2005) exhibited a concordant theism-evolution scatterplot for 11 nations (six overlapping the 13 I correlated). Such results cohere with RTMD (see Figure 1). In contrast, the received view seems quiet when it comes to addressing non-U.S data (although some of its descriptive elements might extend to select nations other than the U.S.—at least circa 1914).

Japan’s wild macaques (K. Inagaki, personal communication, January 18, 2008).

Now for some more logical support for RTMD's competition model: If the U.S. mostly sees God as the country's "wingman" (e.g., compared to relatively vanquished nations abandoned by their "deities"), this theistic favoritism further effectively competes with the evolutionary perspective that is more associated with atheism. After all, creationists are almost never atheists; this null intersection is basically a void quadrant in the 2x2 table that results when "creation vs. evolution" is crossed with "theism vs. atheism." The emptiness where creationist atheists would tally helps yield the *theism versus evolution* competition (and negative correlation). Terming the competitive conflict "a dirty little secret in scientific circles," Coyne (2009) provided a similar view—analogizing that, just because some married people are adulterers does not mean that marriage and adultery are compatible.

Beyond such logic and back to empiricism, undergraduates seem to commonly view evolution as inherently conflicting with creation (see below, consistent with work by Kaufman, Thanukos, Ranney, Brem, & Kwong, 1999, as well as Ranney & Thanukos, in press; see also Thagard & Findlay, in press). Creationists, naturally, often also recognize the conflict (even if they find some grounds for proximal/distal coexistence; Legare & Gelman, 2008); some have even sued a university over a web page entitled "Misconception: 'Evolution and religion are incompatible'" (Burrell, 2009).

Returning to Japan's development, if it followed RTMD theory dynamics, then losing some of its religious underpinnings' plausibility should have inhibited its citizens' afterlife beliefs. Indeed, after WWII, only 18% of Japanese held such beliefs—when first polled in 1975 (Norris & Inglehart, 2004, p. 91). Similarly, only 33% of West Germans believed in an afterlife in 1975. It seems that Germany's "pre-world-war god"—or perhaps the "militaristic views of the inevitability of Teutonic triumph" (Scott, 2004, referring to its late-19th and early-20th century ambitions; p. 93; see Ruse, 2005, pp. 113-114, re: Nazism vs. evolution)—had similarly been relatively disconfirmed by *both* world wars. (NB. There do not seem to be prewar data on nations' evolutionary acceptance.) In contrast, the U.S. had the highest 1975 belief in an afterlife (of the nine nations' data presented by Norris & Inglehart, 2004)—69%—which was almost its lowest value since WWII. (The U.S. afterlife value was 73-74% in the 1960's and 76% in 2001, so the 69% may have been a post-1970 "Vietnam/Watergate dip" that ended by 1995—after the 1991 "U.S. victory" in

the first Gulf War. It bears noting that many view the Vietnam War as a U.S. defeat, yet others see it as a strategic success in ultimately ending the Cold War—or that it could have *easily* been a tactical victory, had the U.S. unleashed nuclear weapons; an item’s data from the last survey I present below indicate that most American undergraduates would agree with the Vietnam easy-victory hypothetical.)

The reader has likely already inferred more specifics regarding RTMD’s theory about U.S. divergence, given that “Manifest Destiny” refers to the 19th-century U.S. notion of a God-given right to expand (mostly regarding territory, although the notion is applicable to other realms). Coming on the heels of The Twelve Fundamentals booklets of 1910-1915 (Scott, 2006), one could see WW I as being won by the “U.S. god,” reinforcing the idea that God backed the nation. The country’s WWI deaths were rather minimal compared to those of the other major combatants (Fischer, Klarman, & Oboroceanu, 2007), and the U.S.’s role was relatively brief (1917-1918). The 1925 Scopes trial’s milieu of religiosity (freshly reinforced by WWI, according to RTMD) left even less room for accepting a hypothesis (evolution) that competed with a strengthened counterpart (Abrahamic religions’ creationism)—which was indirectly supported by the motivated belief that a U.S.-benevolent deity preferentially ushers its citizens to a good afterlife.

WWII further reinforced the U.S.’s God-on-our-side notion, with personal identities incorporating even more glory from America’s national identity. Total deaths increased beyond WWI’s, but were a mere 11% beyond the Civil War mortalities, when the U.S. was 78% smaller (Fischer et al., 2007). American suffered the lowest per-capita deaths of any major WW II combatant.⁶ In the 2005 documentary *Why We Fight*, Gore Vidal said: “We were the only unwrecked major power on Earth.” In contrast, Japan and European nations had been occupied by, or dominated by, foreign forces sometime during 1940-1945. The British Empire began unraveling, and England would likely have been invaded, had Germany not scuttled Operation Sealion and decided on the Soviet Union instead. In 1975, Britain’s afterlife belief rate was 43%, and its main imperial remnants, Australia and Canada (both seemingly frontier nations, like the U.S.) also stood

⁶ As an illustration of RTMD-like elements in WW II, in Patton’s addresses to his troops weeks before D-Day (Blumenson, 1974), he asserted that America loves a winner, won’t tolerate a loser, has never lost a war, and will never lose a war. He also referred to God multiple times (a few cursing, but other times as in “thank God”), and suggested that their deaths would be rather light “two percent” in a given major battle (p. 457).

modestly (48% and 54%, respectively; Norris & Inglehart, 2004). (Canada, the U.S.'s culturally/militarily close neighbor, was understandably shifted toward the U.S.'s 69%, relative to Britain; RTMD might even explain the Australian data as part of the English-language gradient—e.g., using the ANZUS pact and ex-colonial ties.) The remaining countries in the 1975 afterlife survey—France, Belgium, and Italy—were defeated and/or occupied during WWII and all had afterlife belief rates no higher than Australia's. Adding further grist for RTMD, the U.S. economy soared. At WWII's end, more than half of the world's industrial production occurred in the U.S. (Burns & Novick, 2006), home of Earth's largest economy since about 1910, when publication of "the fundamentals" began (Scott, 2006; Scott & Matzke, 2007).

Naturally, RTMD should be applied to all nations, not just those in Miller et al. (2006) and Norris and Inglehart (2004). The theory is meant to expand the received view's account of U.S. divergence—or perhaps how Europe and other peer nations diverged *from the U.S.*—in evolutionary acceptance. There do not appear to be enough comparable historical data (yet) to disambiguate who diverged (more so) from whom (and when), but Norris and Inglehart, 2004, indicate that the U.S. is again an outlier—like relatively noncombatant Brazil—in having a high belief-in-God rate after WWII. Perhaps the U.S. (and Brazil, also slow to embrace evolution) is not yet far from the (circa 1913) historical baseline that has been more so diverged *from* by Europe and Japan.

Since the War of 1812 (when Darwin was a little boy) the contiguous U.S. has not been invaded and the nation has *never* had a massive famine. RTMD suggests that this era of only minor instability threats, combined with the optimism bias found in human nature (e.g., Lovallo & Kahneman, 2003) has fostered the "deity's favorite" status underpinning manifest destiny—and has arrested U.S. development in accepting evolution; analogically, the U.S. might be seen as having the immature mentality of an adventurer (e.g., in lunar exploration) who has seemed rather invincible in battle—having been rarely and only modestly humbled. (Lombrozo, Kelemen, & Zaitchik, 2007, report a greater use of teleological explanations by both young children and Alzheimer's sufferers, and—a bit strongly for some—that this "sheds light on the intuitive appeal of creationism" p. 999.) Thus, U.S. politicians are often referred to as engaging in "cowboy diplomacy," etc. RTMD is, therefore, a kind of supplement to historical/cultural account of why the U.S.

sometimes seems to diverge in unscientific, evidence-ignoring, and emotional ways (Griffin, 2007; cf. Hofstadter, 1963)—with its relative imperviousness to evolutionary evidence being an exemplar.

What the received view of U.S. divergence predicts is not clear, as it seems to describe distal events more than generate explicit, testable, hypotheses (i.e., in its current form, with rather dated historical bases). However, RTMD (for instance) predicts American evolutionary acceptance will increase if/as the U.S. markedly declines in its political, military, and industrial power—or if/as its general level of nationalism decreases such that more of its people view themselves citizens of the world. Current trends suggest that America will no longer have the largest gross economy in a few decades (given China’s greater growth rate), so a natural experiment may be in progress. RTMD suggests that this projected decline (and the declining number of U.S. companies among the world’s largest 500) would be linked to reduced U.S. religiosity and increased atheism, which seems to be accelerating (Kosmin & Keysar, 2009⁷)—and which should also boost America’s share of evolutionary acceptance, given the theism-versus-evolution competition (cf. Evans, 2000). Further, RTMD predicts public levels of evolutionary acceptance in nations not yet (to my knowledge; see below) surveyed. For instance, RTMD hypothesizes that nations with high literacy levels (which enables evolution instruction) that became atheistically communistic due to WWI or WWII reinforcements would have public evolutionary acceptance rates that are higher than the U.S.’s. Russia, for example, may exhibit a higher rate, (a) having been forced to sue for peace after suffering the highest WW I mortalities (effectively followed by 70 years of “disconfirming” God), and (b) having been significantly invaded in WWII. (Of course, the Soviet Union’s dissolution and Russia’s subsequent reduction in communism—and plausibly, atheism—complicates this prediction now.) Consistent with RTMD, various estimates indicate that the Soviet Union’s WW II per-capita fatalities were almost 50 times higher than the U.S.’s, and Russia now has roughly six times the atheists that the U.S. does (Zuckerman,

⁷ Proportions of atheistic, agnostic, or nonreligious U.S. adults grew dramatically from 1990-2008, with the nonreligious soaring from 8.2% to 15.0%—growing in every state—while Christians declined from 86% to 76%. Based on stated beliefs, Kosmin and Keysar also infer that 12% of U.S. adults are atheists or agnostics, with the explicit atheist/agnostic rate more than doubling during 1990-2008; this seems to have followed a slighter prior drop in belief in God (during 1968-1990; Norris & Inglehart, 2004).

2007). Finally, RTMD predicts relationships that are empirically testable in the lab. For instance, manipulating nationalistic emotions may even affect ratings of evolutionary acceptance (see below).

A potential criticism of RTMD is a suggestion that people did not lose faith in their god(s) after terrible wars that were not quite *world* wars. This is hard to assess, given (a) discrepancies between faith and religious affiliation, and (b) the lack of surveys from, say, Rome's empire. Furthermore, *post-Darwinian* history is what should matter most. For example, after the Thirty Years' War (1648), the *absence* of evolutionary theory meant that the losers still had no competitor to creationism to consider (unlike the World Wars)—and the war was apparently more about power than Protestant versus Catholic “gods” conflicting. Similarly, the U.S. Civil War (1861-1865) ended shortly after Darwin's theory was published, so evolution was not a viable “market share” explanatory option for the South to turn to. Additionally, both sides had the same (linguistic, religious, cultural, etc.) “god(s),” and this *intra*-national war was seen as involving conflicting policies (e.g., states' rights and slavery) much more than theologies. (Other RTMD critiques might relate to slavery's relatively late U.S. abolition, various U.S. reactions to the Civil War, Social Darwinism, and/or Catholic-Protestant dynamics, but space here does not permit a spirited defense of RTMD regarding these possible alternatives; see Ruse, 2005.)

Another potential criticism is that, as the world wars fade in collective memory, nationalism will also fade. At present, WW I veterans are all but gone, and WW II veterans are dwindling. However, in our most recent survey, most U.S. undergraduates believe that the nation continues to be a dominant military power. The speed with which the U.S. can successively invade nations and topple governments (disregarding its occupation abilities) still impresses. Yet even if the U.S. believed its military prowess were to be waning, our most recent data (below) suggest that its past successes seem to continue to support general and economic nationalism. (One might contrast the U.S. now with the U.K. following its 1982 Falklands war with Argentina.) The world wars also transformed the U.S.'s scientific national pride: Coyne (2009) notes that pre-1930 Germany garnered seven times the Nobel science prizes than did the U.S., yet over the last three decades, Americans garnered about 60% of *all* of the Nobel science prizes; relative to peers, the U.S. opposes science that conflicts with religious beliefs—not science in general (e.g., superconductivity).

When a nation collectively conceives of itself as having moral superiority and God's ear, that is likely to inhibit competitive notions like evolution—to maximize explanatory coherence (cf. Ranney & Schank, 1998; Thagard, 1992; see Evans, 2000, Lombrozo, Shtulman, & Weisberg, 2006, and Thagard & Findlay, in press, etc., about such connections). These de-activational influences ought to be extreme for evolution regarding our own species, enhancing human exceptionalism (e.g., Ranney & Thanukos, in press; Scott, 2000). This theorizing partly motivated Ranney & Thanukos's prediction that Americans would be less comfortable with explanations about human evolution than about plant evolution. Although their results offered considerably more than the human reticence effect noted earlier (see especially Thanukos, 2002), this RTMD prediction found support. (Goldberg & Thompson-Schill's 2009 results may also shed light, at least indirectly, on human exceptionalism, e.g., compared to plants.) Regarding RTMD as well, note that human exceptionalism (cf. Mead & Mates, in press) has nationalistic parallels—notably (especially post-WW II) American exceptionalism.

Some RTMD Implications re: Global Warming

As noted, a motivation for considering U.S. divergence regards global warming. The U.S.'s divergence from peer nations in evolutionary acceptance and theistically related beliefs may causally connect to its over-represented contribution to global warming. The U.S. emits over one fifth of humanity's CO₂, yet holds less than 5% of Earth's human population. Perhaps those who do not adequately comprehend or embrace organic evolution are relatively unmotivated to try to retard the demise of many species (Wake & Vredenburg, 2008; cf. Hansen & Galetti, 2009, and Wright, et al., 2007, etc., on future anthropogenic impacts)—possibly including *homo sapiens* (cf. dinosaurs; Kaufman, Ranney, Lewis, Thanukos, & Brem, 2000). Rejecting evolution is probably not the sole cause of a country's carbonic rapaciousness, yet nations that grasp more fully that environmental degradations facilitate extinctions should be more likely to reduce dramatic overrepresentations in greenhouse gas emissions more rapidly. Poling and Evans, 2004, found that many American adults do not think that our species can become extinct, which may explain America's markedly cavalier and unworried attitudes toward global warming relative to peer nations (see Leiserowitz,

2007) sustainability; Brazil, another religious nation (with strong afterlife beliefs) that many think ought to conserve its resources more, also exhibits a modest evolution-acceptance proportion. Given these evolutionary acceptance implications for global warming, the U.S. divergence (and Brazil-divergence) from Europe and Japan, etc., might well worry humanity. Recent surveys suggest that U.S. residents are roughly split between whether global warming is primarily anthropogenic, although most now believe that it is at least a somewhat serious problem (e.g., Rasmussen Reports, 2009). Unfortunately for conservationists, in a recent Pew poll (2009) about 20 priorities for the U.S. congress and president, environmental protection tied for 16th (with immigration)—with global warming placing 20th.

A fully successful RTMD theory would, in the end, need to differentially account for every country's past—although we hardly have much reliable international evolutionary public acceptance evidence even now, let alone pre-1945. For the few countries similar to the U.S.—that is, industrialized nations that appeared to win the world wars (or even more recent wars) with relatively modest losses—RTMD posits that turn-of-the-20th-century ideas of people as unique (as a species or to one's national deity) received reinforcement (along with the aforementioned human optimism bias), and that these ideas likely retarded acceptance of both evolution and anthropogenic global warming. In contrast, RTMD predicts that humans seem decreasingly special for countries that were increasingly scarred by WWs I and II (and so on)—regarding military pride, war deaths, nationalist/expansionist/economic ambitions, etc.—producing cultures that are increasingly apt to accept both evolution and the notion of anthropogenic climate change.

Until quite recently, the U.S. government dragged its feet on global warming protocols (e.g., Kyoto), compared to other prosperous nations. Perhaps America's high, RTMD-consistent religiousness (Norris & Inglehart, 2004) produced residents who largely ignore global warming's impending effects (e.g., by thinking the effects to be God's will—or that God will correct them), thus inhibiting both the growth of sustainability and more immediate attempts to slow climate change. (Various websites suggest that some in the U.S. seem to even *prefer* a cataclysmic warming—contra stewardship ideas—as a revelatory path to apocalyptic rapture or a test of faith in God's rescue capacities.) Were RTMD correct, it appears crucial that educators accelerate ways to inform the U.S. about organic evolution—given that global warming might

even yield/speed human extinction. As Earth's atmospheric carbon dioxide has already risen over 35% since the industrial age's dawn (Intergovernmental Panel on Climate Change, 2007), our planet risks an era of unpleasant biological evolution if nations don't act quickly. (Note that a few countries besides the U.S., e.g., China and India—often citing [in]equity concerns—also sidestepped the Kyoto protocol; China's 2006 per-capita oil use was less than 9%—and India's less than 4%—of the U.S.'s use.)

As with evolution, thoughts about global warming yield abundant moral and affective aspects. Emotionally, many people explicitly or implicitly fear what lifestyles future generations will inherit, or wonder what an overheated, "disfigured," world implies about theism. Morally, it was easier for distant ancestors than for us to dine on fish species that now dwindle; Earth is less plentiful. But one might expect that the relationship between theistic and global warming beliefs is more complicated than that between theistic beliefs and evolution. There are more strange-bedfellow elements in the former relationship; for instance, some religious groups clearly value shepherding the environment, even if one thinks that more religious groups see flora and fauna as slaves to human desire. Therefore, one might expect weaker linkages, regarding RTMD, for relationships involving global warming than those involving evolution.

Recent Evidence Regarding RTMD: Surveys From "Germanies" and North America

Although RTMD is new, at least four recent evidence bases—one from Germany and three from my research—bear on it. First, consistent with RTMD's aforementioned predictions about Russia (vs. the U.S.), Kutschera (2008) recently reported that residents in the former East Germany accept evolution more often than those in the former West Germany. RTMD would have predicted this, especially given that East Germany was under greater foreign domination (some would say "war-extending occupation") decades longer than was West Germany. This finding represents solid, but hardly unassailable support for RTMD (e.g., with WW I-losing "Russians" ironically "giving" rather atheistic communism—Marx's *Opium des Volkes* view—to WW II-losing East Germany).

The second source of evidence involves a string of three recent surveys that I have conducted (one with Calida Martinez). Two surveys were of U.S. undergraduates and one surveyed Canadian undergraduates (N

= 229); the Canadian data were collected to gear up toward future studies comparing and contrasting RTMD's inter-construct relationships across borders, but have already yielded intriguing results. Each survey was explicitly designed to assess predicted inter-construct associations. In particular, items used assessed five constructs regarding (1) belief in an afterlife, (2) belief in a deity (or deities), (3) acceptance of evolutionary origins of life (relative to creationism), (4) nationalism, and (5) global warming (especially anthropogenic global warming). More data will be collected shortly, and while the following results are preliminary, the analyses to date indicate relationships among these five constructs that are largely consistent with RTMD offering "value added" to the received view.

While the received view is rather quiet about afterlife beliefs in people's thinking, both the Canadian sample ($n = 52$) and the initial U.S. sample ($n = 105$) showed strong negative correlations between one's belief in an afterlife and one's belief in evolution (relative to creationism; r 's on the order of about $-.6$; p 's $< .0001$). Also consistent with RTMD (Fig. 1), both afterlife beliefs and creation (relative to evolution) beliefs are strongly related to theistic beliefs (r 's on the order of about $.75$; p 's $< .0001$). These data, naturally, reflect the prototypical "Duh!" verbalizations mentioned earlier, regarding why people do *not* prefer evolution to its (occasionally wishful-thinking) competitor(s).

More major predictive differences between RTMD and the received view (i.e., beyond afterlife considerations) are that RTMD hypothesizes relationships involving nationalism and global warming. (Naturally, the Canadian survey dealt with Canadian nationalism and the U.S. surveys with U.S. nationalism.⁸) Interestingly, across the U.S.-Canada border, global warming and nationalism seemed to have different, yet RTMD-consistent (see Fig. 1), relationships with the other constructs. For instance, Canadian nationalism was related to both beliefs in an afterlife and a supreme being(s) (r 's $> .3$, p 's $< .05$). In contrast, nationalism in the initial U.S. sample was negatively related to evolution (relative to creation) beliefs and global warming beliefs (r 's about $-.25$; p 's $< .05$ and $.01$, respectively)—while being marginally related to theistic beliefs ($r = .17$, $p = .05$). In the U.S. sample, global warming beliefs were, additionally,

⁸ The Canadian survey's items represented a subset of the U.S. survey's items, as U.S. participant time was less limited.

related to evolution (relative to creation) beliefs ($r = .19$; $p < .05$), whereas that was not obtained in the Canadian sample.

Through RTMD's lens, these preliminary results suggest that Canadian nationalism may be even more associated with the afterlife than it is in the U.S., and that global warming for Canadians is less associated with evolution/creation and nationalism than it is in the U.S. (Perhaps Canada sees itself as more "green" than America, and the contrast reduces the link between nationalism and global warming to insignificance.) Looking at both samples separately, virtually all of the relevant correlations yielded RTMD-predicted valences, as the few contra-predicted correlations were all small and nonsignificant (e.g., r 's of .1 or less); that is, were an association statistically significant, it was always RTMD-consistent, and in the rare cases that an association was not in directional concert with RTMD, it was diminutive and insignificant.

The initial U.S. sample's results interconnect the troika of evolutionary, nationalistic, and global warming beliefs (and, to a lesser degree, afterlife beliefs) that are at the heart of RTMD's augmentation of the received view. The troika is consistent with the RTMD components that suggest that (a) U.S. manifest destiny may have inhibited the nation's acceptance of both evolution and global warming, and (b) the modest U.S. acceptance of evolution, relative to creationism, may be independently (i.e., further) inhibiting the nation's acceptance of global warming. In contrast, no pair in the troika of constructs are significantly correlated in the Canadian sample; this suggests that, although Canadian nationalism is hardly disassociated from theistic or religious beliefs, compared to the U.S.: (1) Canadian nationalism interferes less with the assessment of scientific theories such as biological evolution and anthropogenic global warming, and (2) global warming is less politically connected to the Canadian evolution-creationism debate.

The first two surveys suggest that the Canadian sample's beliefs are deity-centric and partially consistent with what RTMD predicted for the U.S. (e.g., regarding afterlife and nationalism). The U.S. sample's beliefs seem even more consistent with RTMD (e.g., engaging global warming more and nationalism differently)—and are about as centered on evolution/creation notions as they are on theistic notions. Since Canada's geopolitical history is perhaps the most closely related to the U.S.'s—yet noting that more per-capita Canadians were lost in each world wars (and Canada's much smaller gross economy)—

—it is perhaps not surprising that the Canadian data’s pattern is alternatively similar to and different from the U.S. results in ways that are RTMD-consistent (i.e., consistent when generalizing RTMD beyond the U.S.). For instance, RTMD predicts that Canadians’ military/industrial history would lead them to accept human evolution more than do Americans, and that obtains: 58% of Canadians do (83% among their Green Party—yet only 37% in Alberta; Angus Reid, 2008), which is roughly double the U.S. acceptance percentage (e.g., Coyne, 2009). Likewise, as RTMD would predict based on world war mortalities, economics, etc., Paul (2005) indicates that Canada falls between the U.S. and Great Britain on beliefs regarding human evolution, piety/religiosity, biblical literalism, and God vs. atheism/agnosticism. In short, the Canadian results generally follow a received-view-plus-afterlife-and-partial-nationalism model, while the initial U.S. results predictably more fully follow the RTMD relationships portrayed above (as in Figure 1).

Quite recently, 72 U.S. undergraduates completed the third survey, an expanded one that experimented with many new items. Although somewhat limited in statistical power (e.g., due to some restrictions of ranges), the preliminary pattern of results again follows RTMD’s predictions. For instance, all of the main 15 inter-construct correlations were numerically in the hypothesized direction: that is, 15 of the 15 correlations among the constructs engaging beliefs regarding a deity, an afterlife, evolution, creationism, global warming, and overall nationalism (which was not significantly associated with a conservatism measure). This 15-for-15 pattern was also observed in the larger, original U.S. survey. The Received View only addresses three of these 15 correlations (among “deity,” “creation,” and “evolution”), so all 12 of RTMD’s “value added” directional predictions obtained. In concert with findings from the initial U.S. sample, global warming beliefs were positively related to evolution beliefs ($r = .26$; $p < .05$). The new survey’s results were also in concert with a number of findings that were common to both the aforementioned U.S. and Canadian samples. For instance, again relating to the “Duh!” vocalizations, afterlife beliefs were amply negatively correlated with evolution beliefs ($r = -.48$; $p < .0001$) and quite amply positively correlated with creation beliefs ($r = .76$; $p < .0001$). (Note that conservatism—vs. liberalism—did not negatively correlate with evolutionary acceptance as much as did the more religiously

related constructs.) These findings again underscore the perceived conflict between evolution (along with, perhaps, global warming) and the theistically infused concepts of creation, afterlife, and supreme being(s).

Future Evidence Regarding RTMD: Experiments, Internationality, and Neurocognition

As mentioned above, my laboratory will experimentally manipulate some of the six relevant RTMD dimensions (if/when possible; Fig. 1); these will be important in causally assessing the theory (e.g., at the extreme, whether persuasiveness about anthropogenic global warming increases doubts about the afterlife). The manipulations may include convincing essays and/or critical statistics—for instance, employing the Numerically Driven Inferencing paradigm’s techniques (e.g., Garcia de Osuna, Ranney, & Nelson, 2004; Ranney, Rinne, Yarnall, Munnich, Miratrix, & Schank, 2008; Rinne, Ranney, & Lurie, 2006). Surveys provided to participants in more countries would also, naturally, flesh out which differential parts of RTMD are most empirically justifiable. However, the surveys implemented to date, and the extant data, seem to represent a promising start for RTMD theory.

Neuroscience might also generate pertinent evidence. Recent research indicates that reduced anterior cingulate cortical (ACC) activity in response to error and uncertainty is associated with religious zeal and a greater belief in God (Inzlicht, McGregor, Hirsh, & Nash, 2009); similarly, conservatism has been linked to less conflict-related ACC activity and a reduced sensitivity to changed circumstances (Amodio, Jost, Master, & Yee, 2007). Viewing global warming as an anthropogenic mistake (thus suggesting that a nonhabitual response to the problem is needed), RTMD would predict that individuals who are most cognitively connected with religion, theism, conservatism, nationalism, and creationism would be less likely to recognize global warming as an error; these hypotheses cohere with RTMD’s predictions—and the data above—that such variables are related to difficulties in accepting the existence of (especially anthropogenic) global warming. Future neural imaging studies might address these predictions directly.

Evolution Education: Early and With Contrast

Many concepts are difficult to master (e.g., inertia; Ranney, 1996), and even apparently simple ones leave traces of prior ideas. For instance, in the first 1000 milliseconds’ reaction, even biology professors engage

movement-based root ideas when they classify objects as living or not (Goldberg & Thompson-Schill, 2009). Given that decades of instruction and study cannot completely squelch this developmentally primitive idea, perhaps the later one learns that many moving things are not alive (e.g., rivers and comets), the harder it is to dispel that misconception. It seems good, then, that parents and educators generally debunk the “movement equals life” belief early on (e.g., using cacti as examples).

In contrast, most U.S. residents don’t formally get evolution instruction until high school—if ever (see Kutschera, 2008, about Germany, as well); even as an eventual biology major, I do not recall being taught evolution before college. Adolescence seems too late to deliver the impact that evolution ought to yield in the developing mind. By the time most students “discover” evolution, they have already made significant, if implicit decisions (e.g., about whether to smoke tobacco or own guns). Imagine the cognitive damage if we kept from our children—say until they were 17 years old—that *not all* moving things are alive!

Unfortunately, much instruction about evolution results from selecting paths of least political conflict, such as the choice to *not* teach evolution early. Young children can understand that all living things are effectively our cousins (if distal ones), yet teaching evolution to them seems to many people rather like debunking Santa Claus for preschoolers. In offering religious parents such epistemic latitude—and a gigantic head start—in shaping the “origins” beliefs in their pre-majority children (see Kutschera, 2008), the U.S. apparently has generated a society that appears developmentally delayed relative to what it might understand about evolution (and global warming—or even internationalism—as per RTMD).⁹ This delayed development may even yield reduced understandings of materialism and reductionism (and possibly elements of determinism) in other realms of biology—and even the chemical and physical realms (Ranney, 1998). A bit more radically, RTMD suggests that the delay may even foster U.S. “clannishness,” as nationalism *incoheres* with evolution acceptance; curricula might be wise to foster a sense of international empathy to help societies address global warming’s “tragedy of the commons” (cf. van Vugt, 2009).

⁹ In some respects, allowing this head start for creation is a bit like permitting children to smoke tobacco or discharge firearms without informing them of some of the societal and personal health consequences of tobacco use and gun ownership.

Another effect of shrinking from political conflict regards whether evolution instruction ought to address whether some evolutionary and religious beliefs compete. A tacit bargain seems to have been struck in that most U.S. evolution instructors avoid addressing the competitive scientific-versus-religious accounts of biological origins (see Coyne, 2009, on the National Academy of Sciences' position). It seems that U.S. life science teachers think their position so tenuous that their licenses to teach evolution will be revoked if epistemic criteria are applied to scientific and religious accounts simultaneously.¹⁰ (E.g., many classroom educators effectively say, "We're afraid someone may rescind even the prospect of measly weekday evolution instruction, so we'll cede a big head start, the weekends—and the vast majority of one's childhood—to creationism;" however, similar issues arise for informal educators, such as those in "science museums") Our students, though, often know better; they understand that there are evidential bases for accepting either evolution (fossils, DNA, etc.) or creation (e.g., "bible codes," purported miracles, oral histories, complexity analyses, and documents/testaments with varying degrees of historical provenance or carbon dating, etc.). Indeed, Lombrozo, Thanukos, and Weisberg (2008) found that evolutionary acceptance correlates with understanding science's nature, so formal and informal instructors may be counterproductive if/when they downplay critical tenets of science (e.g., critiquing evidence) while hoping for increased evolutionary acceptance (also see Thagard & Findlay, in press).

Pieces of evidence may have widely diverging degrees of epistemic support, reliability, and belief acceptability (see Ranney, Schank, Hoadley, & Neff, 1996, on the nature of evidence), so they are hardly worthy of uniform weighting (Ranney & Schank, 1998). But creationists may be less likely to accept evolution if what they consider evidence (even if most scientists see the evidence as massively dubitable; cf. Ranney et al., 1996) is ignored or summarily dismissed, by apparent fiat, by those teaching evolution. (See Coyne, 2009, on supernatural phenomena not being completely beyond science). Although difficult to master, I suggest training biology teachers to explicitly evidentially and epistemologically compare and

¹⁰ A recent *Science* news story (Bhattacharjee, 2009) highlights this continued practical and/or epistemic bargaining, as evolution supporters were concerned by Texas science-standards language that seemed pro-creationist (e.g., in the context of contrasting multiple "theories"), yet from a neutral context seems virtually perfectly scientific. This aversion regarding "teaching the controversy" seems at odds with constructivist notions of how we ought teach (other) scientific concepts in relief to students' alternative conceptions.

contrast evolution with creation for times in which their juxtaposition arises in a classroom. We would ask no less of biology teachers when they contrast reproduction with spontaneous generation, let alone chemists when they contrast oxygen with phlogiston or physicists when they contrast models of motion (cf. Ranney, 1996). We ought let the evidence, hypotheses, explanations, competitions/contradictions, predictions, and control (i.e., engineering) carry the day if we are true to science.

Conclusions, Limitations, & More Implications

The preceding variety of empirical and historical evidence, noted and presented, may surprise some in how interconnected evolution seems to be with concepts that relate to Americans' senses of personal meaning (apparently including afterlife, nationalism, and even global warming; also see Brem, Ranney, & Schindel, 2003). Beyond the constructs discussed above, Ranney and Thanukos (in press) cite a number of other factors (particularly "consistency with worldview") that influence the acceptance of evolutionary explanations for biological features—and these factors are largely either directly or indirectly related to the presently proposed RTMD (Reinforced Theistic Manifest Destiny) theory (Fig. 1, etc.).

By markedly broadening the focus to other nations, RTMD subsumes and expands upon the received view about why the U.S. differs from peer countries in its rather modest "market share" with respect to evolutionary acceptance (especially regarding human evolution). In so doing, RTMD might help explain other geopolitically tinged issues that are beyond the scope of this piece (e.g., gun control divergence—or the "climate gap" between U.S. subgroups and how it relates to diversity and social justice; Morello-Frosch, Pastor, Sadd, & Shonkoff, 2009). Even though the evidence cited herein largely considers North American university students, the findings—and RTMD—have entailments extending well outside of both the continent and the samples surveyed. In particular, how a nation's residents understand information about the physical and social environment impacts their thoughts about global environmental problems (van Vugt, 2009); biological evolution would seem to be a linchpin in that understanding. Thus, one might twist Dobzhansky's decades-old famous quote by suggesting that, in terms of the societal importance of

humanity's influence on the biosphere: nothing in evolution makes sense except in the light of anthropogenic species destruction.

Ranney and Thanukos (in press) also cite familiarity as a factor influencing the acceptance of specific evolutionary explanations. This may encourage evolution's promoters, suggesting that more efforts to explain evolution may yield more acceptability—although understanding evolution is hardly perfectly related to its acceptance (cf. Shtulman & Calabi, 2008, with Bishop & Anderson, 1990, and Sinatra, Southerland, McConaughy, & Demastes, 2003); by analogy, many know a great deal about Santa Claus's "life," yet do not accept him "as a hypothesis." Ranney and Thanukos's experiments and surveys also highlight an American culture dominated by time-honored tenets of freedom, equity, and choice. However, choosing creation today is not nearly as epistemically defensible as it was even a decade ago, given increasing fossil evidence and DNA sequencing; creation seems more akin to phlogiston and luminiferous aether, which we no longer teach as viable theories (cf. Griffith & Brem, 2004, on teachers' perspectives on teaching evolution). This epistemic asymmetry in justification between evolution and creation should, one would hope, be reflected in the design of both classroom curricula as well as zoo signage.

Although the scientific study of evolution is more than "mere" history, it represents the study of change—and history is *still* at the heart of public controversies about evolution. Likewise, RTMD tries to account for change (and/or intransigence), albeit by employing psychological and societal analyses. The nascent theory offers some potentially surprising entailments—for instance, that many of the same causes might explain both the U.S.'s evolutionary divergence and its current lack of a vigorous response to global climate change. RTMD hardly pretends to "explain all the variance" in how the U.S. differs from its peers, or even just regarding evolutionary acceptance. It is hoped, though, that the theory can both (1) explain markedly more evidence than does the received view and (2) help fuel a robust dialogue about the 21st-century importance of evolution—as a litmus test for a society's conceptualizing (e.g., about the environment). To date, the empirical results provided above show promise regarding at least the first of these. If this promise continues, perhaps RTMD can expand its analyses from (a) how (individuals within)

nations differentially conceive of evolution to (b) how both international and subcultural populations employ group identity when incorporating evolution-associated concepts such as global warming.

References

Amodio, D. M., Jost, J. T., Master, S. L., & Yee, C. M. (2007). Neurocognitive correlates of liberalism and conservatism. *Nature Neuroscience*, 10, 1246-1247.

Angus Reid Strategies. (2008). *Canadians believe human beings evolved over millions of years*. Available: http://www.angus-reid.com/uppdf/2008.08.05_Origin.pdf. [2008, June 20].

Bendor, J., Diermeier, D., & Ting, M. (2003). A behavioral model of turnout. *American Political Science Review*, 97, 261-280.

Benson, M. (2009, July 10). Lawmaker's take on Earth's age a comedic hit. *Arizona Republic*. [Online]. Available: <http://www.azcentral.com/news/election/azelections/articles/2009/07/10/20090710politics-allen0710-ON.html> [2009, July 12].

Bereiter, C. (2002). Artifacts, canons, and the progression of pedagogy: A response to contributors. In B. Smith (Ed.), *Liberal education in a knowledge society* (pp. 223-244). Chicago: Open Court.

Bhattacharjee, Y. (2009). New Texas standards question evolution, fossil record. *Science*, 324, 25.

Bishop, B. A., & Anderson, C. W. (1990). Student conceptions of natural selection and its role in evolution. *Journal of Research in Science Teaching*, 27, 415-427.

Blumenson, M. (1974). *The Patton papers: 1940-1945*. Boston: Houghton Mifflin.

Brem, S. K., Ranney, M., & Schindel, J. (2003). Perceived consequences of evolution: College students perceive negative personal and social impact in evolutionary theory. *Science Education*, 87, 181-206.

Burns, K., & Novick, L. (Producers & Directors) (2006). *The War*. [Film.] New York & Washington, DC: PBS.

Burress, C. (2009). *Cal web site draws anti-evolution lawsuit*. [Online]. Available: <http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2009/02/14/MNM915T5JB.DTL> [2009, June 26].

Coyne, J. A. (2009, February 4). Seeing and believing: The never-ending attempt to reconcile science and religion, and why it is doomed to fail. *The New Republic*. [On-line:]. Available: http://www.tnr.com/story_print.html?id=1e3851a3-bdf7-438a-ac2a-a5e381a70472 [2009, June 28].

Demastes, S. S., Settlage, J., & Good, R. G. (1995). Students' conceptions of natural selection and its role in evolution: Cases of replication and comparison. *Journal of Research in Science Teaching*, 32, 535-550.

Evans, E. M. (2000). Beyond Scopes: Why creationism is here to stay. In K. S. Rosengren, C. N. Johnson, et al. (Eds.), *Imagining the impossible: Magical, scientific, and religious thinking in children* (pp. 305-333). New York: Cambridge University Press.

Ferrari, M., & Chi M. T. H. (1998). The nature of naïve explanations of natural selection. *International Journal of Science Education*, 20, 1231–1256.

Fischer, H., Klarman, K., & Oboroceanu, M-J. (2007). *American war and military operations casualties: Lists and statistics* (CRS Report for Congress: order code RL32492). [Online]. Available: <http://www.fas.org/sgp/crs/natsec/RL32492.pdf> [2008, May 1].

Gallup Organization. (2009). *On Darwin's birthday, only 4 in 10 believe in evolution*. [Online]. Available: <http://www.gallup.com/poll/114544/Darwin-Birthday-Believe-Evolution.aspx>. [2009, April 30].

Garcia de Osuna, J., Ranney, M., & Nelson, J. (2004). Qualitative and quantitative effects of surprise: (Mis)estimates, rationales, and feedback-induced preference changes while considering abortion. In K. Forbus, D. Gentner, & T. Regier (Eds.). *Proceedings of the Twenty-sixth Annual Conference of the Cognitive Science Society* (pp. 422-427). Mahwah, NJ: Erlbaum.

Goldberg, R. F., & Thompson-Schill, S. L. (2009). Developmental “roots” in mature biological knowledge. *Psychological Science*, 20, 485-487.

Griffin, T. D. (2007). Individual differences in epistemic goals and the acceptance of evolution. In D.S. McNamara & J.G. Trafton (Eds.) *Proceedings of the Twenty-ninth Annual Conference of the Cognitive Science Society* (p. 1765). Mahwah, NJ: Erlbaum.

- Griffith, J. A., & Brem, S. K. (2004). Teaching evolutionary biology: Pressures, stress, and coping. *Journal of Research in Science Teaching*, 41, 791-809.
- Hansen, D. M., & Galetti, M. (2009). The forgotten megafauna. *Science*, 324, 42-43.
- Harman, G., Ranney, M., Salem, K., Döring, F., Epstein, J. & Jaworska, A. (1988). A theory of simplicity. *Proceedings of the Tenth Annual Conference of the Cognitive Science Society* (pp. 111-117). Hillsdale, NJ: Erlbaum.
- Hofstadter, R. (1963). *Anti-intellectualism in American life*. New York: A. E. Knopf.
- Intergovernmental Panel on Climate Change (2007). *Fourth Assessment Report Climate Change 2007: Synthesis Report*. Cambridge: Cambridge University Press.
- Inzlicht, M., McGregor, I., Hirsh, J. B., & Nash, K. (2009). Neural markers of religious conviction. *Psychological Science*, 20, 385-392.
- Kaufman, D., Ranney, M., Lewis, E., Thanukos, A., & Brem, S. (2000). Was Apatosaurus a vegan? Dinosaur knowledge rocks when learning about evolution. *Proceedings of the 22nd Annual Conference of the Cognitive Science Society* (pp. 741-746). Mahwah, NJ: Erlbaum.
- Kaufman, D., Thanukos, A., Ranney, M., Brem, S., & Kwong, C. (1999, April). *Exploring the relationship between conceptual understanding and evolutionary reasoning*. Paper presented at the annual meeting of the American Educational Research Association, Montreal.
- Kaufman, L. (2010, March 3). Darwin foes add warming to targets. *New York Times*. [On-line:]. Available: <http://www.nytimes.com/2010/03/04/science/earth/04climate.html?adxnnl=1&ref=education&adxnnlx=1277327220-f7zgsLMcxirWb8Doue1+xc> [2010, June 23].
- Kosmin, B. A. & Keysar, A. (2009, March). *American religious identification survey [ARIS 2008]: Summary report*. [Online]. Available: http://www.americanreligionsurvey-aris.org/reports/ARIS_Report_2008.pdf [2009, June 25].
- Kutschera, U. (2008). Creationism in Germany and its possible cause. *Evolution: Education and Outreach*, 1, 84-86.

Legare, C. H., & Gelman, S. A. (2008). Bewitchment, biology, or both: The co-existence of natural and supernatural explanatory frameworks across development. *Cognitive Science*, 32, 607-642.

Leiserowitz, A. (2007). International public opinion, perception, and understanding of global climate change (Human Development Report 2007/2008) *Fighting climate change: Human solidarity in a divided world*, UNDP. [Online]. Available: http://hdr.undp.org/en/reports/global/hdr2007-2008/papers/leiserowitz_anthony6.pdf [2009, August 30].

Lombrozo, T., Kelemen, D., & Zaitchik, D. (2007). Inferring Design: Evidence of a preference for teleological explanations in patients with Alzheimer's disease. *Psychological Science*, 18, 999-1006.

Lombrozo, T., Shtulman, A., & Weisberg, M. (2006). The intelligent design controversy: Lessons from psychology and education. *Trends in Cognitive Sciences*, 10, 56-57.

Lombrozo, T., Thanukos, A., & Weisberg, M. (2008). The importance of understanding the nature of science for accepting evolution *Evolution: Education and Outreach*, 1, 290-298.

Lovaglio, D., & Kahneman, D. (2003). Delusions of success: How optimism undermines executives' decisions. *Harvard Business Review*. 81 (July), 56-63.

Mead, L. S., & Mates, A. (in press). Why science standards are important to a strong science curriculum and how states measure up. *Evolution: Education and Outreach*.

Miller, J. D., Scott, E. C., Okamoto, S. (2006). Public acceptance of evolution. *Science*, 313, 765-766.

Morello-Frosch, R., Pastor, M., Sadd, J., & Shonkoff, S. B. (2009). *The climate gap: Inequalities in how climate change hurts Americans & how to close the gap*. Los Angeles, CA: USC PERE Publications.

Norris, P., & Inglehart, R. (2004). *Sacred and secular: Religion and politics worldwide*. Cambridge: Cambridge University Press.

Paul, G. (2005). Cross-national correlations and quantifiable societal health with popular religiosity and secularism in the prosperous democracies: A first look. *Journal of Religion & Society*, 7, 1-17.

People For the American Way Foundation. (2000, March). *Evolution and creationism in public education: An in-depth reading of public opinion*. DYG, Inc.

Pew Research Center for the People and the Press. (2009, January). *Economy, jobs trump all other policy priorities in 2009*. [Online]. Available: <http://people-press.org/report/485/economy-top-policy-priority> [2009, May 6].

Poling, D. A., & Evans, E. M. (2004). Are dinosaurs the rule or the exception? Developing concepts of death and extinction. *Cognitive Development*, 19, 363-383.

Ranney, M. (1996). Individual-centered vs. model-centered approaches to consistency: A dimension for considering human rationality. *Vivek, A Quarterly in Artificial Intelligence*, 9 (2), 35-43.

Ranney, M. (1998, August). *Who are you to play God? Puzzles from an interloping "rederminist" (reductive determinist)*. [Multidisciplinary Perspectives on Evolutionary Reasoning symposium.] Paper presented at the annual Cognitive Science Society meeting, Madison, WI.

Ranney, M. A., Rinne, L. F., Yarnall, L., Munnich, E., Miratirx, L., & Schank, P. (2008). Designing and assessing numeracy training for journalists: Toward improving quantitative reasoning among media consumers. In P. A. Kirschner, F. Prins, V. Jonker, & G. Kanselaar (Eds.), *International Perspectives in the Learning Sciences: Proceedings of the Eighth International Conference for the Learning Sciences, Volume 2* (pp. 2-246 to 2-253). International Society of the Learning Sciences, Inc.

Ranney, M., & Schank, P. (1998). Toward an integration of the social and the scientific: Observing, modeling, and promoting the explanatory coherence of reasoning. In S. J. Read & L. C. Miller (Eds.), *Connectionist models of social reasoning and social behavior* (pp. 245-274). Mahwah, NJ: Lawrence Erlbaum Associates.

Ranney, M., Schank, P., Hoadley, C., & Neff, J. (1996). "I know one when I see one": How (much) do hypotheses differ from evidence? In R. Fidel, B. H. Kwasnik, C. Beghtol, & P. J. Smith (Eds.) *Advances in classification research: Vol. 5*. (ASIS Monograph Series; pp. 141-158, etc.) Medford, NJ: Learned Information.

Ranney, M. A., & Thanukos, A. (in press). Accepting evolution or creation in people, critters, plants, and classrooms: The maelstrom of American cognition about biological change. To appear in R. Taylor &

M. Ferrari (Eds.), *Epistemology and science education: Understanding the evolution vs. intelligent design controversy*. Oxford: Routledge.

Rasmussen Reports (2009, January). *44% say global warming due to planetary trends, not people*. [Online].

Available:http://www.rasmussenreports.com/public_content/politics/issues2/articles/44_say_global_warming_due_to_planetary_trends_not_people [2009, May 6].

Reiser, B.J., Tabak, I., Sandoval, W.A., Smith, B. K., Steinmuller, F., & Leone, A.J. (2001). BGuILE: Strategic and conceptual scaffolds for scientific inquiry in biology classrooms. In S. M. Carver, & D. Klahr (Eds.), *Cognition and Instruction: Twenty-five Years of Progress* (pp. 263-306). Mahwah, NJ: Erlbaum.

Rinne, L., Ranney, M., & Lurie, N. (2006). Estimation as a catalyst for numeracy: Micro-interventions that increase the use of numerical information in decision-making. In S.A. Barab, K.E. Hay, & D.T. Hickey (Eds.) *Proceedings of the Seventh International Conference of the Learning Sciences* (pp. 571-577). Mahwah, NJ: Lawrence Erlbaum.

Rosenstone, R.A. (1988). *Mirror in the shrine: American encounters with Meiji Japan*. Cambridge, MA: Harvard University Press.

Ruse, M. (2005). *The evolution-creation struggle*. Harvard University Press: Cambridge, MA.

Schindel, J.E., & Ranney, M. A. (2001, April). *Undergraduate views related to teaching evolution and creation*. Paper presented at the annual meeting of the American Educational Research Association, Seattle, WA.

Scott, E. C. (2000, December 7). *The creationism/evolution continuum*, [Online]. Available: http://www.ncseweb.org/resources/articles/9213_the_creationevolution_continu_12_7_2000.asp [2008, January 28].

Scott, E. C. (2004). *Evolution vs. creationism: An introduction*. Greenwood Press: Westport, CT.

Scott, E.C. (2006). Creationism and evolution: It's the American Way. *Cell*, 124, 449-451.

Scott, E. C., & Matzke, N. J. (2007). Biological design in science classrooms. *Proceedings of the National Academy of Sciences*, 104 (suppl. 1), 8669-8676.

Shtulman, A., & Calabi, P. (2008). Learning, Understanding, and Acceptance: The Case of Evolution. In B. C. Love, K. McRae, & V. M. Sloutsky (Eds.), *Proceedings of the 30th Annual Conference of the Cognitive Science Society* (pp. 235-240). Austin, TX: Cognitive Science Society.

Sinatra, G. M., Brem, S. K., & Evans, E. M. (2008). Changing minds? Implications of conceptual change for teaching and learning about biological evolution. *Evolution: Education and Outreach*, 1, 189-195.

Sinatra, G. M., Southerland, S.A., McConaughy F., Demastes, J.W. (2003). Intentions and beliefs in students' understanding and acceptance of biological evolution. *Journal of Research in Science Teaching*, 40, 510–28.

Stets, J. E., & Burke, P. J. (2003). A sociological approach to self and identity. In M. R. Leary & J. P. Tangney (Eds.), *Handbook of self and identity* (pp. 128-152). New York: Guilford Press.

Thagard, P. (1992). *Conceptual revolutions*. Princeton: Princeton University Press.

Thagard, P., & Findlay, S. (in press). Getting to Darwin: Obstacles to accepting evolution by natural selection. *Science & Education*.

Thanukos, A. (2002). *Acceptance of evolutionary explanations as they are applied to plants, animals, and humans*. Unpublished doctoral dissertation, University of California, Berkeley.

Van Vugt, M. (2009). Averting the tragedy of the commons: Using social psychological science to protect the environment. *Current Directions in Psychological Science*, 18, 169-173.

Wake, D., & Vredenburg, V. (2008) Are we in the midst of the sixth mass extinction? A view from the world of amphibians. *Proceedings of the National Academy of Sciences*, 105, 11466-11473.

Wright, S. J. et al. (2007). The plight of large animals in tropical forests and the consequences for plant regeneration. *Biotropica*, 39, 289-291.

Zuckerman, P.(2007.) *Atheism: Contemporary Rates and Patterns*. The Cambridge Companion to Atheism. In M. Martin (Ed.). Cambridge University Press: Cambridge.

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