Research Article

Inferring Design

Evidence of a Preference for Teleological Explanations in Patients With Alzheimer's Disease

Tania Lombrozo,[1] Deborah Kelemen,[2] and Deborah Zaitchik[3]

[1]Department of Psychology, University of California, Berkeley; [2]Department of Psychology, Boston University; and [3]Department of Psychiatry, Massachusetts General Hospital, Charlestown, Massachusetts

ABSTRACT—*Unlike educated adults, young children demonstrate a "promiscuous" tendency to explain objects and phenomena by reference to functions, endorsing what are called teleological explanations. This tendency becomes more selective as children acquire increasingly coherent beliefs about causal mechanisms, but it is unknown whether a widespread preference for teleology is ever truly outgrown. The study reported here investigated this question by examining explanatory judgments in patients with Alzheimer's disease (AD), whose dementia affects the rich causal beliefs adults typically consult in evaluating explanations. The results indicate that unlike healthy adults, AD patients systematically and promiscuously prefer teleological explanations, suggesting that an underlying tendency to construe the world in terms of functions persists throughout life. This finding has broad relevance not only to understanding conceptual impairments in AD, but also to theories of development, learning, and conceptual change. Moreover, this finding sheds light on the intuitive appeal of creationism.*

In 1802, William Paley presented a now classic thought experiment. Paley invited readers to imagine coming across either a stone or a watch. One might legitimately ask why either object exists or how it came to be there, but different explanations seem appropriate for the two objects. For a stone, one might be content to conclude that "it had lain there for ever" (Paley, 1802/1998, p. 1). But for the watch, argued Paley, this explanation will not do. This is because the complex coordination of the watch's components, each essential to the watch's proper functioning, suggests the existence of an underlying design and an accompanying designer. Applying the same reasoning to humans and

Address correspondence to Tania Lombrozo, Department of Psychology, UC Berkeley, 3210 Tolman Hall, Berkeley, CA 94720, e-mail: lombrozo@berkeley.edu.

other aspects of nature, Paley argued for the existence of an ultimate designer: God.

Although contemporary scholars debate the merits of Paley's argument, his reasoning is intuitively compelling. People typically explain the existence and properties of objects such as stones by appealing to proximate causal mechanisms (e.g., geological processes), and the existence and properties of artifacts such as watches by appealing to their functions (e.g., telling time). When one is confronted with objects that appear to have functions, such as hearts, it seems only natural to adopt a functional, or *teleological*, mode of explanation: Hearts exist and have the properties they do because they are for pumping blood.

Inferring the appropriateness of a teleological explanation from an apparent function, which we call the *inference to design*, is often quite reasonable. The intricate correspondence between watches and telling time provides evidence that watches were designed for telling time, just as the correspondence between hearts and pumping blood provides evidence that hearts resulted from divine creation (for Paley) or natural selection (for contemporary scientists). But the inference to design is not always valid. Mountains support the function of climbing, yet most adults reject the explanation that mountains exist *because* they are for climbing (Kelemen, 1999c). This is because adults generally restrict teleological explanations to cases in which the function invoked in the explanation played a causal role in bringing about what is being explained (Lombrozo & Carey, 2006): The fact that watches tell time led to the existence of watches, but the fact that mountains support climbing did not lead to the existence of mountains. The fit between the structure being explained and a plausible function provides evidence that this causal condition holds, but background beliefs (e.g., about the origins of mountains) can override the inference to design and lead to the rejection of a given teleological explanation.

In this article, we examine the hypothesis that teleological explanations are compelling and pervasive because they reflect an explanatory default: Unless people have evidence to the

contrary, they assume that a good fit between an object's structure and a plausible function licenses a teleological explanation. This explanatory default can be overridden by background beliefs inconsistent with a teleological explanation, as typically occurs when adults explain the existence and properties of nonliving natural objects, such as stones or mountains. Our hypothesis predicts that people with sparse or compromised background beliefs should err on the side of accepting too many, rather than too few, teleological explanations. Evidence from children, who lack many of the background beliefs that prevent adults from accepting teleological explanations, confirms this prediction. In fact, young children have been characterized as "promiscuously teleological": They overwhelmingly accept and prefer teleological explanations for objects like watches, but also for objects like stones and mountains (DiYanni & Kelemen, 2005; Kelemen, 1999b, 1999c, 2003; Kelemen & DiYanni, 2005; but see Greif, Kemler Nelson, Keil, & Gutierrez, 2006, and Keil, 1992). For example, a majority of 7- and 8-year-olds endorsed the explanation that "mountains exist to give animals a place to climb" in preference to the alternative that "mountains exist because volcanoes cooled into lumps" (Kelemen, 1999c).

The phenomenon of promiscuous teleology in childhood provides support for the hypothesis that the inference to design is an explanatory default. However, developmental evidence is inconclusive about whether this default persists into adulthood. Moreover, the hypothesis is difficult to test in adults, who have deeply held beliefs about the origins of familiar objects and more general beliefs that constrain explanations of novel objects (Keil, 2003; Lombrozo, 2006; Sloman, Lombrozo, & Malt, 2007). Such beliefs restrict the acceptance and preference for teleology (Kelemen & Rosset, 2007; Lombrozo & Carey, 2006) and could thus mask an underlying preference for teleological explanations. A stringent test of the hypothesis that the inference to design is a lifelong default can be conducted in an adult population with impaired or inferentially weakened causal beliefs. One such population is patients with Alzheimer's disease (AD), a form of dementia that causes serious semantic and conceptual deficits (Silveri, Daniele, Giustolisi, & Gainotti, 1991; Zannino, Perri, Carlesimo, Pasqualetti, & Caltagirone, 2002). Recently, Zaitchik and Solomon (in press) reported that AD patients mirror young children's "Piagetian animism" in attributing life to inanimate entities such as airplanes and the sun. This finding suggests that relevant biological beliefs are compromised in AD patients. If their causal beliefs about the origins of objects are also compromised, they should—like children—exhibit a promiscuous tendency to accept and prefer teleological explanations.

In the experiment that follows, we tested the prediction that AD patients will exhibit promiscuous teleology. In addition, we examined beliefs about the origins of the objects being explained. Kelemen and DiYanni (2005) found that children often invoked a designer, usually God, to account for the existence of entities like mountains, and that the extent to which individual children accepted teleological explanations correlated with how often they invoked a designer. We were interested in whether Alzheimer's patients might exhibit a similar tendency to promiscuously invoke a designer.

METHOD

Participants

Forty-one adults participated. Twelve healthy young adults (6 men, 6 women; mean age = 21 years, range = 18–28) and 12 healthy elderly adults (5 men, 7 women; mean age = 73 years, range = 66–81; mean education = 15.3, range = 12–20) were recruited from the general public in the Boston area. The cognitive status of each participant was reviewed to confirm there was no history of progressive cognitive decline. None of the healthy participants had conditions known to cause cognitive deficits (e.g., vitamin deficiency, electrolyte imbalance) or a history of severe head trauma, alcoholism, or psychiatric illness. To corroborate the cognitive status of the elderly participants, an experienced tester administered the Mini-Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975). The mean MMSE score of the healthy elderly group was 29 (range = 26–30).

Seventeen Alzheimer's patients (6 men, 11 women; mean age = 84 years, range = 73–93; mean education = 14.7 years, range = 10–18) were recruited from the Gerontology Research Unit of the Massachusetts General Hospital and the Hebrew Rehabilitation Center for the Aged. Neurological, psychiatric, and neuropsychological evaluations indicated these participants met standard criteria for probable AD (McKhann et al., 1984). Individuals with other complicating medical conditions were excluded. The mean MMSE score of the AD patients was 23.1 (range = 17–30). All participants had adequate hearing and visual abilities for the task demands.

Procedure

Participants completed an interview that consisted of two parts, an explanation choice task and a causal-beliefs task. The script for the explanation choice task began as follows:

> I'm going to read you some questions and possible answers. Some of the answers will seem appropriate, but others may seem silly or untrue. For each answer, I just want you to tell me whether or not you think it's an appropriate answer to the question. If you're unsure, just tell me that. Ready? Here's the first question:

Participants were then presented with 10 "why" questions, each of which had two possible answers, one teleological and one mechanistic. The stimuli, adapted from items used with children (Kelemen & DiYanni, 2005), included two items from each of five domains: artifacts (cars, tables), biological traits (eyes, stomach), biological organisms (trees, dogs), nonliving natural objects (mountains, sun), and natural phenomena (rain, wind). For artifacts, nonliving natural objects, and natural phenomena,

TABLE 1

Examples of the Questions and Answers Presented to Participants

Category	Question	Mechanistic explanation	Teleological explanation
Artifacts	Why do tables have flat tops?	Because flat pieces of wood were placed on wooden legs	So that people can eat on them
Biological traits	Why are there eyes?	Because bodies have special cells that combine to produce eyes	So people and animals can see
Biological organisms	Why does Earth have trees?	Because they grow from tree seeds	So that animals can have shade and protection
Nonliving natural objects	Why is the sun so bright?	Because the chemical reactions on the sun produce light	So that animals and plants have enough light to survive
Natural phenomena	Why is there rain?	Because water condenses in clouds and forms droplets	So that plants and animals have water for drinking and growing

one question was about an object's properties, and the other was about an object's existence (this distinction did not yield reliable differences and is not discussed further). The questions were presented in one of four orders. For each participant, mechanistic explanations were presented first for half of the items. Examples of the questions and answers are presented in Table 1.

Responses to the two possible answers to each question were coded as acceptance judgments. Following these two acceptance judgments, participants were asked to make a single preference judgment, specifying which of the two answers—the teleological or the mechanistic—they preferred.

At the conclusion of the explanation choice task, participants completed the causal-beliefs task, in which they were asked about the causal origin of each of the items in the explanation choice task. For example, for the sun item they were asked: "Did someone or something make the sun so bright or did it just happen?" For the eyes item they were asked: "Did someone or something make eyes or did they just appear?" For a given participant, the 10 causal-origins questions were asked in the same order as the corresponding explanation choice questions.

RESULTS

Explanation Choice Task

Because few items were tested in each domain, the five domains were divided into two categories for further analysis: *warranted* items, those that typically warrant teleological explanations (artifacts, biological traits), and *unwarranted* items, those that typically do not (biological organisms, nonliving natural objects, natural phenomena). Using this classification, we examined acceptance of and preference for explanations as a function of population (young adults, elderly adults, AD patients) and teleological-explanation status (warranted, unwarranted).

"Don't know" responses were generated in only six cases, by 1 elderly participant and 5 AD patients. Appropriate responses were provided for the remaining 1,224 questions. There were no significant effects of the order of the questions nor significant differences between the young and elderly participants, except as noted.

A 2×3 analysis of variance (ANOVA) with explanation status (warranted, unwarranted) as a within-subjects variable, population (young, elderly, AD) as a between-subjects variable, and proportion of accepted teleological explanations as a dependent variable revealed significant main effects of both explanation status, $F(1, 38) = 67.20$, $p < .01$, $p_{rep} > .99$, $\eta_p^2 = .639$, and population, $F(2, 38) = 4.53$, $p < .05$, $\eta_p^2 = .193$, as well as a two-way interaction, $F(2, 38) = 6.40$, $p < .01$, $\eta_p^2 = .252$ (see Fig. 1a). Teleological explanations were more often accepted for warranted than for unwarranted items (98% vs. 62%), paired-samples $t(40) = 6.89$, $p < .01$, $p_{rep} > .99$, and AD patients accepted teleological explanations 87% of the time, significantly more often than the young participants (66%), $t(27) = -3.59$, $p < .01$, $p_{rep} = .990$, and marginally more often than the healthy elderly participants (73%), $t(27) = -1.92$, $p = .065$, $p_{rep} = .904$. There were no significant population differences in acceptance of teleological explanations for warranted items, but AD patients accepted teleological explanations more often in the unwarranted cases than did young participants, $t(27) = -4.02$, $p < .01$, $p_{rep} > .99$, or healthy elderly participants, $t(27) = -2.05$, $p < .05$, $p_{rep} = .917$. Critically, the elevated acceptance of teleological explanations in AD patients cannot be accounted for by an indiscriminate tendency to accept proffered explanations: Even the Alzheimer's patients discriminated item types, accepting teleological explanations more often for warranted than for unwarranted items (97% vs. 79%), paired-samples $t(16) = 3.25$, $p < .01$, $p_{rep} = .976$.

The same analysis was carried out with acceptance of mechanistic explanations as the dependent variable, revealing a significant main effect of teleological-explanation status, $F(1, 38) = 5.31$, $p < .05$, $p_{rep} = .941$, $\eta_p^2 = .123$, but no effect of population, $F(2, 38) = 1.53$, $p = .230$, $\eta_p^2 = .074$, or interaction, $F(2, 38) = 1.37$, $p = .265$, $\eta_p^2 = .067$. Participants were less likely to accept mechanistic explanations when teleological explanations were warranted than when they were not (64% vs. 79%), paired-samples $t(40) = -2.54$, $p < .05$, $p_{rep} = .957$.

These analyses reveal that AD patients differ from healthy participants in accepting teleological explanations promiscu-
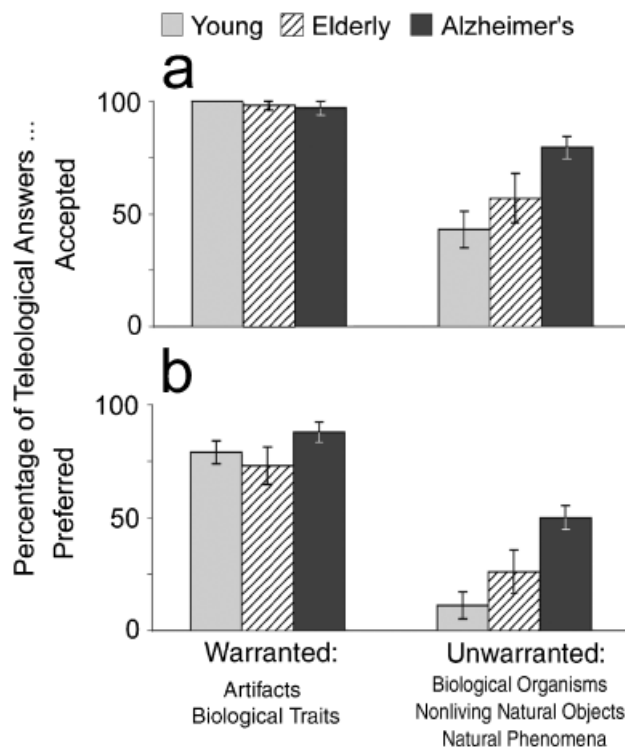
Fig. 1. Average percentage of teleological explanations (a) accepted and (b) preferred as a function of domain and population. The domains are grouped according to whether or not they typically warrant teleological explanations. Bars denote standard errors of the means.

ously: They are more likely to accept teleological explanations both overall and specifically for unwarranted items, but do not differ from healthy participants in accepting mechanistic explanations. A stronger test of teleological tendencies in AD patients involves explanatory preference: Do they prefer teleological explanations over mechanistic alternatives, even for unwarranted items? A 2×3 ANOVA with explanation status (warranted, unwarranted) as a within-subjects variable, population (young, elderly, AD) as a between-subjects variable, and explanation preference as a dependent variable revealed main effects of explanation status, $F(1, 38) = 145.05, p < .01, p_{rep} > .99, \eta_p^2 = .792$, and population, $F(2, 38) = 6.36, p < .01, \eta_p^2 = .251$, as well as a significant interaction, $F(2, 38) = 4.48, p < .05, \eta_p^2 = .191$ (see Fig. 1b). Overall, participants were more likely to prefer teleological explanations for warranted than for unwarranted items (81% vs. 32%), paired-samples $t(40) = 10.92, p < .01, p_{rep} > .99$. However, AD patients preferred teleological explanations in 65% of cases, significantly more often than either the young participants (38%), $t(27) = -4.58, p < .01, p_{rep} > .99$, or the healthy elderly participants (45%), $t(27) = -2.42, p < .05, p_{rep} = .947$. As with acceptance judgments, the difference between populations was greater for unwarranted than for warranted items. AD patients were significantly more likely to prefer teleological explanation for unwarranted items than were young participants, $t(27) = -4.81$,

$p < .01, p_{rep} > .99$, or healthy elderly participants, $t(27) = -2.32, p < .05, p_{rep} = .940$, but no more likely to prefer teleological explanations for warranted items than were young participants, $t(27) = -1.34, p = .191, p_{rep} = .822$, or healthy elderly participants, $t(27) = -1.76, p = .091, p_{rep} = .884$.

Note that the preference for teleological explanations in the AD population cannot be accounted for by chance responding: AD patients preferred teleological explanations more often than predicted by chance (6.5/10 vs. 5/10), one-sample $t(16) = 3.71, p < .01, p_{rep} = .986$, and were more likely to prefer teleological explanations for warranted than for unwarranted items (88% vs. 50%), paired-samples $t(16) = 6.74, p < .01, p_{rep} > .99$. To address the concern that AD patients may have preferred teleological explanations because they failed to understand the mechanistic alternatives, we repeated the 2×3 ANOVA on explanation preferences including only those items for which individuals accepted both the mechanistic and the teleological explanations. This analysis yielded identical patterns of significance. AD patients preferred the teleological option for unwarranted items 57% of the time despite having accepted the mechanistic alternative, whereas the healthy young and elderly participants preferred the teleological option for unwarranted items only 6% and 25% of the time, respectively, $t(25) = -4.41, p < .01, p_{rep} > .99$, and $t(25) = -2.14, p < .05, p_{rep} = .925$.

Finally, Table 2 reports the percentage of explanations accepted and preferred within each domain as a function of group. Because the healthy young and elderly participants did not differ statistically in the analyses reported in this section, they were combined into a single control group. AD patients were more likely than participants in the control group to accept and prefer teleological explanations in each of the unwarranted domains: biological organisms, nonliving natural objects, and natural phenomena.

Causal-Beliefs Task

Participants' responses to questions about causal origins were classified into four categories: those that invoked a supernatural agent (*God* responses), those that invoked a human agent (*person* responses), those that discussed the evolution of a biological trait (*evolution* responses), and those that discussed a natural process other than the evolution of a biological trait (*process* responses; e.g., plate tectonics, growth, or a chemical reaction). Only in five cases, involving 3 AD patients, did a subject fail to provide a response. The 405 generated responses were classified by two independent coders, one of whom was not affiliated with the study; total agreement was more than 98%. Fewer than 3% of responses failed to conform to one of the four response categories.

Responses were analyzed as a function of population (young adults, elderly adults, AD patients), with teleological-explanation status (warranted, unwarranted) and response type (God, person, evolution, process) as within-subjects variables (see Fig. 2). There were significant main effects of population, $F(2, 38) =$

TABLE 2

Percentage of Explanations Accepted and Preferred, by Domain and Population

Domain and population	Mechanistic explanation accepted	Teleological explanation accepted	Teleological explanation preferred
Teleological explanation warranted			
Artifacts			
Control subjects	75	98	77*
AD patients	59	97	91
Biological traits			
Control subjects	61	100	75
AD patients	59	97	86
Teleological explanation unwarranted			
Biological organisms			
Control subjects	71	44**	25**
AD patients	71	80	56
Nonliving natural objects			
Control subjects	82	46*	17**
AD patients	91	68	41
Natural phenomena			
Control subjects	75	61**	15**
AD patients	88	91	53

Note. For this analysis, healthy young and elderly participants were combined in a single control group. AD = Alzheimer's disease. Asterisks indicate significant population differences, *$p < .05$, one-tailed ($p_{rep} > .87$), **$p < .05$, two-tailed ($p_{rep} > .91$).

5.00, $p < .05$, $\eta_p^2 = .208$, and response type, $F(3, 36) = 142.13$, $p < .01$, $\eta_p^2 = .922$, as well as a significant interaction between response type and teleological-explanation status, $F(3, 36) = 445.45$, $p < .01$, $\eta_p^2 = .974$. The young generated process responses significantly more often than the elderly, $t(22) = 2.29$, $p < .05$, $p_{rep} = .932$, and AD patients, $t(27) = 2.17$, $p < .05$, $p_{rep} = .928$, but tended to invoke God less often than the elderly, $t(22) = -1.93$, $p = .071$, $p_{rep} = .899$, and AD patients, $t(27) = -1.76$, $p = .068$, $p_{rep} = .902$. The elderly and AD populations did not differ from each other in frequency of either process responses, $t(27) = -0.26$, $p = .800$, $p_{rep} = .571$, or God responses, $t(27) = 0.36$, $p = .719$, $p_{rep} = .600$. Overall, process and person responses were more frequent than God and evolution responses. The interaction with explanation status resulted from the fact that person responses were overwhelmingly generated for items that warrant teleological explanations, whereas process responses were overwhelmingly generated for items that do not warrant teleological responses.

Relation Between the Tasks

Although AD patients were significantly more likely to accept and prefer teleological explanations than were healthy participants, they were no more likely to invoke creation (by divine or human agents). The comparison between AD patients and healthy elderly adults is especially telling: Although they invoked God equally often, AD patients accepted and preferred teleological explanations more often than the healthy elderly.
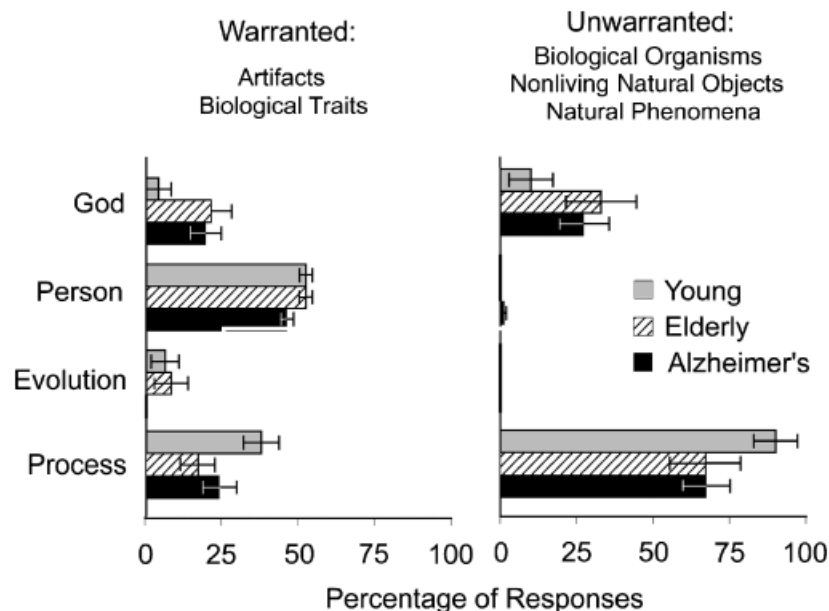

Fig. 2. Distribution of responses to questions about the causal origins of items as a function of domain and population. Responses were categorized according to whether they invoked a supernatural agent ("God"), a human agent ("person"), evolution of a biological trait ("evolution"), or a natural process other than the evolution of a biological trait ("process"). The domains are grouped according to whether or not they typically warrant teleological explanations. Bars denote standard errors of the means.

To further investigate the relation between performance on the two tasks, we created two composite scores for each participant: an explanation index, corresponding to the total number of teleological explanations accepted (of 10) in the explanation choice task, and an origins index, corresponding to the total number of items (of 10) for which the participant invoked a process that typically supports teleological explanations (God, person, or evolution responses) in the causal-beliefs task. Results for these indices were consistent with the analyses reported earlier in that the explanation index varied significantly as a function of population, $F(2, 38) = 5.05$, $p < .05$, $\eta_p^2 = .210$, but the origins index did not, $F(2, 38) = 1.97$, $p = .153$, $\eta_p^2 = .094$. The correlations between these indices were .33 in the young ($p = .30$), .36 in the elderly ($p = .25$), and .06 in the AD patients ($p = .83$). Although nonsignificant, the correlations for healthy participants are comparable in magnitude to those documented by Kelemen and DiYanni (2005) for children. The absence of a correlation within the AD population suggests that AD patients accepted teleological explanations independently of their beliefs about items' origins. In particular, they were significantly more likely than healthy participants to accept teleological explanations for items they did not attribute to God, a person, or evolution (4.5 vs. 3.0 out of 10), $t(39) = -2.04$, $p < .05$, $p_{\text{rep}} = .919$.

DISCUSSION

In contrast to healthy adults, patients with AD broadly accept and prefer teleological explanations. They explain the existence of rain by noting that it provides water for plants and animals, and the existence of trees by noting that they provide shade. This tendency mirrors the phenomenon of promiscuous teleology in children, but the present findings go beyond developmental data to suggest the preference for teleology is never outgrown. Rather, the preference persists throughout life, reemerging when causal beliefs that might otherwise constrain it are limited or compromised. In short, these findings provide evidence for a basic human preference to understand the world in terms of purpose. When faced with an object that supports a plausible function, humans make an immediate but defeasible inference to design, and assume a teleological explanation is warranted.

Additional evidence supports our conclusion that a preference for teleology persists throughout life. First, the data reported here suggest that healthy adults are surprisingly willing to entertain scientifically questionable teleological explanations (see Fig. 1a), even if they ultimately prefer a mechanistic alternative (see Fig. 1b). Second, ongoing research with scientifically naive adults and with adults responding under speeded conditions provides converging evidence for an underlying tendency toward teleology. Casler and Kelemen (2007) found elevated teleological endorsements among Roma (Gypsy) adults with little schooling, which suggests that a teleological preference is reduced primarily as a result of causal beliefs typically

acquired through formal education. Kelemen and Rosset (2007) found that educated adults making speeded judgments show heightened acceptance of teleological explanations, presumably because processing limitations restrict access to background beliefs that defeat the inference to design. Finally, the appeal of intelligent-design creationism (Evans, 2000; Kelemen, 1999a; Lombrozo, Shtulman, & Weisberg, 2006), ultra-adaptationism in evolutionary biology (Gould & Lewontin, 1979; Pinker & Bloom, 1990), and widespread misunderstanding of evolution as a goal-directed process (Brumby, 1985; Shtulman, 2006) provide further evidence of the human tendency to view the world in terms of design.

But does the tendency to infer design also require an inference to a designer? The current results suggest not. AD patients were no more likely to spontaneously invoke a designer (human or divine) than were healthy elderly participants, and healthy participants accepted teleological explanations for properties they attributed to natural selection. AD patients also differed from healthy adults and children in that their judgments about the acceptability of teleological explanations were not correlated with a tendency to invoke processes such as intentional design or natural selection (cf. Kelemen & DiYanni, 2005). In particular, Alzheimer's patients generally accepted teleological explanations whether or not they explained the corresponding items by appeal to design or selection. This pattern confirms our initial hypothesis that the mere presence of a plausible function is sufficient for a teleological explanation to be accepted; mechanistic beliefs are required to reject a teleological explanation, but are unnecessary to accept a teleological explanation. Moreover, the finding that AD patients have a robust preference for teleological explanations without the "promiscuous theism" (Kelemen, 2004) observed in children suggests that promiscuous teleology is not a consequence of promiscuous theism.

Although our central conclusion concerns the existence and persistence of teleological tendencies, the current findings are also significant for what they indicate about the conceptual life of Alzheimer's patients. AD is best known for its devastating effects on memory, but a growing literature suggests that AD patients may be better characterized as having inferential problems at the level of intuitive theories, rather than as having indiscriminate, low-level semantic deficits (Zaitchik, Koff, Brownell, Winner, & Albert, 2004, 2006; Zaitchik & Solomon, 2007, in press). For example, many AD patients (like preschoolers) attribute life to inanimate but active objects like the sun (Zaitchik & Solomon, in press), and claim that a salient but superficial change in an animal's properties (e.g., removing a lion's mane) can change its species (Zaitchik & Solomon, 2007). In young children, such errors in folk-biological reasoning are attributed to ignorance (e.g., Carey, 1985), but AD patients seem to have a basic understanding of the biological mechanisms, such as growth and reproduction, that should constrain attributions of life and species membership. In most AD patients,

such knowledge may be present, but no longer used to properly constrain inferences. Similarly, we found that AD patients accept mechanistic explanations as often as their healthy counterparts do, but fail to spontaneously consult beliefs about causal mechanisms in determining whether to restrict the scope of teleology.

Finally, the current findings have important implications for understanding of learning and education. Recent work in folk physics (Dunbar, Fugelsand, & Stein, in press) and theory of mind (Apperly, Riggs, Simpson, Chiavarino, & Samson, 2006) suggests that the persistence of reasoning strategies observed in childhood is not uncommon. Such strategies may be masked by additional or alternative mechanisms that dominate in adulthood, only to reemerge when these secondary mechanisms are inhibited or impaired. Recognizing the developmental continuity of a preference for teleological explanation can help scientists understand public issues such as the appeal of creationism, and inform educational efforts about topics such as evolution.

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