

More Than a Blood Pump: An Experimental Enquiry of the Folk Theory of the Heart

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Abstract

The present research sought to address an intriguing yet heretofore unanswered question with the tools of experimental psychology: Do people today still subscribe to the outdated folk belief that the heart is a mental organ, governing certain, if not all, aspects of mental life—a belief we termed cardiopsychism? The results from multiple experiments provided converging evidence for the conclusion that cardiopsychism is still very much alive in the minds of modern people. Aside from demonstrating the continued presence of cardiopsychism, we explored both the antecedent and consequence of holding this misconception. Through cross-cultural comparison, we found evidence suggesting that the conventionalized heart-expressions people speak might be responsible for perpetuating cardiopsychism. In addition, our hypothetical scenario study indicated that the perseverance of cardiopsychism might be more than just an innocuous glitch but could have real-world impacts.

Keywords: folk belief; cross-cultural comparison; language; cognitive linguistics; belief perseverance

Introduction

In 1988, Claire Sylvia, a former ballerina, received the heart of a young man killed in a car accident. Following the surgery, she had the uncanny experience that the young man's psychological characteristics had transferred to her. A decade later, Ms. Sylvia published an instant best-seller titled *A Change of Heart*, chronicling her personality transformation which she believed was set into motion by the heart transplant. In book's preface, she summarized how this experience compelled her to revise her understanding of the heart (Sylvia & Novak, 1998):

All my life I have been told despite the protests of poets and murmuring of mystics, the human heart is just a pump. An incredibly important pump but only a pump... According to this view, which is the accepted one in contemporary Western medicine, the heart contains no feelings and carries no wisdom, no knowledge and no memories. ... I used to believe these things, but today I know differently (p. II).

Despite the title, Ms. Sylvia in fact received not only the heart but also the lungs from the same donor during the same operation. Yet, all the credits for the personality

transformation she supposedly had experienced somehow went to the heart.

Why did Ms. Sylvia so readily revise her theory of the heart yet refuse to entertain the possible involvement of the lung transplant in her apparent metamorphosis? Perhaps, she might have already tacitly believed that the heart, aside from functioning as a blood pump, is also the seat of the mind even prior to the surgery. In other words, her uncanny experience did not so much revise her lay theory of the heart as reinforced her old belief.

Could cardiopsychism still be alive?

In the present research, we refer to the belief that the heart is causally responsible for some, if not all, mental activities and states as *cardiopsychism*, a term coined by combining *cardio* (i.e. heart) and *psyche* (i.e. soul or mind). Cardiopsychism is a folk theory with a long pedigree. Among its earliest champions, one finds such revered names as Plato, Aristotle and Confucius. For the most part of the recorded history—both Western and Eastern—cardiopsychism of various shapes and forms were widely accepted and had greatly influenced both cultural and medical practices (Yu, 2009). The impact of one particular brand of cardiopsychism of the Western tradition, i.e. the heart is the seat of emotions and true self, is still palpable in the realms of arts and literature.

Despite its decorated past, cardiopsychism has been debunked by science since Renaissance. Medical observations and scientific research all point to the irrefutable conclusion that the brain rather than the heart is where the action is, as far as the mind is concerned. Yet, Ms. Sylvia's memoir, an unabashed endorsement of cardiopsychism, was able to resonate with the public some 15 years after its publication. A reader posted these thoughts about the book in 2013, "It does not surprise me that there is so much memory and personality in the heart ... too bad medical science is not more open to what people are telling them of their experience." This observation inspired the focal question of the present research: *To what degree have modern people outgrown the misconception of the heart as a mental organ?*

Psychological research on belief perseverance showed that people tend to hold on to erroneous beliefs even when confronted with information that contradicts or undermines the basis of those beliefs (Anderson, 2007; Winer et al., 2002). Given the prominence and prevalence of

cardiopsychism throughout the history, it would not be surprising to find that people today still conceptualize the heart according to cardiopsychism despite the mounting scientific evidence to the contrary. In fact, in 1999 a 15-year-old British girl was forcibly given a heart transplant against her will because she feared that she would lose her own unique identity (Dyer, 1999).

Note that it is possible for the same individual to believe in cardiopsychism while simultaneously acknowledging that the heart is merely a mechanical pump. According to the research on implicit cognition (Greenwald et al., 2002), it is not uncommon for people to hold conflicting beliefs concurrently. Thus, even if people today explicitly proclaim their allegiance to the scientific view, it does not necessarily mean they have wholeheartedly rejected cardiopsychism. We next examine extant research with data pertinent to the question of whether cardiopsychism is still a living belief.

Extant evidence

In an early study, Kuhn and colleagues (1987) found that 31% of the heart transplant candidates they interviewed expressed fantasies of personality change due to donor's heart. More recently, Inspector and colleagues (2003) found that about half of the heart-transplant recipients they studied expressed concerns about acquiring the donor's personality characteristics along with the heart. However, not only did both studies focused exclusively on a special population, namely transplant patients, they did not compare the heart with other internal organs; therefore it is unclear whether these patients' thoughts were specific about the heart not.

In contrast, Sanner (2001) interviewed respondents sampled from the general public and queried their thoughts about both the heart and other organs. She wrote (2001) "informants feared that they would be influenced by the donor [in terms of personality], above all if one were to receive a heart." However, her interview was unstructured and her hermeneutic approach to content analysis was susceptible to researcher's own bias and belief.

A study conducted by Hood and colleagues (2011) did provide some preliminary experimental evidence for the continued presence of cardiopsychism amongst people today. The researchers found that college students were less willing to accept a heart transplant from a murderer than from an upstanding citizen. However, it was unclear whether participants' aversion toward receiving the murderer's heart was due to the fear of acquiring the murderer's personality or the discomfort with being associated with the murderer in any manner.

Instead of questioning informants directly, some cognitive linguists sought to show that cardiopsychism is still alive by analyzing the lexicons of the languages people speak. The reason why linguistic analysis could potentially answer a psychological question is language often reflects the underlying conceptual structure of its speakers (Kövecses & Koller, 2006; Wierzbicka, 1997).

Niemeier (2003) analyzed the conventionalized heart-expressions in modern English and found these expressions

(e.g. being one's heart's desire, softhearted) are more or less rooted cardiopsychism. A parallel analysis of the heart-expressions in modern Chinese yielded similar findings (Yu, 2009). Though modern science has long rejected cardiopsychism, the linguistic expressions people speak have yet to be updated to reflect the current scientific knowledge. Instead, these expressions, at least as far as their literal meanings are concerned, continue to advocate the heart's special status as a mental organ. Both Niemeier (2003) and Yu (2009) proposed that when people grow up in the midst of these *prima facie* pro-cardiopsychism expressions, they would at least tacitly accept cardiopsychism as a valid theory of the heart.

There is little doubt that linguistic-expressions *can* reveal the living beliefs of its speakers (e.g. Winer et al., 2002). But conventionalized expressions might also just be conventions. In other words, it is possible that the corpus of heart-expressions, in both Chinese and English, might be no more than the conceptual fossils from the past, reflecting an archaic conception that no one believes in today. It seems that the jury is still out regarding the current status of cardiopsychism. Thus, we attempted to find some tentative answer to this question through controlled experiments.

Experiment 1: What do Others Believe?

In a pre-test ($n = 266$), we found that the overwhelming majority (96%) of our target population, Amazon Mechanical Turk workers (MTurkers for short), know about the scientific view that emotion and personality are the products of the brain rather than the heart. This raised the concern that even if people do believe in cardiopsychism, they might opt to give the socially desirable (i.e. scientifically correct) answer when directly asked. To circumvent this issue, we leveraged egocentrism to uncover people's true belief.

In the domain of social inference, egocentrism refers to people's tendency to anchor on what they know about their own minds when inferring the thoughts of others (see Tamir & Mitchell, 2013). Prior research had exploited egocentrism to assess people's true opinions regarding sensitive issues (e.g. racial stereotype) to which they are less likely to give honest answers (e.g. Cuddy et al., 2009).

Participants and Procedure

166 MTurkers who lived in the United States and self-reported speaking English at home completed an online study. Participants were randomly assigned to one of the three between-subject conditions (focal organ: heart vs. liver vs. bladder). Participants read two ostensible scientific statements and estimated the percentage of Americans believing in each one.

The first statement was the same across all conditions and served as the control. Specifically, participants estimated the percentage of Americans who believe that even a simple handshake can transmit HIV viruses. The second, experimental statement was different across the conditions. Specifically, participants estimated the percentage of

Americans who believe that emotions are generated *not* in the brain but in the heart (or liver or bladder)—depending on the focal organ condition participants were assigned to.

If people did believe in cardiopsychism to some degree, then their estimates for the experimental statement would be higher when the focal organ was the heart than the other two organs. In contrast, participants' estimates for the control statement should be the same across all the conditions.

Results and Discussion

A 2×3 mixed ANOVA revealed a significant two-way interaction, $F(2,161)=19.54$, $p<0.01$. For the control statement, participants in all three focal organ conditions made very similar estimates ($M_{heart} = 20\%$, $M_{liver} = 16.4\%$, $M_{bladder} = 19\%$), $F(2,162) = 0.73$, $p = 0.48$.

In contrast, participants' estimates for the experimental statement were significantly different across the conditions ($M_{heart} = 27.7\%$, $M_{liver} = 7.2\%$, $M_{bladder} = 7.6\%$), $F(2, 162) = 43.56$, $p<0.01$. The heart-condition participants reported higher estimates than those in the other two conditions, $F(1,107)=49.10$, $p<0.001$; which did not differ from each other $F(1, 109) = 0.14$, $p = 0.71$.

Assuming participants' estimates were driven by egocentrism, our finding that participants thought more people would regard the heart as the seat of emotion than other organs can be taken as evidence of their personal endorsement of cardiopsychism. However, egocentrism is not necessary for solving social inference problems (Ames, 2004), therefore participants' estimates might not be indicative of their private belief. Thus, in the next experiment we sought for less equivocal evidence with a different paradigm.

Experiment 2: Will Your Soul Be Moved?

According to Bloom (2005), most people intuitively conceptualize the self as primarily mental in nature yet occupying a spatial location. Thus, if people believe that at least part of the mind is located in the heart, then when the heart is relocated to a different spatial location, they should feel that the self is moved as well.

Participants and Procedure

126 English-speaking MTurkers who lived in the United States completed an online study. Participants' task was to indicate where they felt their Self was under different circumstances.

All participants completed 3 trials, involving 3 different circumstances. In all trials, participants first imagined an organ was removed from their body and transplanted to a person named HZ. Then they marked where they felt like their Self would be relocated on a straight line anchored on the two ends by their own body and HZ's body respectively. The left end (i.e. participant's body) of the straight line was coded as 1 and the right end (i.e. HZ's body) as 100. The body parts implicated in the three trials were the heart,

hands and lungs respectively. The order of the trials was randomly determined for each individual participant.

Results and Discussion

If participants believed in cardiopsychism, then they would the Self farther away from their own body when their heart was transplanted into HZ's body than either the hands or lungs. A within-subject ANOVA on the location of the Self confirmed this prediction, $F(3,363)=122$, $p<0.001$. Pairwise comparison revealed that participants located the Self farther away from their own body when the heart was transplanted ($M=39.4$) than either the lungs ($M=27.9$) or the hands ($M=27.1$). These results lend further credence to the claim that cardiopsychism is still a living belief.

Experiment 3: Can You Make Robots Feel?

In this experiment, we employed yet another paradigm to probe people's lay theory of the heart. In addition, we attempted to cue participants of the scientifically correct view to see if the vestige of cardiopsychism could still be uncovered under a more stringent condition.

Participants and Procedure

146 MTurkers who lived in the United States and self-reported speaking primarily English at home completed an online study. We employed a 2 (cue position: first vs. last) \times 2 (focal organ: heart vs. lung) mixed design where the cue-position was the between-subject factor. All participants first read the same passage inspired by the movie Robocop. Briefly, participants were told that many people feel queasy about having robots replace human beings as the police out of the concern that robots do not understand human values and cannot feel human emotions. Then participants were presented with the following hypothetical scenario:

At least in theory, one way to enable emotion and conscience in robots is to create cyborgs by replacing some human parts with machine while preserving other human parts. Next, you will be presented with several human parts one by one. For each human part, please rate, on the basis of your intuition, the degree to which it must be *preserved* to prevent any noticeable negative impact on the capacity of the cyborgs for emotion and conscience.

Participants then judged one by one how indispensable each of the three focal organs—namely, the brain, the heart and the lungs—is on a 1-to-10 scale. Participants assigned to cue-first condition judged the brain's indispensability first; while those assigned to cue-last condition judged the brain last. The order in which they judged the heart and lungs was randomized. Note that the indispensability rating for the brain was not reported because the brain was included only to remind participants of the mind's real physical substrate.

Results and Discussion

If participants believed in cardiopsychism, they would regard the heart as more indispensable than the lungs for preserving the cyborgs' capacity for feeling and values. This is indeed what we found. A 2 (cue position: first vs. last) \times 2 (focal organ: heart vs. lungs) mixed ANOVA on the indispensability ratings reveal only a significant main effect of organ type, $F(1,73)=62.53$, $p<0.01$. The heart was deemed *more* indispensable than the lungs regardless of whether participants were reminded of the brain's status as the true physical substrate of the mind or not (Figure 1).

The first three experiments together provided converging evidence for the continued presence of cardiopsychism in people's mind today. We next turned the attention to ascertaining why cardiopsychism was able to persevere despite long being refuted by science.

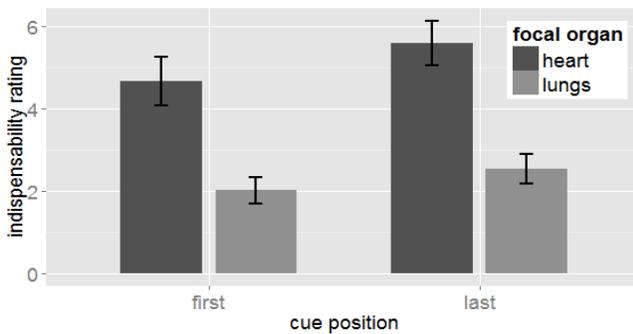


Figure 1: Mean ratings of different conditions.

Experiment 4: How does the Chinese Heart Differ from its English Counterpart?

As alluded to earlier, the conventionalized heart-expressions in modern Chinese and English are mostly rooted in cardiopsychism (Niemeier, 2003; Yu, 2009). That is, the literal meanings of these expressions are tantamount to messages advocating the mental capacities of the heart. Thus, people living in these linguistic communities are surrounded by *prima facie* endorsements of cardiopsychism. This creates an ideal milieu for cardiopsychism to insidiously implant itself firmly in people's belief system. As research on the illusory truth effect has shown, simply exposing people to a claim could increase the perceived truth of this claim (e.g. Hawkins & Hoch, 1992). This is the case even when the claim was explicitly flagged as false initially (e.g. Skurnik, Yoon, Park, & Schwarz, 2005).

If the linguistic input did contribute to the perpetuation of cardiopsychism, then the specifics of the cardiopsychism should differ between two linguistic communities whose heart-expressions imply different folk models of the heart. According to lexical analysis by Yu (2009) and Niemeier (2003), the folk model implied by modern Chinese heart-expressions ascribes to the heart both cognitive and affective functions; whereas its English counterpart considers the heart as governing primarily emotion but not cognition. Thus, we could test if linguistic input contribute

to the perseverance of cardiopsychism by verifying whether the difference between the functions the Chinese and the English speakers believe the heart can perform paralleled the differences between the folk models implied by the their respective heart-expressions.

Participants and Procedure

The native English speakers were 122 MTurkers who lived in the United States and self-reported speaking primarily English at home. The native Chinese speakers were 125 native Chinese speakers recruited from the Chinese online survey platform, Sojump, which served as the data source for several recent cross-cultural psychology studies (e.g. Kreuzbauer et al., 2014). All participants were told that they would first learn about some new information and then make some intuitive judgment in light of the newly acquired information. Participants from both cultures were randomly assigned to one of the four conditions of a 2 (information topic: heart vs. lungs) \times 2 (judgment topic: emotion vs. cognition) between-subject design.

Participants first learned that a recently discovered chemical is effective at treating viral and bacterial infection of the heart (or lungs)—depending on the information-topic condition. Then participants in the judgment-on-emotion condition rated how possible it is to use this chemical to treat emotional disorders, such as depression, anxiety and irritability; whereas those in the judgment-on-cognition condition rated how possible it is to use this chemical to treat cognitive disorders, such as memory loss and low attention span. The possibility rating was always made on a -4 (absolutely impossible) to $+4$ (absolutely possible) scale.

Results and Discussion

To facilitate interpretation, we analyzed data for the two judgment-topic conditions separately.

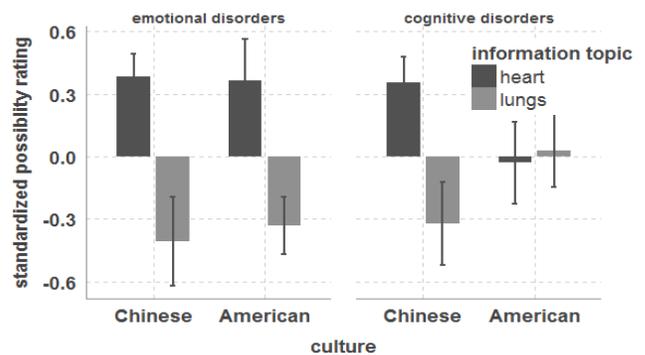


Figure 3: Possibility ratings for different conditions.

Judgment concerning emotional disorders. After standardizing the possibility ratings within each culture, we ran a 2 (culture: American vs. Chinese) \times 2 (information topic: heart vs. lungs) ANOVA. Only a main effect of information topic emerged, $F(1, 121)=19.84$, $p<0.001$. When judging the possibility of using the chemical to treat emotional disorders, both Chinese and English gave higher

ratings when the chemical supposedly can treat cardiac infection than pulmonary infection (Figure 3 left panel).

Judgment concerning cognitive disorders. A similar 2×2 ANOVA on the standardized possibility ratings revealed a significant two-way interaction, $F(1,118)=4.33$, $p=0.04$. When judging the possibility of using the chemical to treat cognitive disorders, Chinese speakers gave higher ratings when the chemical supposedly can treat cardiac infection than pulmonary infection; whereas English speakers were indifferent (Figure 3 right panel).

This experiment showed that the cardiopsychistic belief of Chinese speakers seemed to differ from that of English speakers in a manner as foreshadowed by lexical analysis. Specifically, though both Chinese and English speakers regarded the heart as a feeling organ, only Chinese regarded the heart as a thinking organ. Therefore, the results of the present experiment were consistent with the hypothesis that linguistic input might have played a causal role in perpetuating cardiopsychism. In the next experiment, we examined whether believing in cardiopsychism may have some real-world consequences.

Experiment 5: Would You Accept a Pig Heart?

The shortage of donated organs has prompted scientific investigation into the possibility of xenotransplantation, i.e. transplanting non-human, usually pig, organs to humans (McLean & Williamson, 2005). A question with policy implication is whether cardiopsychism may lead to stronger resistance toward xenotransplantation of the heart than other organs. We addressed this question in the present study.

Participants and Procedure

136 English-speaking MTurkers living in the United States completed an online study. Participants were assigned to one of the four conditions of 2 (prime type: scientific-thinking vs. control) \times 2 (focal organ: heart vs. liver) design.

Participants first read a short passage that differed across the prime-type conditions. Participants in the scientific-thinking-prime condition read a stern criticism of the decline of scientific thinking among Americans. This passage was intended to convey disapproval of unscientific thinking so that participants might attempt to give scientifically-sanctioned answers to relevant questions. In contrast, participants in the control-prime condition read a neutral description of the increase in support for capital punishment among Americans. After the prime passage, participants were asked to rate the degree to which they thought the social trend described in the passage was a bad or good thing. They made their ratings on a -4 (extremely bad) to $+4$ (extremely good) scale.

Afterwards, participants completed a seemingly unrelated task, where they were asked to imagine that in some distant future the technology for xenotransplantation of pig organs is well established and they happen to need a XXX transplant. XXX was replaced by either the heart or liver depending on the focal organ condition. Participants further learned that they could choose between a human XXX or a pig one; but

since the human organs are scarcer, they would need to pay a premium if they prefer the human XXX. Then participants answered this question: "I would choose the human XXX as long as its cost is NO MORE than ? % of the cost of the pig XXX." Participants' answers to this question constituted the critical dependent variable. A response larger than 100% would suggest that the participant placed a premium on human transplants. In addition, higher premium were evidence for stronger resistance to xenotransplants.

Results and Discussion

We first analyzed participants' attitude toward the social trend described in the prime passage with a 2×2 ANOVA. Only the main effect of the prime-type was significant, $F(1,133)=35.02$, $p<0.001$. While participants were largely indifferent toward the increase in support for capital punishment ($M = -0.25$); they clearly considered the decrease in scientific thinking a bad thing ($M = -2.39$). These results suggested that the scientific-thinking-prime passage successfully conveyed a sense of disapproval toward unscientific thinking.

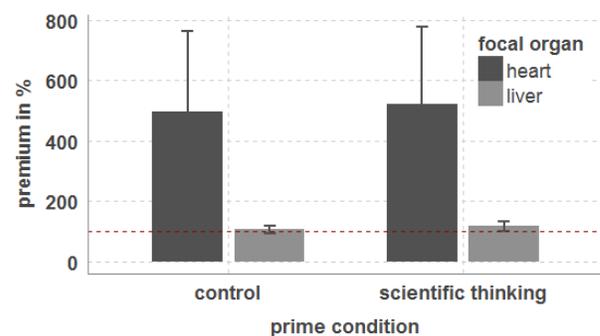


Figure 4: Premium for transplants of human origin.

To analyze the critically dependent variable, we applied square-root transformation to correct for the skewness before conducting a 2×2 ANOVA on the transformed responses. Only the main effect of focal organ was significant $F(1,133)=7.48$, $p=0.007$. As shown in Figure 4 with the untransformed response, participants were barely willing to pay any premium for the human transplant when the liver was concerned. Yet, when the heart was concerned, participants were willing to pay a large premium for the human transplants. These results suggest that people were more resistance toward xenotransplant when the heart is at stake. Moreover, this prejudice against the pig heart was not attenuated even when people were prompted to think scientifically.

Summary and General Discussion

The question that motivated the present research was: Is the outdated misconception of the heart as a mental organ (i.e. cardiopsychism) still a living belief in people's minds? With an assortment of varied paradigms, we gathered converging evidence for a positive answer to this question.

At this juncture, it would be remiss not to compare cardiopsychism with another folk theory of human psychology, i.e. psychological essentialism (essentialism for short). Essentialism is the belief that some invisible internal essence determines a person's psychological characteristics and behaviors (Gelman, 2003). Moreover, according to essentialism, this hidden essence can be passed onto others via different kinds of physical contacts including transplant. It is clear that people believing in essentialism should also consider the heart to be causally responsible for certain mental properties on the merits of the essences it contains. Thus, it could be argued that cardiopsychism might just be special manifestation of essentialism.

Essentialism entails that the essence permeates throughout the body but does not specify on how exactly the essence is distributed. Thus, although essentialism implies that the transfer of any body part from one individual to another should cause the recipient to take on some of the donor's characteristics (Meyer et al., 2013), it is mute on whether one part is would be more effective at transmitting essence than the other. Therefore, essentialism alone would not predict heart-favoritism, i.e. people would impute more mental power to the heart than any other organs of similar size. However, it is still possible that essentialism is the precondition for cardiopsychism.

Having established the perseverance of cardiopsychism, we took a first step toward understanding why this outdated belief was able to survive refutations from the scientific community. Via cultural comparison, we found that though both native Chinese and English speakers believe in cardiopsychism; they differ in what mental functions they tacitly believe the heart can perform. Moreover, this difference corresponds to the difference revealed by contrasting the literal meanings of the heart-expressions of the two languages. Thus, the exposure to conventionalized heart-expressions that are yet to catch up with the modern science seems responsible, at least partially, for perpetuating cardiopsychism. Nonetheless, due to the correlational nature of cross-cultural approach, further studies are needed to further investigate what help preserve cardiopsychism.

In the present research, we found evidence consistent with the notion that cardiopsychism might pose a particular obstacle to the acceptance of xenotransplant of the heart. Future studies can also explore how cardiopsychism might be harnessed to achieve greater social good.

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