Charitable estate planning as visualized autobiography:

An fMRI study of neural correlates

Russell N. James III[i]

Paper prepared for presentation at the Erasmus Centre for Strategic Philanthropy

Erasmus University Rotterdam, the Netherlands

April 2, 2012

Abstract

This first ever functional magnetic resonance imaging (fMRI) analysis of charitable bequest decision-making found increased activation in the precuneus and lingual gyrus of the brain compared to charitable giving and volunteering decisions. Greater lingual gyrus activation was also associated with increased propensity to make a charitable bequest. Previous studies have shown that activation of these brain regions is related to taking an outside perspective of one's self, recalling the recent death of a loved one, and recalling vivid autobiographical memories across one's life. We propose that bequest decision-making is analogous to visualizing the final chapter in one's autobiography and that fundraisers may do well to emphasize donors' autobiographical connections with the charity. Due to inherent mortality salience, people may resist creating this final chapter, but once engaged may seek to leave an enduring legacy.

[i] Author information: Russell N. James III, Associate Professor & Director of Graduate Studies in Charitable Planning, Texas Tech University, Department of Personal Financial Planning, Lubbock, TX 79409, email: russell.james@ttu.edu.

Charitable estate planning as visualized autobiography: An fMRI study of neural correlates

Introduction

In 2010, charitable estate gifts exceeded $22 billion, far surpassing the total of all corporate charitable giving which totaled about $15 billion (Giving USA, 2011). Over the previous 20 years charitable bequests have more than doubled in real dollar terms (Giving USA, 2011). Demographic trends point to substantial additional growth of charitable estate giving in the coming years. Such growth is based not only on the aging of the population as a whole, but also upon the increasing propensity to make charitable bequests, largely driven by higher levels of education and childlessness (James, Lauderdale, & Robb, 2009). Thus, charitable bequest giving is a large and growing part of total philanthropic dollars in the United States.

Despite the substantial and growing size of charitable estate planning, there is ample evidence of far greater philanthropic potential. Depending upon the survey instrument used, an estimated 70% to 80% of Americans engage in charitable giving each year (Giving USA, 2011). Conversely, only about 5% of Americans have a charitable estate plan (James, 2009a). This tremendous gap suggests the possibility of fundamentally different decision-making processes involved in the two types of charitable activity. A better understanding of the nature of these cognitive differences may suggest reasons for the behavioral gap. The identification of such cognitive differences could then facilitate the development of potential advising and fundraising strategies sensitive to these differences. Using functional magnetic resonance imaging (fMRI), we explore the differences in neural activation between contemplating bequest giving decisions and either or both charitable giving and volunteering decisions. Because the present study pioneers into neural correlates of charitable estate planning, we have only tentative hypotheses about specific activation patterns. We generally expect to see increased activation in areas involved in death-related contemplation, and perhaps a shift away from areas engaged in first person action concepts (as in personally giving or volunteering) to a more neutral contemplation of outcomes in which one is not the first-person actor (as when one's executor distributes assets).

Literature Review

No previous research has examined the neural correlates of bequest-related charitable decision making or any form of bequest-related decision making. However, previous neuroscience research has investigated the related area of current charitable giving. The first fMRI study on charitable giving was conducted by Moll, et al. (2006). They found that giving to charitable organizations engaged mesolimbic reward systems in the same way as when subjects received monetary rewards. Further, the decision to donate or not was specifically mediated by activation in areas (medial orbitofrontal-subgenual and lateral orbitofrontal) which play key roles in social attachment and aversion (Moll, et al, 2006).

Harbaugh, Mayr, and Burghart (2007) similarly found that charitable giving elicited neural activity in reward processing areas including the ventral striatum. Additionally, they found that forced transfers, analogous to taxation, to charities also activated these reward processing areas. However, there may be some question about the conclusion regarding forced transfers as the areas described are also activated by any salient activity, including those with negative valences (Jensen, et al., 2003).

Izuma, Saito, and Sadato (2009) added the variable of perceived observation. Subjects made charitable choices both in the visible absence and presence of observers. The presence of observers increased the propensity to make charitable gifts. Accordingly, activation in the ventral striatum was greater before a decision to donate when observers were present as compared to when they were absent. Activation was greater before a decision to keep funds (not donate) when observers were absent as compared to when observers were present. These suggest an incorporation of perceived social costs and benefits into the reward processing decision making as reflected by ventral striatum activation.

Hare, et al. (2010), found that the subjective value of making a charitable donation was associated with activation in the ventral medial prefrontal cortex. Further, functional connectivity analysis suggested that this value calculation may have been driven by input from regions involved in social cognition, specifically the anterior insula and posterior superior temporal cortex.

Methods

Sixteen adult male subjects participated in this experiment. All subjects were right handed, healthy, and had normal to corrected vision. Prior to entering the scanner, subjects reviewed information including the definitions of terms used in the questions (such as a "bequest"), along with the names and a one sentence description of each charitable organization referenced in the experiment.

After entering the scanner, subjects rested for about 7 minutes while anatomical and radiological images were taken. Subjects had right and left response buttons for each hand, for a total of four response buttons. Prior to the first set of functional scans, subjects practiced reading instructions on the screen and pressing designated response buttons to verify their ability to read and respond appropriately. There were three types of charitable questions:

1. "If asked in the next 3 months, what is the likelihood you might GIVE money to ______"
2. "If asked in the next 3 months, what is the likelihood you might VOLUNTEER time to ____"
3. "If you signed a will in the next 3 months, what is the likelihood you might leave a BEQUEST gift to _____"

Questions about projected future giving and volunteering were used in order to create a scenario where bequest giving decision projections were equivalent to giving decisions. There is no realistic way to enforce a commitment to make a bequest in the scanner, as there is with current charitable giving where gifts can be deducted immediately from subject payments. In order to make the decision scenarios roughly similar, all questions refer to the probability of future activity within the next three months under a condition requiring an actual decision (either being asked or signing a will).

Charitable questions were written at the top of the screen. The bottom of the screen displayed the four options of “None”, “Unlikely”, “Somewhat Likely”, and “Highly Likely”, spaced to match the relative locations of the four response buttons. “None” was selected with the left button of the left hand, “Unlikely” with the right button of the left hand, “Somewhat Likely” with the left button of the right hand, and “Highly Likely” with the right button of the right hand.

Charitable questions were rotated in 16-second blocks, with the first 9 seconds displaying the first of the particular type of question (give, volunteer, or bequest) and the last 7 seconds displaying the second of the same type of question. Recipient pairs were presented in groups of three sets (including a bequest set, a giving set, and a volunteering set) with the same two recipients listed in each set. The sequence of question types was rotated to evenly balance whether the giving or bequest question set appeared first within each recipient pairing (bequest-give-volunteer followed by give-bequest-volunteer). In total 96 charitable questions were asked, 32 of each type, using 28 large charitable organizations and 4 family member recipient categories.[i]

The functional imaging was conducted using a Siemens 3.0 Tesla Skyra to acquire gradient echo T2*-weighted echoplaner images (EPI) with blood oxygenation level-dependent (BOLD) contrast. Functional data was collected in a single 13.3 minute session consisting of 265 whole brain images, with the first 5 images taken during an unrelated finger tapping task used as a marker for preprocessing and lateralization. Each volume comprised 45 axial slices collected in a descending manner. The imaging parameters were as follows, echo time: 21 ms; field of view: 282 mm; flip angle: 80˚; in-plane resolution and slice thickness: 3 mm; repetition time: 3 seconds. Whole brain high-resolution structural scans (1 X 1 X 1 mm) were acquired from all subjects and coregistered with their mean EPI images.

Image analysis was conducted using SPM8 (Wellcome Department of Imaging Neuroscience, Institute of Neurology, London, UK). Images were motion corrected with realignment to the first volume, adjusted for beta-zero magnetic field inhomogeneities, spatially normalized to standard

Montreal Neurological Institute (MNI) Echo-Planar Imaging (EPI) template, and spatially smoothed using a Guassian kernel with a full-width-at-half-maximum of 8 mm. High pass temporal filtering (using a filter width of 128 seconds) was also applied to the data.

The contrasts presented results from application of a general linear model (GLM) in three steps. First, a GLM was estimated for each individual with first order autoregression using the three regressors of giving questions, volunteering questions, and bequest questions, where each regressor was based on the entire 16-second block during which the relevant question type was visible on the screen. Second, first-level single-subject contrasts were calculated for bequest trials minus giving trials and the converse, bequest trails minus volunteering trials and the converse, and bequest trials minus the combination of both giving and volunteering trials and the converse. Third, second-level group contrasts were calculated using a one-sample t-test on the single-subject contrasts.

Separately, a linear parametric modulation analysis was conducted using the subject responses coded as 1 for “None”, 2 for “Unlikely”, 3 for “Somewhat Likely”, and 4 for “Highly Likely”. In this analysis, the regressors for giving, volunteering and bequest questions were not based upon the entire 16-second blocks, but rather the time from each individual question presentation to subject response. A division was necessary for this analysis because each 16-second block included two of the same type of question, and each question had its own separate subject response. Segments for which the subject made no response were excluded from the analysis. An exception to this rule was made if a response was recorded within ½ second of the end of the presentation of the question followed by another response to the subsequent question. In this case, the first response was attributed to the previous question and the time to response was recorded as the time during which the previous question was displayed.

Anatomical localizations were identified by overlaying the t-maps on a normalized structural image averaged across subjects. Activation areas were labeled with the most probable gray matter location for coordinates of the highest peak level within the cluster.

Results

Behavioral

[Insert Table 1 about here]

Converting the projected likelihood of making a charitable bequest into numbers as 1 for "None", 2 for "Unlikely", 3 for "Somewhat Likely", and 4 for "Highly Likely" resulted in an average of 2.09 for bequest questions, 2.22 for giving questions, and 2.42 for volunteering questions. Only 27.9% of all bequest responses were in the "Somewhat Likely" or "Highly Likely" categories, as contrasted with 39.5% of all giving responses, and 45.7% of all volunteering responses. The response time to answer the bequest questions was also greater, overall, than for the other types of questions. However, the speed of response in the volunteering questions is likely reduced due to their position as the last questions in each sequence for each recipient pair.

fMRI

[Insert Table 2 about here]

[Insert Figure 1 about here]

Table 2 reports areas of differential activation with charitable bequest blocks as contrasted with charitable giving blocks, volunteering blocks, and charitable giving and volunteering blocks combined. Only areas significant in either the peak-level or cluster-level at $p<.05$ after correction for family-wise error (FWE) are reported. The first three contrasts reflect areas of greater activation during the charitable bequest condition. These results consistently show lingual gyrus and precuneus activation in contrasts with giving, volunteering, and giving and volunteering combined. The only additional result to pass the p<.05 FWE threshold was a primary motor cortex (precentral gyrus) activation in the volunteering contrast. This primary motor cortex difference is likely due to differences in button pushes[ii] between the two conditions (Yousry, et al., 1997; Cramer, et al., 1999) and is not of interest for the present analysis.

In the converse analysis, the cuneus displayed consistently greater activation for either or both charitable giving and volunteering questions compared with bequest questions. The sole remaining difference was a greater activation in the insula with volunteering questions that was significant at the cluster-level, but not peak-level. Figure 1 displays the location of the significant differential activations comparing bequest decisions with the combination of both giving and volunteering decisions.

[Insert Table 3 about here]

Where the contrasts in Table 2 sought to discover neurological differences between charitable bequest decisions and other types of charitable decisions, Table 3 reports activations associated with a higher or lower predicted likelihood of making a charitable bequest. Once again, we set aside from consideration the lateralized results from the precentral and post-central gyrus as likely reflecting the association between physical button pushes and agreement level. This results in only two areas of interest with significant activation. Lingual gyrus activation was associated with higher projected likelihood of making a charitable bequest. Conversely, insula activation was associated with lower projected likelihood of making a charitable bequest.

Discussion

Two areas showed greater activation (p<.05 FWE) during charitable bequest decision-making as compared with charitable giving or volunteering: the precuneus and lingual gyrus. Additionally, the lingual gyrus was the only area, other than that related to the button pressing itself, where increased activation was significantly associated (p<.05 FWE) with increased projected likelihood of making a charitable bequest.

Taking an outside perspective on one's self

The precuneus appears to be differentially involved in taking the viewpoint of observing one's self from an outside perspective (Vogeley & Fink, 2003) and has been referred to as the 'mind's eye' (Fletcher, et al., 1995). Kjaer, et al., (2002) found greater precuneus activation when subjects described their own physical characteristics and personality traits as compared to describing the physical characteristics and personality traits of another person. Lou, et al. (2004) compared changes when recalling judgments of psychological traits of one's self, one's best friend, and a neutral reference person. Precuneus activation was greatest when referencing one's self, moderate when referencing one's best friend, and lowest when referencing a neutral reference person. Correspondingly, transcranial magnetic stimulation disrupting normal neural circuitry in this area slowed the ability to recall judgments about one's self significantly more than the ability to recall judgments about others. Summarizing a wide range of such studies, D'Argembeau, et al. (2007, p. 935), wrote, "The neural correlates of self-referential processing most consistently observed across these studies are located in the medial prefrontal cortex and in medial posterior regions (in the posterior cingulate cortex or the precuneus)"

D'Argembeau, et al. (2007) compared first person perspective with third person perspective judgment by contrasting subjects' own opinions about self and another person with subjects' projections about the other person's opinions about self and the other person. The most significant area of activation associated with third person perspective as contrasted with first person perspective was the lingual gyrus. (The precuneus was the fourth most significantly associated region). The lingual gyrus has commonly been associated with taking a third person perspective. Even in simple motor tasks, creating a third person as contrasted with a first person perspective generates significantly greater activation in the lingual gyrus (Hesse, Sparing, & Fink, 2009; Jackson, Meltzoff, & Decety, 2006]

The suggestion that taking a third person perspective is inherent in a bequest task makes sense considering the timing of the transfer, i.e., after death. It is easy to imagine personally giving a current charitable gift or volunteering time to a cause. However, imagining a bequest transfer is different as, at the time of transfer, the actor is deceased. If requests for bequest giving invoke images of one's status of being deceased (i.e., death saliency), it is easy to see how such contemplation would involve observing one's self (perhaps one's deceased self) from an outside perspective.

Death and grief

There have been relatively few fMRI studies on the topic of death-related emotion.[iii] Gündel, O'Connor, Littrell, Fort and Lane (2003) worked with subjects who had lost a first-degree relative in the previous year. Participants were interviewed about the death, the cause of death, and the memorial service for the deceased. From this interview, 15 grief-related words with an autobiographical connection to the death of the loved one (such as "collapse," "funeral," or "loss") were contrasted with neutral words, both with and without a background picture of the deceased. The only region showing significant activation (at p<.05, corrected) in response to grief-related words (as contrasted with neutral words) was the precuneus. This may be particularly relevant for our study, as the bequest questions subjects were presented only as text. The precuneus did not differentially activate for the picture of the deceased, however one of only two significant (at p<.05, corrected) activation areas was the lingual gyrus.[iv]

O'conner, et al (2008), followed a similar protocol, but reported results only for specific pain and reward regions related to a specialized diagnosis of "complicated grief," and thus excluded our regions of interest. No other fMRI studies have been conducted on grief from the loss of a human loved one (O'Conner, Gündel, McRae, & Lane (2007) re-analyzed the same fMRI data as in Gündel, et al. (2003) but for different purposes). However, Freed, et al. (2009) examined grief caused by the loss of a pet. Twenty subjects who had lost a pet dog or cat within the previous 3 months were presented with words previously identified to remind them of their deceased pet. Of the twelve areas showing significant activity in response to the deceased reminder words, four were located in the precuneus.

Autobiographical memories

Reminders of a recently deceased loved one activated the precuneus for words (Gündel, et al., 2003; Freed et al, 2009) and the lingual gyrus for images (Gündel, et al., 2003). These two areas were also prominent in a study of autobiographical family memories in Gilboa, Winocur, Grady, Hevenor, and Moscovitch (2004). Participants (average age of 51) were presented with photographs from across their life, corresponding with ages 5-11, 11-20, 20-30, 30-40, and after 40. The photographs were selected by family confederates without the participant's involvement. Each photograph depicted some event (not simply portraits) and included the participant. Precuneus and lingual gyrus activation occurred when the subjects were able to vividly recall and relive the event in the picture, but not where the scenes were only vaguely familiar. The authors explained, "retrieving detailed vivid autobiographical experiences, as opposed to personal semantic information, is a crucial mediating feature that determines the involvement of hippocampus and two posterior neocortical regions, precuneus and lingual gyrus, in remote autobiographical memory." (Gilboa, et al., 2004, p. 1221)

In a similar study with subjects 60 to 70 years of age, Viard, et al. (2007) had subject family members identify vivid events that had occurred during the ages of 0-17, 18-30, 31-previous five years, previous five years-previous year, and previous year. During the experiment, subjects were presented with text reminders of each event and asked to mentally relive personal episodes … by "traveling back in time", and remembering as much detail as possible" (Viard, et al., 2007, p. 2455). Regardless of the recency of the event, such reliving differentially activated the precuneus and lingual gyrus. Of the six regions showing significant activation, two were located in the precuneus and two in the lingual gyrus. In Denkova (2006), three of the four most statistically significant regions associated with recalling autobiographical personal events were in the lingual gyrus and precuneus areas.

In a study of autobiographical memory with Alzheimer's patients and non-impaired controls, Meulenbroek, et al. (2010), had participants answer true-false statements about their most salient lifetime events gathered from a previous interview. For both Alzheimer and control groups, the most statistically significant region of activation for the autobiographical memory tasks when contrasted with generic true-false semantic questions was the precuneus. However, Alzheimer's patients showed enhanced activity in four regions including the right precuneus and left lingual gyrus as compared with control subjects.

In a study contrasting autobiographical memory with third person perspective, Rabin, Gilboa, Stuss, Mar, and Rosenbaum (2009), suggested that among other areas, the "bilateral precuneus may respond more strongly to familiar events involving the self and possibly when the self is projected across time." D'Argembau, et al. (2007) summarized, "Finally, the precuneus and the left temporal pole have also been observed to be activated in earlier perspective-taking studies (Ruby & Decety, 2001, 2003, 2004) and this has been related to imagery, autobiographical memory retrieval and semantic processing (Cabeza & Nyberg, 2000)…. Similarly, activation of the visual cortex (in the lingual gyrus) might also be related to autobiographical memory retrieval and in particular to visual imagery components, which play a key role in autobiographical memory (Greenberg & Rubin, 2003)"(p. 941).

Deactivations

The cuneus was significantly deactivated during bequest giving questions as contrasted with charitable giving and volunteering questions. This result is also consistent with the concept that bequest decision-making is unique in mandating a third person perspective. (Again, it is easy to image writing a check or volunteering at a school from a first person perspective, but post-mortem occurrences are inconsistent with first person perspective because the self is no longer an actor.) Jackson, Meltzoff, and Decety (2006) found both that the lingual gyrus was associated with third person perspective and simultaneously that the cuneus was associated with first person perspective. Two of the three areas of significantly greater activation while observing the first person perspective were located in the cuneus as were three of the seven areas of greater activation in imitating a first person perspective (Jackson, Meltzoff, & Decety, 2006). Similarly, Wurm, von Cramon and Schubotz (2011), found greater activation in the lingual gyrus for third-person perspective and simultaneously greater activation in the cuneus for first-person perspective. Others have also associated cuneus activity with first-person perspective-taking as contrasted with third-person perspective-taking (David, et al, 2006; Lorey, et al, 2009).

In the charitable bequest questions, insula activation had a negative relationship with the self-reported likelihood of making a bequest. However, insula activation was also associated with volunteering decisions as contrasted with bequest decisions. A wide range of emotional functions engage the insula, including actual and social pain, but also happiness, sadness, disgust, fear and anger (Eisenberger, Lieberman, & Williams, 2003; Rainville, 2002). Thus, it is plausible that one type of emotion is associated with rejecting the charitable bequest (perhaps social discomfort from being viewed as not generous or disgust at being asked), but that a different type of emotion is associated with insula activation for volunteering questions.

Implications

The brain areas differentially engaged for bequest decisions are also engaged for vivid autobiographical memories including death-oriented reminders of a recently deceased loved one. We suggest that these findings might inform the work of professionals in an estate planning or planned giving context in part through the consideration of two concepts: the visual autobiography and the management of death salience.

The visual autobiography

The activation of both the lingual gyrus and the precuneus indicate that the processing taking place is primarily related to internally generated imagery. The lingual gyrus in the occipital lobe is part of the visual system and damage to the lingual gyrus causes a total loss of dreaming (Bischof & Bassetti, 2004). The precuneus has been called “the mind’s eye” and is required for visual imagery of memories (Fletcher, et al, 2005).

Creating images for the mind’s eye of a desired outcome is a good approach when working with clients or donors in a variety of situations. However, in this case, knowing that the distinctive cognitive processing being used is clearly imagery-based heightens the importance of helping the client to “paint a picture” of the desired outcome. No doubt, complex planning must involve the requisite tax calculations and legal structures, but the core decision of selecting recipients appears to be one of visual imagery.

Beyond being visual, the results suggest that the bequest decision may be analogous to creating the final chapter in one’s personal autobiography (*see also* Schervish, 2006). The precuneus and lingual gyrus activation (as well as the cuneus deactivation) are consistent with the idea that subjects are taking an outside or third-person perspective looking back on themselves during bequest decision-making. The precuneus and lingual gyrus are also engaged during the recollection of vivid autobiographical memories from across the entire life span. As such, it might be useful to think of the goals in estate planning or planned giving in an autobiographical/narrative form. Estate planning clients and planned giving donors may, in a sense, be creating a story – a story that is part of one’s life story. To the extent that current plans (or lack of plans) are inconsistent with that life story, advisors and fundraisers may be able to raise sufficient cognitive dissonance to spur action. This inconsistency may come from planning (or lack of planning) that causes a divergence from, for example, a lifetime of charitable actions, or perhaps a lifetime of avoiding unnecessary taxes and expenses. Identifying potential negative results that contradict one’s desired autobiographical identity, or positive possibilities that enhance one’s desired autobiographical identity, may be key to motivating action.

The management of death salience

Bequest decision making processes differentially activated areas similar to those involved in using death-oriented words to evoke memories of a recently deceased loved one (Gündel, et al., 2003;

Freed, et al., 2009). This association is consistent with the rather obvious idea that bequest decisions involve reminders of mortality. Although such a suggestion is unlikely to produce much controversy, it can lead to practically useful implications due to the large body of research on the effects of mortality salience.

In psychology, “terror-management theory” suggests two levels of reactions or “defenses” to mortality salience (Pyszczynski, Greenberg, & Solomon, 1999). The initial defenses, labeled as proximal defenses, are focused on removing death reminders from awareness (Hirschberger, 2010). This can involve a variety of avoidance strategies such as denying one’s vulnerability, distracting oneself, avoiding self-reflective thoughts, and so forth (Pyszczynski , Greenberg, & Solomon, 1999). The “second line of defense,” called distal defenses, are characterized by attempts to achieve literal (i.e., religious) or symbolic death transcendence through support of one’s worldview or self-esteem (Hirschberger, 2010, p. 205). Symbolic death transcendence or symbolic immortality requires that some part of one’s self – one’s family, achievements, community – will continue to exist after death.

Understanding these two levels of reactions to mortality salience (avoidance and transcendence) can help to explain common issues in estate planning and planned giving. The “proximal” defense suggests that the most common initial reaction will be to avoid or postpone the topic. This matches the reality that, even among older adults, most have no will or trust (James, Lauderdale, & Robb, 2009). For fundraisers, the enemy of the planned gift often isn’t “no”; the enemy is “later”. Combatting this may involve creating deadlines, making appointments, or promoting time-limited campaigns, all in an attempt to work against the inclination to avoid the topic altogether. For example, Rosen (2011) in his book on planned gift marketing pointed to the example of a challenge gift where a donor agreed to match 10% of bequests, up to $10,000 per donor, signed prior to a deadline.

However, once problems of avoidance are overcome, the distal defenses to mortality-salience become more relevant. Symbolic immortality requires something, identified with the decedent, which will live beyond them. For most, the desire for symbolic immortality may be expressed by benefitting descendants and immediate family members who will live on beyond them. (It may also help to explain why the most significant demographic predictor of charitable estate planning is the absence of children (James, 2009a).) Among those who do leave charitable bequests, the desire for symbolic immortality is consistent with the inordinately large share of bequest dollars that go to permanent private foundations, typically bearing the deceased's name (James, 2009b). It further suggests that charitable bequest donors will be particularly interested in lasting gifts (endowments, named buildings, scholarship funds, etc.) made to stable organizations.

Limitations

This is the first study to examine bequest decision-making using fMRI techniques. The actual significance of the related activations may not be well understood until several variations and replications are conducted. Many brain regions, including the ones differentially activated in this study, are involved in a wide range of activities. As such, the activations may relate not to the proposed function, but to some other function. [v] Consequently, although the activation differences are clear, explanations of the causes behind these neurological correlates should be considered preliminary working concepts only.

Table 1: Self-reported likelihood to give, volunteer, or bequest

Category	(1) "None"	(2) "Unlikely"	(3) "Somewhat Likely"	(4) "Highly Likely"	Missing	Average Response
Bequest	30.7%	38.9%	16.6%	11.3%	2.5%	2.09
Give	30.5%	28.3%	26.8%	12.7%	1.8%	2.22
Volunteer	24.4%	29.1%	25.8%	19.9%	0.8%	2.42
Bequest Response Time	3.49	4.08	3.42	3.57		3.74
Give Response Time	3.03	4.08	3.92	3.49		3.64
Volunteer Response Time	2.69	3.73	3.45	2.52		3.18

Table 2:

Relative Activations Comparing Charitable Bequest with Giving and/or Volunteering

(reporting only p<.05 FWE corrected)

			peak-level		**cluster-level**	
Contrast	**Title**	**MNI Co-ordinates**	***p* (FWE-corr)**	**Z-score**	***p* (FWE-corr)**	k_e
(1) Bequest>Give	Lingual Gyrus	-2, -78, -2	0.004	5.44	0.000	1399
	Precuneus	26, -66, 42	0.102	4.64	0.009	313
(2) Bequest>Volunteer	Lingual Gyrus	2, -80, -4	0.007	5.32	0.000	2254
	Precuneus	30, -66, 40	0.180	4.47	0.004	356
	Precentral Gyrus	-34, -3, 36	0.397	4.19	0.001	433
(3) Bequest>(Give+Volunteer)	Lingual Gyrus	0, -78, -4	0.001	5.82	0.000	2016
	Precuneus	26, -66, 42	0.007	5.33	0.001	475
(4) Give>Bequest	Cuneus	8, -88, 20	0.157	4.51	0.003	388
(5) Volunteer>Bequest	Cuneus	8, -88, 20	0.060	4.79	0.000	1008
	Insula	-38, -20, 8	0.323	4.27	0.001	462
(6) (Give+Volunteer)>Bequest	Cuneus	6, -90, 22	0.011	5.22	0.000	1014

Height threshold T=3.73 (p<0.001 uncorrected); Extent threshold (k=0 voxels); Voxel size 2x2x2 mm; Volume 184660 voxels; Expected voxels per cluster, k =22.45 (C1); 21.982 (C2); 22.706 (C3); 22.45 (C4); 21.982 (C5); 22.706 (C6); FWHM (in mm)=14.7x14.5x11.9 (C1); 14.6x14.3x11.9 (C2); 14.8x14.5x12 (C3); 14.7x14.5x11.9 (C4); 14.6x14.3x11.9 (C5); 14.8x14.5x12 (C6)

Table 3:

Activating with Increasing and Decreasing Charitable Bequest Agreement

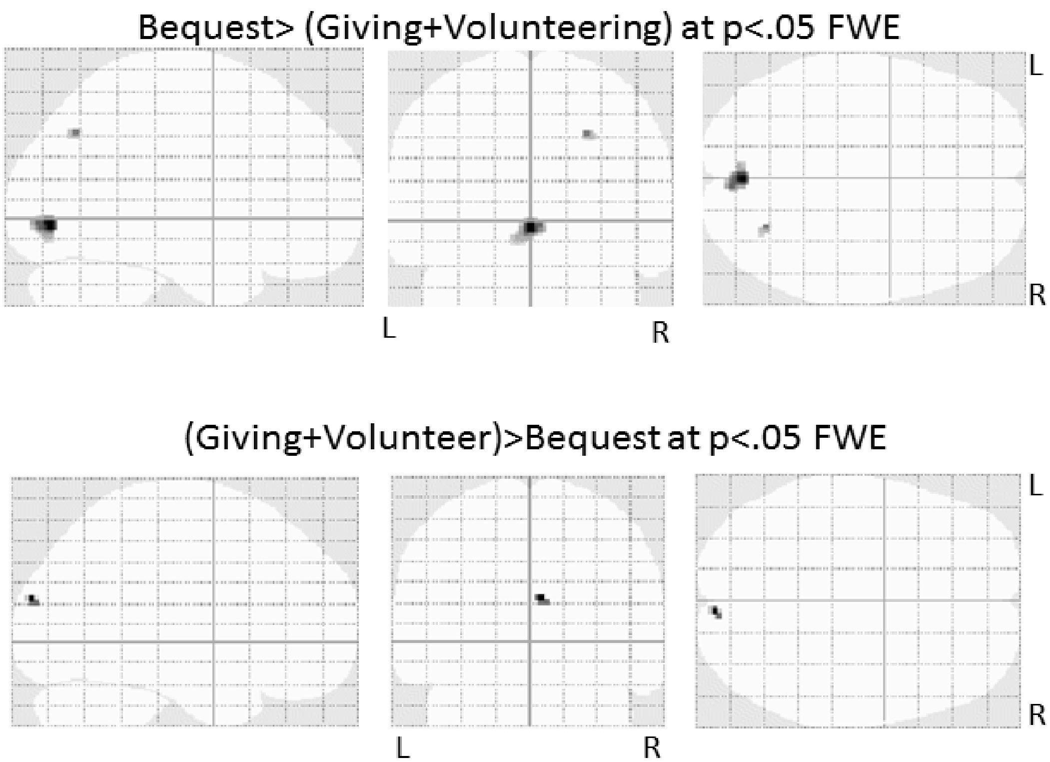
(Linear Parametric Modulation reporting only p<.05 FWE corrected)

			peak-level		**cluster-level**	
Contrast	**Title**	**MNI Co-ordinates**	***p* (FWE-corr)**	**Z-score**	***p* (FWE-corr)**	**cluster size**
(1) Increasing with agreement	Lingual Gyrus	10, -68, -4	0.004	5.46	0.000	671
	Postcentral Gyrus	-40, -22, 52	0.007	5.37	0.000	1200
(2) Increasing with disagreement	Precentral Gyrus	38, -20, 62	0.000	6.20	0.000	1387
	Insula	42, -20, 18	0.171	4.61	0.013	196

Height threshold T=3.73 (p<0.001 uncorrected); Extent threshold (k=0 voxels); Voxel size 2x2x2 mm; Volume 184660 voxels; Expected voxels per cluster, k =13.976 ; FMHM (in mm) = 12.5x12.3x10.2

Figure 1:

Brain image of differential activations in bequest v. giving and volunteering



References

Bischof, M., Bassetti, C. L. (2004). Total dream loss: a distinct neuropsychological dysfunction after bilateral PCA stroke. *Annals of Neurology*, *56*, 583-586.

Burke, B. L., Martens, A., & Faucher, E. H. (2010). Two decades of terror-management theory: A meta-analysis of mortality salience research. *Personality and Social Psychology Review, 14*(2), 155-195.

Cramer, S. C., Finklestein, S. P., Schaechter, J. D., Bush, G., & Rosen, B. R. (1999). Activation of distinct motor cortex regions during ipsilateral and contralateral finger movements. *Journal of Neurophysiology, 81*(1), 383-387.

D'Argembeau, D., Ruby, P., Collette, F., Degueldre, C., Balteau, E., Luxen, A., Maquet, P., & Salmon, E. (2007). Distinct regions of the medial prefrontal cortex are associated with self-referential processing and perspective taking. *Journal of Cognitive Neuroscience, 19*(6), 935-944.

David, N., Bewernick, B. H., Cohen, M. X., Newen, A., Lux, S., Fink, G. R., Shah, N. J., & Vogeley, K. (2006). Neural representations of self versus other: Visual-spatial perspective taking and agency in a virtual ball-tossing game. *Journal of Cognitive Neuroscience, 18*(6), 898-910.

Denkova, E. (2006). *The neural bases of autobiographical memory: How personal recollections interact with emotion and influence semantic memory* (Doctoral dissertation). Retrieved from http://en.scientificcommons.org/20960088

Eisenberger, N. I., Lieberman, M. D., Williams, K. D. (2003). Does rejection hurt? An fMRI study of social exclusion. *Science 302*(5643), 290-292.

Fletcher, P. C., Frith, C. D., Baker, S. C, Shallice, T., Frackowiak, R. S. J., & Dolan, R. J. (1995). The mind's eye - precuneus activation in memory-related imagery. *Neuroimage , 2*(3), 195-200.

Freed, P. J., Yanagihara, T. K., Hirsch, J., Mann, J. J. (2009). Neural mechanisms of grief regulation. *Biological Psychiatry, 66*(1), 33-40.

Gilboa, A., Winocur, G., Grady, C. L., Hevenor, S. J., & Moscovitch, M. (2004). Remembering our past: Functional neuroanatomy of recollection of recent and very remote personal events. *Cerebral Cortex*, *14*(11), 1214-1225.

Giving USA Foundation. (2011). *Giving USA 2011: The Annual Report on Philanthropy for the Year 2010.* Chicago: Giving USA Foundation.

Gündel, H., O'Connor, M. F., Littrell, L., Fort, C., & Lane, R. D. (2003). Functional neuroanatomy of grief: An fMRI Study. *American Journal of Psychiatry, 160*, 1946-1953.

Greenberg, D. L., & Rubin, D. C. (2003). The neuropsychology of autobiographical memory. *Cortex, 39*, 687–728. Harbaugh, W. T., Mayer, U., Burghart, D. R. (2007). Neural responses to taxation and voluntary giving reveal motives for charitable donations. *Science, 316,* 1622-1625.

Hare, T. A., Camerer, C. F., Knoepfle, D. T., O'Doherty, J. P., Rangel, A. (2010). Value computations in ventral medial prefrontal cortex during charitable decision making incorporate input from regions involved in social cognition. *The Journal of Neuroscience, 30*(2), 583-590.

Hesse, M., Sparing, R., & Fink, G. (2009). End or means--the "what" and "how" of observed intentional actions. *Journal of Cognitive Neuroscience, 21*(4), 776-790.

Hirschberger, G. (2010). Compassionate callousness: A terror management perspective on prosocial behavior. In M. Mikulincer & P. R. Shaver (Eds.), *Prosocial motives, emotions, and behaviors: The better angels of our nature* (pp.201-219), Washington, DC: American Psychological Association.

Izuma, K., Saito, D. N., and Sadato, N. (2009). Processing of the incentive for social approval in the ventral striatum during charitable donation. *Journal of Cognitive Neuroscience, 22*(4), 621-631

Jackson, P. L, Meltzoff, A. N., Decety, J. (2006). Neural circuits involved in imitation and perspective-taking. *NeuroImage, 31*(1), 429-439.

James, R. N., III., Lauderdale, M. K., & Robb, C. A. (2009). The growth of charitable estate planning among Americans nearing retirement. *Financial Services Review, 18*(2), 141-156.

James, R. N., III. (2009a). Health, wealth, and charitable estate planning: A longitudinal examination of testamentary charitable giving plans. *Nonprofit and Voluntary Sector Quarterly, 38*(6), 1026-1043.

James, R. N., III. (2009b). The myth of the coming charitable estate windfall. *The American Review of Public Administration, 39*(6), 661-674.

Jensen, J., McIntosh, A. R., Crawley, A. P., Mikulis, D. J., Remington, G., Kapur, S. (2003). Direct activation of the ventral striatum in anticipation of aversive stimuli. *Neuron, 40*(6), 1251-1257.

Kjaer, T.W., Nowak, M., Lou, H.C. (2002). Reflective self-awareness and conscious states: PET evidence for a common midline parietofrontal core. *Neuroimage, 17*, 1080-1086.

Lou, H. C., Luber, B., Crupain, M., Keenan, J. P., Nowak, M., Kjaer, T. W. (2004). Parietal cortex and representation of the mental self. *PNAS, 101*, 6827–6832.

Lorey, B., Bischoff, M., Pilgramm, S., Stark, R., Munzert, J. & Zentgraf , K. (2009). The embodied nature of motor imagery: the influence of posture and perspective. *Experimental Brain Research, 194*(2), 233-243.

Mechelli, A., Humphreys, G. W., Mayall, K., Olson, A., Price, C. J. (2000). Differential effects of word length and visual contrast in the fusiform and lingual gyri during reading. *Proceedings: Biological Sciences, 267*(1455), 1909-1913.

Moll, J., Kreuger, F., Zahn, R., Pardini, M., Oliveira-Souza, R., & Grafman, J. (2006). Human front-mesolimbic networks guide decisions about charitable donation. *PNAS*, *103*(42), 15623-15629.

Meulenbroek, O., Rijpkema, M., Kessels, R., Rikkert, M., Fernández, G. (2010). Autobiographical memory retrieval in patients with Alzheimer's disease. *NeuroImage, 53,* 331–340.

O'Connor, M. F., Gündel, H., McRae, K., & Lane, R. D. (2007). Baseline vagal tone predicts BOLD response during elicitation of grief. *Neuropsychopharmacology, 32*, 2184–2189.

Pyszczynski, T., Greenberg, J., & Solomon, S. (1999). A dual process model of defense against conscious and unconscious death-related thoughts: An extension of terror management theory. *Psychological Review, 106,* 835-845.

Quirin, M., Loktyushin, A., Arndt, J., Küstermann, E., Lo, Y., Kuhl, J. & Eggert, L. (2011). Existential neuroscience: a functional magnetic resonance imaging investigation of neural responses to reminders of one's mortality. *Social Cognitive and Affective Neuroscience.* Advance online publication. doi:10.1093/scan/nsq106

Rabin, J. S., Gilboa, A., Stuss, D. T., Mar, R. A., & Rosenbaum, R. S. (2010). Common and unique neural correlates of autobiographical memory and theory of mind. *Journal of Cognitive Neuroscience*, *22*(6), 1095-1111

Rainville, P. (2002). Brain mechanisms of pain affect and pain modulation. *Current Opinions in Neurobiology, 12*(2), 195.

Ruby, P., & Decety, J. (2001). Effect of subjective perspective taking during simulation of action: A PET investigation of agency. Nature Neuroscience, 4, 546–550.

Ruby, P., & Decety, J. (2003). What you believe versus what you think they believe: A neuroimaging study of conceptual perspective-taking. European Journal of Neuroscience, 17, 2475–2480.

Ruby, P., & Decety, J. (2004). How would you feel versus how do you think she would feel? A neuroimaging study of perspective-taking with social emotions. Journal of Cognitive Neuroscience, 16, 988–999.

Rosen, M. J., (2011). *Donor-centered planned gift marketing*. John Wiley & Sons: Hoboken, NJ.

Schervish, P. G., (2006). The moral biography of wealth: Philosophical reflections on the foundation of philanthropy. *Nonprofit and Voluntary Sector Quarterly, 35*, 477-492.

Viard, A., Piolino, P., Desgranges, B., Chételat, G., Lebreton, K., Landeau, B., Young, A., De La Sayette, V., & Eustache, F. (2007). Hippocampal activation for autobiographical memories over the entire lifetime in healthy aged subjects: An fMRI study. *Cerebral Cortex 17*(10), 2453-2467.

Vogeley, K., & Fink, G.R. (2003). Neural correlates of the first-person-perspective. [Review]. *Trends in Cognitive Science*, *7*, 38-42.

Wurm, M. F., von Cramon, D. Y. & Schubotz, R. I. (2011). Do we mind other minds when we mind other minds' actions? A functional magnetic resonance imaging study. *Human Brain Mapping, 32,* 2141-2150.

Yousry, T. A. , Schmid, U. D., Alkadhi, H., Schmidt, D. Peraud, A., Buettner, A. & Winkler, P. (1997). Localization of the motor hand area to a knob on the precentral gyrus: A new landmark. *Brain 120*, 141-157.

---

[i] The sequence of presentation was UNICEF or CARE; World Wildlife Fund; The Nature Conservancy; Ducks Unlimited; National Audubon Society; Wildlife Conservation Society; a church, synagogue, mosque, etc.; a missionary or missionary organization; a religious school (K-12); a religious college or university; a religious disaster relief organization; The YMCA; your parent or parents; your child, niece, or nephew; your brother or sister; your grandparent, aunt, or uncle; The American Cancer Society; The American Alzheimers Association; The American Heart Association; The American Diabetes Association; Komen Breast Cancer Foundation; YWCA; Boys and Girls Clubs of America; Girl Scouts or Boy Scouts; Big Brothers / Big Sisters of America; Campus Crusade for Christ; Christian Broadcasting Network; Focus on the Family. These were presented in blocks of two. The blocks rotated beginning with Bequest, then Give, then Volunteer followed by Give, then Bequest, then Volunteer throughout.

[ii] An alternate design approach would have been to randomize the location of the four responses to reduce such differences. The concern is that such randomization would introduce more unrelated cognitive complexity in the search task for the location of the appropriate response and a greater potential for response error. Although the current design does introduce uninteresting activations as a result, these are activations within relatively well known locations.

[iii] Other than those discussed here, there is only one other specifically death-related fMRI study (Quirin, et al, 2011). Here fear was intentionally elicited by asking for level of agreement with threatening statements such as "I am afraid of a painful death," "I do not mind the idea of being shut in a coffin when I die", "The pain involved in dying frightens me", etc. As expected, these questions generated activation in fear areas such as the amygdala, but nothing in the areas activated by the current study, perhaps pointing to a difference between simple mortality-salience (as might occur with bequest-related questions) and intentionally induced fear.

[iv] The other was the cuneus, which differentially *deactivated* in the present study.

[v] As with many areas of the brain, the lingual gyrus activates in a variety of different circumstances. One initial interpretation of the lingual gyrus association in Table 2 may simply be due to increased levels of semantic complexity and word length (Mechelli, et al, 2000). The bequest question included 78 characters and 21 words without the recipient name as compared with 62 characters and 16 words for the giving question. However, the additional association of lingual gyrus activation with increasing levels of agreement to the bequest question suggests some other mechanism. This parametric modulation comparison is made only among bequest questions

and these are identical except for the name of the recipient. We tested correlations between the level of agreement and the semantic complexity of the names of the recipients to see if this might explain the association. However, both the total number of characters (r= -0.06) and the average word length (r= -0.125) were negatively correlated with the level of agreement (coding response, as in the parametric modulation analysis, “None” as 1 , “Unlikely” as 2, “Somewhat Likely” as 3, and “Highly Likely” as 4), suggesting that this is not the source of the association.