



## “Lord, Teach Us to Pray”: Prayer Practice Affects Cognitive Processing

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### Abstract

A secular observer might assume that prayer practice affects those who pray by making the cognitive concepts about God more salient to their lives. Those who pray, however, often talk as if prayer practice – and in particular, kataphatic (imagination-based) prayer – changes something about their experience of their own minds. This study examined the effect of kataphatic prayer on mental imagery vividness, mental imagery use, visual attention and unusual sensory experience. Christians were randomly assigned to two groups: kataphatic prayer or Bible study. Both groups completed computerized mental imagery tasks and an interview before and after a one month period of practice. The results indicate that the prayer group experienced increased mental imagery vividness, increased use of mental imagery, increased attention to objects that were the focus of attention, and more unusual sensory experience, including unusual religious experience, although there were substantial individual differences. These findings suggest that prayer practice may be associated with changes in cognitive processing.

### Keywords

AU1 [Please provide keywords]

### Introduction

Prayer is a common and important human behavior. A 2008 Pew study interviewed a representative sample of 35 000 adults and found that nearly three out of five of them pray at least once each day (Pew, 2008). Gallup reports that three in four American adults pray daily (Gallup and Lindsay, 1999). Yet very little research has been done on the cognitive effect of prayer practice. Most of the empirical research on religion focuses on the social goods generated by the awareness of God (Shariff and Norezayan, 2007; Atran and Henrich, 2010) or on the psychological mechanisms through which an invisible agent seems

intuitively plausible (Boyer, 2003; Richert and Barrett, 2005; Epley et al., 2008). The great majority of scientific articles on the consequences of prayer address health outcome (e.g., Ai et al., 2010).

Christians, however, say that prayer changes their experience of God and that prayer changes them (Foster, 1998). Evangelical Christians, usually identified by the combination of belief in the Bible as literally or near literally true and in the importance of a personal relationship with Jesus, are particularly insistent that prayer changes a person's experience of God (Hybels, 1998; Warren, 2002). They say that to know God one must pray, and that those who pray will change because they know God differently. A skeptic might protest that these are the pious platitudes people learn to assert when they go to church, or that time spent thinking about God simply makes God more relevant. But an ethnographic study of evangelical Christianity (Luhrmann, 2010) observed that among the changes reported by congregants, they sometimes mentioned that their mental imagery grew sharper. They said that it took work to learn to pray, and that some people were naturally better than others in prayer practice. Those who prayed avidly reported more intense, unusual spiritual experiences. They sometimes reported that they had heard God speak audibly, or seen the wing of an angel. These unusual experiences differed in several respects from hallucinations reported by persons with psychosis: they were brief (rarely more than a few words), rare (congregants who reported them rarely reported more than one or two), and not distressing, although sometimes described as odd (Luhrmann, 2011). The congregants identified these unusual experiences as having sensory content, and as different in kind from ordinary thoughts, intuitions and mental images. These observations raise the possibility that there are significant cognitive consequences to prayer practice and that those changes may be relevant to what people report as the experience of God.

This question has not yet been adequately addressed, despite the empirical work on the cognitive consequences of practicing meditation. Research on meditation has shown that practice leads to improved sustained attention and to attentional stability. These results were found among expert practitioners, as the outcome of a 3-month retreat and 5 hour per day practice (Lutz et al., 2009; MacLean et al., 2010), although Tang et al. (2007) did find improvement in an attention network task with novices. Even among non-experts, meditation can decrease heart rate, lower blood pressure, alter brain activity, and improve immune function and self-regulation (Davidson et al., 2003). These results suggest that the cognitive consequences of other religious practices are worth exploring.

When most Christians talk about prayer, they are usually not referring to meditation. In the Christian tradition, meditation-like prayer is described as “apophatic,” a word based on the Greek term for “denial,” because the practitioner attempts to dis-attends to sensation and thought. Most Christian prayer is “kataphatic,” or “affirmative.” In kataphatic prayer the person praying actively constructs mental images using the inner senses. A widely used evangelical book on prayer instructs: “Seek to live the experience [of scripture]. Smell the sea. Hear the lap of the water against the shore. See the crowd. Feel the sun on your head and the hunger in your stomach. Taste the salt in the air. Touch the hem of his garment” (Foster, 198: 29–30). Many Christian churches encourage people to actively construct mental images of the scenes and events depicted in their religious text, using all their inner senses, but particularly their visual imagination. This emphasis on using mental imagery to seek and to materialize God’s presence can be found in Christian writings on prayer throughout the Christian tradition.

Why are these practices said by practitioners to be so effective? Cognitive psychologists have argued that mental imagery and perception (seeing with the mind’s eye and seeing in the world) are undergirded by the same mechanisms (Kosslyn, 1980; Farah et al., 1988; Kosslyn et al., 1993). This suggests that if one can alter the first, the second should likewise show some changes. Cognitive psychologists have argued further that interpretation affects perception. Ludwig Helmholtz claimed that the perception of the world is shaped by our knowledge of the world; he went so far as to call vision an “unconscious inference” (Gregory, 1997). As Fodor (1983) has observed, the implication is that hallucination-like phenomena should occur more frequently than would be expected on the basis of clinical reports. Indeed, psychologists increasingly suggest that hallucinations can be explained as thoughts which are experienced as perceptions (Bentall, 1999; Jones and Fernyhough, 2007). These arguments suggest a general theoretical model: that attention to the mind should affect the experience of the mind, so that increased attention to internally held mental imagery should have some effects on a range of image-related cognition: on perceptual processing, on unusual sensory experience, and on the vividness of imagery itself. They suggest that imagery rich practices may make what is imagined more real, not simply because increased attention leads to increased salience, but because the increased attention leads subjects to experience images as more “real” – more percept-like.

We ask here for the first time whether kataphatic prayer practice can influence perceptual processing, and whether the practice might also alter the subjective reporting of mental imagery and of unusual sensory phenomena.

The ethnographic reports from such practitioners suggest that this kind of prayer is effortful – they say that prayer requires training and practice – and that the effort changes them in a variety of ways, some of which are not obviously related to spiritual experience (for example, the reports of sharper mental imagery). The present study was carried out to go beyond these ethnographically collected self-reports of such practitioners. We assigned Christian volunteers to one of two groups in order to examine directly the effects of different kinds of religious practice. One group of participants was randomly assigned to engage for four weeks in the kind of active mental imagery found in the prayer practice of many Christian churches. A second group engaged in Bible study – or more specifically, lectures on the Gospels – over the same period of time. If active mental imagery practice has an effect on both imagery vividness and the reports of unusual sensory experience, as suggested by the ethnographic interviews, the first group should differ from the second group on standard measures of mental imagery and reports of unusual experience following practice. However, it is also possible that any systematic religious practice, including Bible study, could lead to increased mental imagery and religious experiences. We hypothesized that participants trained with katephatic prayer would (1) report sharper mental imagery; (2) use mental imagery more readily; (3) demonstrate improved performance on a perceptual task; and (4) report more unusual sensory experience.

### Participants

Participants were recruited through an advertisement seeking people “interested in spiritual transformation and the Christian spiritual disciplines,” primarily through notices placed in church bulletins in four gently charismatic evangelical congregations on the San Francisco peninsula. Two of these churches were Vineyard Christian Fellowships; the other two were non-denominational churches of a similar style. In these congregations, claims that one has had a direct spiritual experience of God is welcomed, but not required or presumed. Participants thus shared theological expectations about prayer and God’s presence. Of the 101 subjects in the bible study (48) and katephatic (53) conditions, 80 were female, 70 were white, and the average age was 44. While 32% had no more education than high school or an associate’s degree, 21% held postgraduate degrees. All subjects had no reported history of psychosis and no presentation of current clinical signs. All subjects were assured that their data would be anonymous. Prior to the study, 67% of subjects reported that they prayed 15 minutes or less each day.

### *Human Subjects*

This research was approved by the Institutional Review Board at Stanford University. All subjects gave informed written consent to participation. The approval is up-to-date.

### **Materials**

Participants were told that they would be randomly given one of three classic spiritual disciplines: apophatic, kataphatic, or the discipline of study. These, along with fasting, are the “inward” disciplines presented in *Celebration of Discipline*, a book read by many evangelical Christians. We described three conditions to defray the possible inference about experimental work that there is a test condition and a control condition. We wanted to make it clear to participants that lectures on the Gospels was a spiritual discipline, an interpretation we thought would be more likely if it were presented as one among three conditions. Indeed, Bible study is widely understood within evangelical circles to be a spiritual discipline. However, subjects were not recruited to the third condition for analytic purposes.

For the kataphatic prayer condition, subjects were given instructions used by an evangelical spiritual director to introduce congregants to this kind of prayer: “The core of this method is the use of the imagination to draw close to God, to enter into the scriptures and to experience them as if they were alive to you.” We provided iPods with four tracks of thirty minutes each, in which a biblical passage was read to background music, and then re-read while inviting the subject to use all the senses to participate in the scene with the imagination. There was a track based on the 23rd psalm; on the nativity; on the passion; and on the transfiguration. Here is an example of the recorded instruction from the track on the 23rd psalm: “*The Lord is my shepherd . . . see the shepherd before you . . . see his face . . . his eyes . . . the light that streams from him . . . he turns to walk, and you follow him . . . Notice his gait . . . see the hill over which he leads you . . . feel the breeze over the grass . . . smell its sweetness . . . listen to the birds as they sing . . . notice what you feel as you follow this shepherd . . .*”. In each track, participants were asked to close their eyes.

For the Bible study condition, subjects were given a section from Foster’s text extolling the spiritual benefits of intellectual study of the scripture. They were also provided with iPods which held 24 30 minute lectures on the Gospels from the Teaching Company, by Luke Timothy Johnson. (One copy was purchased for each iPod.) These lectures give an introduction to the way that the

different gospel authors chose to portray Jesus. 71% of those who listened to them reported that they liked them at least in part.

In addition, participants were given a set of cognitive tasks under computer control, and they were interviewed in depth. The computer data as collected prior to the interview data. In the return session this procedure was repeated.

## Procedure

A single researcher ran all subjects. Participants were randomly assigned to one of two conditions: prayer and study. They were asked to listen to their iPods thirty minutes a day, six days a week, for four weeks (in evangelical circles, a half hour is often presented as the ideal daily prayer time). We monitored use with the iPod playcount and by daily comment sheets. All subjects were asked to return their iPods upon finishing the month.

### *Subjective Assessment of Mental Imagery Vividness*

The Vividness of Visual Imagery Questionnaire (Marks, 1973) is a most widely used tool to measure self-reported vividness of mental imagery (Marks, 1989; McKelvie, 1995). Participants were seated in front of a computer. They heard a recorded voice which asked them to close their eyes and imagine four different scenes. In each scene, participants were instructed to imagine four scenarios sequentially. For example, in the country scene, participants were instructed to imagine the contours of the landscape; the color and shape of a tree; the color and shape of a lake; and a strong wind, blowing on the lake, causing waves. After imagining all four scenarios in each scene, subjects opened their eyes to enter a number from 1 to 5 to rate how vivid their imagery had been. The VVIQ was administered before and after the intervention. As in all computer exercises, the voice used in the task was not the voice used in the spiritual discipline.

In addition, in the post-intervention interview (administered after the computer tasks) participants were asked among other questions: “Did you find that your mental imagery seemed sharper or different in some way this month?”

### *Objective Measures of Perceptual Accuracy and Mental Imagery Use*

*Letter Detection.* Subjects were given 32 trials of successively presented simple, block-style capital letters in Courier 16 point font. Each letter was presented for 15 ms in a series of 21 letters. There was always one of three target letters presented in white: a B, G, or S. The subject was asked to report which target letter had been present in the string of letters. The computer randomly chose the remaining letters with the condition that no letter was presented twice within

a trial. The task was given both in the pre-training sessions and the post-training session.

*Geometric Shapes.* In the post-training session, participants were given a well-known imagery task. It consisted of recorded verbal instructions to create and transform six different geometric images (Finke, 1989). For example:

Imagine a 'plus'. Add a vertical line on the left side. Rotate the figure 90 degrees to the right. Now remove all lines to the left of the vertical line.

Subjects listened to the task without drawing, and then were asked to draw the figures. They were given one point for each correctly drawn shape. There were six trials.

*Paired Words.* In the post-training session, participants were presented with 20 pairs of words one pair at a time (for example, "yacht" and "umbrella"). Each pair remained on the screen for 5 s. Subjects were asked to memorize each pair. After all 20 pairs had been presented, they were shown the first word of each pair and asked to recall the second. Prior research has demonstrated that subjects are more likely to remember the second word of the pair if they are instructed to form a mental image to represent the pair (Bower 1970). We did not give specific instructions to form a mental image.

*Fade In/Fade Out.* In the post-training session subjects were presented with 20 different visual forms: ten images and ten words. For example: "church"; "green"; "Christ"; "school"; an image of cherries; an image of Jesus; an image of a cross; an image of a chair. The words and images were presented in a random order by the computer. Participants were given these instructions:

Welcome to the Fade In task. During this task, you will be shown a series of blurry images/words. These images/words will become increasingly clear so that eventually you will be able to identify what you are seeing. You will have to indicate at what point you are able to identify the image/word that is being shown.

On the following screens, you will view a series of 20 images/words shown one at a time. Once you know what the image/word is, press the spacebar. You will then see a space to enter text. Please type in the image/word that you have just seen. Finally, hit the enter key or click continue to proceed to the next picture.

Each visual form was divided into 41 forms which had been sequentially blurred by 10% increments. Each of the 41 images was shown for 500 millis before automatically switching to the next image until the participant pressed the spacebar. After all twenty forms had been shown, the participant was given the following instructions:

Welcome to the Fade Out task. This task is similar to the Fade In task you just completed. However, during this task, you will be shown a series of images/words that will become increasingly blurry so that eventually you will no longer be able to identify what you are seeing. You will have to indicate at what point you are no longer able to see the image/word that is being shown.

On the following screens, you will view a series of 20 images/words shown one at a time. Once you no longer see the image/word, press the spacebar. You will then see a transitional screen. This is just to give you a chance to rest before viewing the next image. Once you are ready to view the next image hit the spacebar or click continue to proceed.

The images were then presented in reverse order, from most clear to most blurry.

We then presented similar instructions about auditory phrases. Each participant was given two phrases. One was secular and the other religious: “I like peanut butter” and “I will always be with you.” Each phrase was mixed in Garageband with white noise to produce fifteen different versions which progressed from white noise only to phrase only in equivalent increments. Sounds were matched in amplitude overall and presented at a comfortable listening level. Each of the 15 audio files was heard for 7000 ms before automatically switching to the next audio file. All 15 audio files were shown unless Participant pressed the spacebar. In the fade in task, the phrases were presented from most fuzzy to most clear, and in the fade out task, from the most clear to the most fuzzy. When subjects pressed the spacebar in the fade in task to indicate that they had recognized the phrase, they were asked to write down the phrase they had heard in a textbox.

### *Unusual Sensory Experience*

We conducted interviews to determine the kinds of unusual experiences subjects reported prior to our intervention, and the impact of the spiritual discipline upon such phenomena. It is uncommon to ask about such experiences, but they are sometimes associated with the report of direct experience of God sought within these congregations. Unusual sensory phenomena are reported far more frequently than many people suppose (Sidgwick et al., 1894; Posey and Losch, 1983; Tien, 1991; Ohayon et al., 1996). For the most part, such experiences in the non-clinical population are quite different from those in whom criteria for psychosis are met: the former experiences are rare, brief, and not distressing (Luhrmann, 2011).

We choose to assess these experiences by interview, rather than questionnaire, because prior work has shown that subject self-report is less accurate than observer-rated assessment (Horwood et al., 2008). Both the first author and the interviewer were trained in the use of a questionnaire now used in epidemiological research designed to distinguish between perceptual experience (in which the source of the experience was experienced as being outside of the head) and non-perceptual experience (Harrison et al., 2004).

After a series of semi-structured questions exploring the subject's prayer and spiritual experience, subjects were asked:

"Some people hear a voice when they are alone – sometimes when they are falling asleep or waking up, or even when they are fully awake. Has anything like that happened to you?"

They were also asked a series of follow-up questions to determine whether an experience had been understood to be experienced as perceptual: whether the voice or sound was heard with the ears, seemed to come from outside the head, and so forth. We asked for an example, and we sought to determine a rate. We also asked them about sounds. Phenomena related to substance use were excluded. We asked similar questions about visual phenomena. These questions were repeated in the post-intervention.

## Results

### *Imagery Vividness*

VVIQ scores in the first session ranged from 16 to 80. We created a dichotomous variable to assess whether the change between sessions was positive for each subject by subtracting the score from the pre-training session from the score of the post-training session. The result was coded 0=result 0 or less; 1=result greater than 0. Significantly more subjects in the prayer condition reported positive change ( $\chi^2(1, n=101)=4.182, p=0.041$ ). Two subjects judged themselves to have fully vivid imagery in their pre-intervention scores and thus their scores could not improve. If they are excluded from the analysis, the association strengthens ( $\chi^2(1, n=99)=5.260, p=0.022$ ).

When asked directly in the post-intervention interview whether their mental imagery had seemed sharper or different in any way during the month, only 6 of 48 subjects in the study condition said that their imagery had become sharper; 38 of 53 subjects in the prayer condition said that it had ( $\chi^2(1, n=101)=35.9, p<0.001$ ).

### *Letter Detection*

Improvement in task performance between pre-training and post-training sessions was computed by subtracting the pre-training score from the post-training score. The raw data favor the prayer group, but the result is not significant (mean improvement lectures condition=0.74; mean prayer condition=1.6,  $F(1, 98)=1.609, p=0.208$ ). However, there is a ceiling effect. 56% of all subjects scored 90% or above accuracy (29 or more correct of the 32 trials). We then did an analysis which excluded participants who scored above 90% (correct identification on 29 or more of the 32 trials) on the first test. One subject scored in the bottom 10% at baseline but had a perfect score in the second session; this change was more than three standard deviations from the mean change. This subject is omitted from the analysis reported here. Among the remaining 43 subjects (21 in the study condition and 22 in the prayer condition) the mean improvement in the number of times a subject correctly identified the target letter was 1.24 in the study condition and 3.73 in the prayer condition ( $F(1, 41)=4.387, p<0.05$ ). Of the eleven subjects who showed an increase of more than 5 detections out of 32 trials, 9 were in the prayer condition.

### *Geometric Shapes and Paired Words*

For both tasks, the performance mean is higher for those in the prayer condition (geometric forms study mean=2.65 correctly drawn; prayer mean 3.11 forms correctly drawn  $F(99)=1.778, p=0.185$ ); paired words study mean 11.45 pairs correctly identified, prayer condition 12.48 pairs correctly identified). For all participants, subjects were more likely to be high performers (successfully drawing more than two thirds of the shapes (5 or more of 6) or more than three quarters of the paired words (16 or more of 20)) if they were in the prayer condition ( $F(1, 94)=3.833, p=0.05$ ).

### *Fade In/Fade Out*

There was no difference between conditions in the time it took for participants to identify visual forms (words and images) as they faded in during the post-training session (study mean=12.537 s; prayer mean=12.535 s). Both were quicker to say that they recognized the religious forms than the non-religious forms. A paired samples *t*-test was done to compare the point at which subjects said that they could identify the religious and non-religious forms in each condition. In the study condition, there was a significant difference between the identification of religious forms (mean=11.897 s, SD=1.641 s) and non-religious forms (mean=13.177 s, SD=1.105 s);  $t(44)=-8.595, p=0.000$ . In the prayer condition,

there was also a significant difference between the identification of the religious forms (mean=11.789 s, SD=1.812 s) and the non-religious forms (mean=13.283 s, SD=1.370 s);  $t(48)=-10.245, p=0.000$ ).

The differences between the two conditions become apparent when subjects identified the point at which they could no longer see the forms as they faded out (study mean=12.040 s, prayer mean=12.950 s). An ANOVA of the means finds a significant difference ( $F(1, 92)=3.911, p=0.05$ ). When seeing the religious visual forms fade away, participants in both the study condition and prayer condition took longer to say that they could no longer see them, but the mean time was significantly longer for those in the prayer condition (study mean=12.961 s, prayer mean=13.971 s) ( $F(1, 92)=4.074, p=0.046$ ).

Again, both groups said that they could see the religious forms for longer. A paired t-test was done to compare the point at which they could no longer see the forms. In the study condition, there was a significant difference between the point at which the nonreligious forms could no longer be seen (mean=11.616 s, SD=2.278 s) and the point at which the religious forms could no longer be seen (mean=13.096 s, SD=2.598 s);  $t(42)=11.4, p=0.000$ . In the prayer condition, there was also a significant difference between the point at which nonreligious forms could no longer be seen (mean=1.648 s, SD=2.396) and the point at which religious forms could no longer be seen (mean=13.146 s, SD=2.399);  $t(50)=11.9, p=0.000$ ).

Both the content of the visual forms (religious or non-religious) and the training condition (study vs. prayer) thus contributed to the length of time that participants said that they could no longer see the words and images.

With the auditory phrases in the post-training session, there was no difference between conditions in the time that it took participants to identify the phrase “I like peanut butter” (study mean=84.971 s, prayer mean=87.328 s). However, participants in the prayer conditions were faster to say that they recognized the phrase “I will always be with you” (study mean=80.263 s, prayer mean=73.567 s). The difference becomes significant when comparing the number of times the phrase was repeated before the participants pressed the spacebar (study mean=12.4 times, prayer mean 10.7 times) ( $F(1, 71)=0.555, p=0.02$ ). This may reflect some increase in perceptual acuity; among those who identified the phrase with complete accuracy, there is still a difference in the number of times the phrase played before the participant pressed the spacebar (study mean=12.3 times, prayer=10.8 times) ( $F(1, 42)=3.00, p=0.09$ ).

Those in the prayer condition were also slower, compared to those in the study condition, to say that they could no longer hear the phrase “I will always be with you” (study mean=52.237 s; prayer mean=57.013 s). They were also slower to say that they could no longer hear the phrase “I like peanut butter” (study mean

42.546 s; prayer mean 48.731 s). The difference between the average mean for these two phrases trends towards significance ( $F(1, 91)=1.915, p=0.170$ ).

### *Unusual Sensory Experience*

Before coding, each transcript was corrected to obtain word-for-word accuracy. Then transcripts were independently coded by three people blind to the discipline each subject had received. This group then met to discuss disagreements, while still remaining as a group blind to the subject condition.

Several different indicators suggest that the prayer practice increased the rate of reported unusual sensory experience. Among the 50 subjects who in the pre-training interview had reported that they had experienced neither a hallucination-like auditory nor a visual experience more than once a year on average (16 in the study condition, 34 in the prayer condition), none in the study condition reported such an experience on return; 7 in the prayer condition did ( $\chi^2(1, n=50)=3.83, p=0.05$ ).

Subject 57: “Oh yeah. Just yesterday, I thought I kept seeing a person. But you know that was like a parking meter or something like that.”

Subject 70: “I literally thought he was here . . . I saw a black thing in the house . . . I walked – I went after it.”

Subject 90: “I seem to think just once, but it was very mild.”

Subject 94: “When I was listening to the [iPod] today, it was almost bizarre. It sounded very computerized, like it was almost a very different voice, so much so that I had to turn on the lights.”

Subject 94: Like two or three times – I felt like . . . I saw something and I looked and it wasn't there.”

Subject 95: “Twice kinda in two days . . . “what did you say?” ad he goes, “I didn't say anything.” It was just like I thought he was speaking . . .”

Subject 127: “Sometimes I think I hear my cell phone ring, or I think I hear it vibrating, and it's not.”

Subject 21 reported a new memory of a previous experience: “I swear Mary said to me, “Your mother doesn't love you. . . . It was so loud and clear, and it wasn't like I was looking for that.”

We also looked at the content of the reported experience. Of our 101 subjects, on return six reported religious experiences that seemed to have perceptual content (one of these was tactile). All but one was in the prayer condition.

### Prayer subjects:

Subject 48: “I had spiritual images during the prayer time, especially the angels. The angels were real – were very real and awesome. And one time I had my eyes closed, it was dark, so I had all the lights off, and I actually, I mean it looked like, I opened my eyes, because I thought someone had walked in and turned the lights on, because it was just so bright, but it was still dark in the room.”

Subject 74: “God’s voice speaking to me... a word of encouragement... I hear God’s voice in an audible way... One time.”

Subject 86: “Just ‘be obedient. Be obedient.’... I guess I think I hear it through my ears.”

Subject 108: “I felt this warm feeling in my left hand, as if He [God] was holding it.” [Interviewer: “what was it that really made you think that it was God that was right there holding your hand?” Subject: “well, the sensation in my hand.”

Subject 123: “I hear water waves sometimes .. up against the wall. I hear that a lot, or a waterfall, and especially since I’ve heard the kataphatic.” She associated this sound of water with Psalm 23.

### Study subject:

Subject 71: “God’s voice... not to worry, that my job will be there, don’t worry.” [Interviewer: ... “Outside your head?” “Yeah.”]

## Discussion

Cognitive psychologists have proposed that mental imagery and perception operate through the overlapping neural mechanisms; they have also suggested that internal thought and imagery may be misinterpreted as perceptual experiences, resulting in unusual sensory phenomena (Grossberg, 2002; Bentall, 2003). This suggests that practices that improve imagery could well increase the rate of unusual sensory experience by making inner sensory experience – images, imagined conversations – more sensorially compelling and thus, more liable to be misinterpreted and misremembered, as a reality monitoring model might suggest (Johnson and Raye, 1981). Yet the basic argument remains controversial in the scientific literature (Pylyshyn, 2002), and no studies have shown a reported increase in unusual sensory experience associated with prayer.

This is what our data have shown. We have demonstrated that a form of prayer practice which uses mental imagery in many sensory modalities, visual

above all, increases imagery vividness and (to some extent) alters perceptual accuracy. Our data have shown that these practices lead to reports of unusual sensory experiences and to reports of unusual sensory experiences associated with the religious ideas which form the content of the practice. Moreover, these developments are related. The imagery vividness reported in a subject's pre-intervention VVIQ is related to whether that subject reports an unusual sensory vision or voice upon return. There is a significant correlation between our judgment of whether a subject reported a vision (coded 0=none, 1=maybe 2=yes) with that subject's initial VVIQ ( $r(97)=0.230$ ,  $p=0.024$ ); there is a trend for the report of a hearing a voice ( $r(99)=0.160$ ,  $p=0.114$ ). Increased visual imagery vividness does appear to increase the likelihood of unusual visual phenomena. Most of the research on mental imagery training focuses on its impact on some other skill, often sports-related (for example, Weinberg, 2008; Olsson et al., 2008). Empirical evidence that repeated use of mental images improves imagery vividness is less abundant, although a study of Tibetan Buddhist visualization practice found that the practice trained the capacity to access heightened visuospatial processing resources (Kozhevnikov et al., 2009). Our study is the first to demonstrate such visual imagery improvement with forms of Christian prayer, and the first to link this improvement with increased reports of unusual sensory phenomena.

This is an important finding because mental health researchers have recently grown aware of the frequency of reports of unusual sensory phenomena in the non-clinical population. Many of these scientists have described such phenomena as evidence of a "psychotic continuum" (Johns and van Os, 2001; van Os et al., 2008; Scott et al., 2009). The scientific claim is that these phenomena are evidence that psychosis is distributed throughout the population. A recent paper argues against the view that these phenomena are evidence of psychosis; it suggests that unusual auditory phenomena, including those experienced by persons who meet criteria for schizophrenia, are best understood as dissociative and resulting from trauma (Longden et al., 2012).

Our work suggests that there may be a different pathway for at least some of these phenomena. By demonstrating that they are reported more frequently by those who practice mental imagery cultivation, we show that there is a practice dimension – a learning dimension – to the experience which is not in itself, as a learning practice, related to trauma. This observation does not rule out the possibility that those who report such experiences may be prone to psychosis. However, by demonstrating that ordinary prayer practices make such reports more common, we suggest that not all such unusual sensory experiences should be presumed to be the sequelae to psychiatric distress.

Moreover, our work supports a theoretical model which explains how such phenomena might emerge out of ordinary cognitive process. If, as Kosslyn and Farah and their colleagues have found, imagery and perception depend on many of the same neural structures, increased attention to mental imagery should have some effects on a range of image-related cognitive processes: on perceptual processing, on the use of imagery, on unusual sensory experience, and on the vividness of imagery itself. We have that the increased attention has the consequences implied by the model, but not until now supported by experimental evidence: that the practice of intentionally attending to mental imagery increases subjective vividness, increases the use of mental imagery in problem solving, and increases the reporting of unusual sensory experience. We have shown that subjects experience themselves as sensing shapes and hearing words for longer than others. These findings suggest that paying attention to mental imagery alters the subject's awareness of such inner phenomena to the extent that that it alters the subject's decision about what the subject perceives to be real.

Mental imagery cultivation, and inner sense cultivation more generally, are found in spiritual practice not only in Christianity but in spiritual traditions around the world. Mental imagery cultivation is important in shamanism, Tibetan Buddhism, Jewish mysticism, and even Sufism (Corbin, 1969; Scholem, 1974; Beyer, 1978; Noll, 1985). The historian Mary Carruthers argues that prayer in European medieval monastic culture was primarily understood as a process of crafting thought. In this culture, she says, memory was understood not as a mirror of the past or a record of what has happened, but as a tool to make real what God desired. She quotes the fifth century monk Arnobius (1998: 135):

Paint, paint before your eyes the various fabricated things, whenever you chant of these [while reciting the verses of the psalm]. Of what sort? Those which were seen with wonder by the apostles [chiefly John]: paint the temples, paint the baths, paint the forums and the ramparts rising on the high summit.

Those “painted” pictures were meant to become part of the monks' memory and thus, their means to think and act. Ignatius Loyola reformulated the tradition as the Spiritual Exercises which have become the canonical example of kataphatic prayer. It is this tradition towards which contemporary evangelical Christianity reaches when encouraging congregants to imagine that God is present. They do not of course regard God as imaginary; as throughout this tradition, they regard the imagination as a tool humans use to conceive of the immaterial.

Why should these practices be so common in spiritual traditions? Our research suggests that the ubiquity of these practices is a consequence of their effectiveness. They appear to train the use of mental imagery and perceptual processing. They appear to increase the likelihood of the subject reporting meaningful unusual sensory experience, such as hearing God's audible voice. They enhance the ability to treat what the mind imagines as more real than the world one knows. This is crucial to the experience of God. Those who claim to know God must be able to conceive of an entity not visible in the world before them who is nevertheless the reason that the world exists. They must also learn to imagine that entity as good, because the world as it is does not always lend itself to the inference that its creator is wise and benevolent. Evolutionary psychology argues that people believe in invisible agents because our cognitive apparatus has evolved so that we over-interpret the presence of agency in events (Barrett, 2000; Boyer, 2002). This powerful argument explains the predisposition to religious belief – not the way faith is sustained. Mental imagery cultivation helps to sustain faith by enabling that which is imagined to seem more real.

Imagery cultivation also appears to enable subjects to experience God as a being who can talk back. One of the questions in our post-training interview was “Did you experience God more as a person this month?” (This is a goal for many evangelical churches. As one text remarks: “It's really important to understand that God is not an impersonal force. Even though He is invisible, God is personal and He has all the characteristics of a person. He knows, he hears, he feels and he speaks” (Bickel and Jantz, 1996: 40)). The response to this question was particularly striking because the lectures in the study condition had emphasized the ways in which two of the gospel authors, Mark and John, draw out Jesus' humanity and, in different ways, his experience of pain, anguish and real human friendship. Moreover, the insistence that one should experience God as a person (as well as a great and mighty being) is heard from the pulpits of these churches repeatedly. Yet only 17 of the 48 subjects in the study condition replied “yes” to this question, while 39 of the 53 kataphatic subjects said yes ( $p < 0.001$ ).

Prayer seeks to intensify the personal meaning of religious concepts; to make them more available, more powerful and more real. This research moves us toward a new theory to explain how prayer works. It also has a second implication. That knowledge shapes perception is the meeting point for psychology and anthropology. Responding to calls for a great integration of anthropological and psychological work (Bender et al., 2010), we suggest that psychologists and anthropologists can collaborate to understand meaning and consequences of great tracts of unexplored human behavior.

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