

MODERN AMERICAN NON-MONOGMAISTS:
SEX DIFFERENCES IN ROMANTIC JEALOUSY

By

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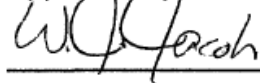
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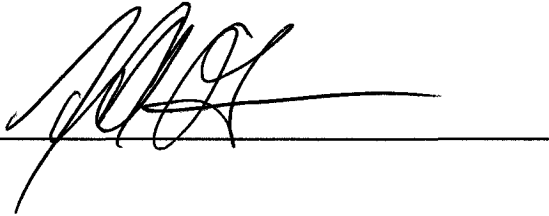


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RUNNING HEAD: MODERN AMERICAN NON-MONOGMAISTS

Modern American Non-monogamists:

Sex Differences in Romantic Jealousy

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Honors Thesis

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Abstract

Gender differences in jealousy may have evolved as part of a mating strategy that exists at the biological level. If this is a correct assumption, then jealousy-invoking stimulus sensitivities might be independent of mating-system, sexual orientation, and culture. This implies that non-monogamous men and women, like their monogamous counterparts, will differ in the types of jealousy they experience. However, if the previous results found in similar studies are an artifact of measurement, as the double-shot hypothesis predicts, we would expect to discover that the subject's responses given to questions designed to detect the double-shot effect, would regress to the mean in comparison with previous samples and in comparison to answers given to the same population that were designed after the original study.

Modern American Non-monogamists:

Sex Differences in Romantic Jealousy

Non-monogamy refers to the practice of having more than one long-term, intimate, sexual relationship with more than one person at a time. This practice, when practiced in the context of marriage, is often known as polygamy, which exists in three forms polygyny (one male having multiple wives), polyandry (one female having multiple husbands), and group marriage or polygynandry (a combination of polygyny and polyandry).

According to the *Ethnographic Atlas Codebook*, derived from George P. Murdock's *Ethnographic Atlas*, which recorded the marital composition of more than 1000 societies from 1960-1980, 186 of the societies were monogamous, occasional polygyny was more frequent than monogamy with 453 societies fitting in this category, 588 societies had more frequent polygyny, and polyandry was the least common with only 4 societies practicing it (4, 5). Even within those cultures which allow polygamy, the actual practice often occurs only rarely. To take on more than one spouse often demands substantial economic resources. For the majority of the population, this places polygamy out of reach. However, the legal practice of polygamy is not the only type of non-monogamy; some people choose to form non-monogamous romantic social bonds with more than one person at a time, even in societies where legal polygamy is not permitted.

According to the Polyamory Society the practice of polyamory is “the non-possessive, honest, responsible and ethical philosophy and practice of loving multiple people simultaneously,” with the full awareness and permission of all partners involved (Introduction to Polyamory, 2005). Polyamory is the term most often used by modern American non-monogamists

where the practice of non-monogamy is not an artifact of religious culture (i.e., some modern Mormon cultures). Polyamorists are the population that this research will attempt to study.

The proposed study tests hypothesis regarding the effects of gender and the non-monogamous practice known in America as Polyamory, on jealousy. Previous studies have concluded that women express greater concern over emotional infidelity while men express greater concern over sexual infidelity (Buss, Larsen, Western & Semmelroth, 1992).

Review of Literature

A landmark study conducted by in 1992 by Buss, Larson, Western, & Semmelroth supported the theory that jealousy response is sex-linked. This evolutionary theory of sex differences in jealousy proposes that:

jealousy is an evolved response to the fitness threats associated with the loss of exclusive access to a reproductive partner. Because sexual reproduction requires different contributions from men and women, they may experience different threats to their investments when their partners become involved with others. As a result the cues that activate jealousy may also differ for men and women (Buss et al., 1992).

Buss et al.'s results have been replicated (in at least 21 samples) cross-culturally in almost every study conducted using similar methods (Bailey et al., 1994; Buss et al., 1992; Buss et al., 1999; Buunk et al., 1996; DeSteno et al., 2002; Geary et al., 1995; Harris et al., 1996; Pietrzak et al., 2002; Shackelford et al., 2002; Voracek et al., 2001; Wiederman et al., 1993; Wiederman et al., 1999.)

Although there was considerable agreement in most studies conducted on the subject Buunk et al. (1996) found that the differences varied somewhat cross-culturally. Further divergent studies conducted by Sheets and Wolfe (2001) established that "heterosexual men

experience greater distress in reaction to a partner's sexual infidelity than do heterosexual women, lesbians, or gays." However, they go on to say that the divergence is comparative because lesbians, heterosexual women, and gays were more concerned about a partner's emotional infidelity while heterosexual men were upset by both types of infidelity equally.

Evolutionary Theory

The main theory that attempts to explain these apparent differences between men and women is evolutionary theory, which links jealousy with gender as an evolutionary adaptation evolved to solve different adaptive problems faced by the different genders.

Historically males have routinely been confronted with an adaptive problem not faced by females, the dilemma of being unsure of the parentage of their progeny. A woman's offspring could as easily be fathered by another man as it could be by the woman's partner. This can be very costly for a male who is investing resources in the child. From a woman's viewpoint, she faces an adaptive problem that males generally don't have to deal with. Unfaithfulness by her primary partner could be tremendously harmful. If the man decided to funnel his energy, time, resources, commitment, and parental contributions to another partner and her children the man's previous female partner would be left to raise their offspring on her own. These differences in adaptive problems faced by the different genders may explain why in previous studies conducted on sex differences in jealousy, men were found to be more distressed by sexual infidelity and women to be more concerned about emotional infidelity (Bailey, Gaulin, Agyei, & Gladue, 1994; Buss Larson, Western, & Semmelroth, 1992; Buss, Shackelford, Kirkpatrick, Choe, Lim, Hasegawa, et al., 1999; Buunk, Angleitner, Oubaid, & Buss, 1996; DeSteno & Salovey, 2002; Geary, Rumsey, Bow-Thomas, & Hoard, 1995; Harris & Christenfeld, 1996; Pietrzak, Laird,

Stevens, & Thompson, 2002; Shackelford, Buss, & Bennett, 2002; Voracek, Stieger, & Gindl, 2001; Wiederman & Allgeier, 1993; Wiederman & Kendall, 1999).

Double-Shot Effect

Another objection to Buss et al.'s (1992) results is the double-shot effect (DeSteno, 1996). According to the double-shot hypothesis, emotional infidelity implies the occurrence of sexual infidelity, and subjects will report that emotional infidelity is the more distressing of the two. Further the hypothesis states that it is possible that individuals may perceive the two types of infidelity as equally likely to imply the occurrence of one another.

In our culture men are believed to be capable of sex without emotional attachment, while women normally are not believed to be capable of this. Given this theory, when given a forced-choice question where he must choose between his partner's participation in sexual or emotional infidelity, men will be more likely to choose sexual infidelity as more upsetting than emotional infidelity since they imagine that it is probable that if a woman is engaging in sex, then emotional involvement is naturally implicated. If this is the case, men will choose sexual infidelity, because it indicates that sexual and emotional infidelity are occurring simultaneously. Equally, women may assume that since men are capable of having sex without emotional attachment, a man's emotional infidelity is a bigger concern because it is a sign that he is both sexually and emotionally involved. Therefore, females would be more likely to be distressed by emotional than sexual infidelity since it implies that both are going on (Harris & Christenfeld, 1996). Since both types of infidelity may not be seen as independent there may be an error in the way questions were asked in Buss et al.'s (1992) research.

Rationale and Hypotheses

Little research has been conducted on modern American non-monogamous practices so little is empirically known about the social construct of this mating system. It would seem that individuals who choose to live a non-monogamous lifestyle in a culture that promotes monogamy would present a puzzle to researchers. Do these individuals experience jealousy in the same way as monogamous individuals do?

Gender differences in jealousy may have evolved as part of a mating strategy that exists at the biological level. If this is a correct assumption, then jealousy-invoking stimulus sensitivities might be independent of mating-system, sexual orientation, and culture. This implies that non-monogamous men and women, like their monogamous counterparts, will differ in the types of jealousy they experience. Therefore, the null hypothesis is: modern American non-monogamist male populations will be less upset by sexual infidelity and the female populations will be less upset by emotional infidelity.

Methods

A sample of 200 subjects will be studied. Two samples will be used and the samples will be taken from undergraduate populations and polyamory convention participants.

After reporting demographic information the subjects will be given one of two different questionnaires patterned after Buss et al.'s (1992) original questionnaire and using two questions designed to answer the hypothesis proffered and one question, used by Buunk et al. (1996), designed to control for a possible double-shot effect. Subjects will complete a questionnaire of about 40 questions that refer to their non-monogamous lifestyle. Interspersed throughout the questionnaires will be distracter questions, which will ask about different dimensions of the polyamorous relationship. These questions are designed to give the impression that the researchers are researching a broader area of knowledge of polyamorous relationships, and are

intended to prevent testing effects from occurring, as the knowledge that we are researching jealousy in particular could affect the responses of the subjects.

Group "A" subjects will be presented with the following dilemmas:

Question 1:

Please think of a serious committed romantic relationship that you have had in the past, that you currently have, or that you would like to have. Imagine that you discover that the person with whom you've been seriously involved with becomes interested in someone else. What would distress or upset you more (please circle only one):

- (A) Imagining your partner forming a deep emotional attachment to that person.
- (B) Imagining your partner enjoying passionate sexual intercourse with that other person.

Question 2:

- (A) Imagining your partner trying different sexual positions with that other person.
- (B) Imagining your partner falling in love with that other person.

The following question (originally used by Bunk et al.), will be included among the questions asked to attempt to detect a possible double-shot effect:

Question 3:

Imagine that your partner both formed an emotional attachment to another person and had sexual intercourse with that other person. Which aspect of your partner's involvement would upset you more?

- (A) the sexual intercourse with that other person?

(B) the emotional attachment to that other person?

Most monogamists expect their partner to not have extra-pair copulations, the questions used by Buss et al. (1992) and Buunk et al. (1996) were designed for monogamists and implied that, in the imaginary scenario, the partner was behaving without the subject's consent. Since modern American non-monogamists frequently have relationships outside of their primary relationship with the consent of their primary partner the questions originally used by Buss et al. (1992) and Buunk et al. (1996) may not be an effective measure of jealousy in non-monogamists. To account for this possible misspecification the questions asked in group B will have a modification and use the words "without your knowledge or consent."

Group "B" will be presented with the following questions, adapted from the questions asked in group A's questionnaire.

Question 1:

Please think of a serious committed romantic relationship that you have had in the past, that you currently have, or that you would like to have. Imagine that you discover that the person with whom you've been seriously involved with becomes interested in someone else. What would distress or upset you more (please circle only one):

- (A) Imagining your partner forming a deep emotional attachment to that person, without your knowledge or consent.
- (B) Imagining your partner enjoying passionate sexual intercourse with that other person, without your knowledge or consent.

Subjects will complete a questionnaire of about 40 questions that refer to their non-monogamous lifestyle. One of the questions they will answer is the following question, originally used by Buss et al. (1992), with the same instructions as the first, but followed by a different, although similar, choice:

Question 2:

- (A) Imagining your partner trying different sexual positions, without your knowledge or consent, with that other person.
- (B) Imagining your partner falling in love, without your knowledge or consent, with that other person.

Question 3:

Imagine that your partner both formed an emotional attachment to another person, without your knowledge or consent, and had sexual intercourse with that other person. Which aspect of your partner's involvement would upset you more?

- (A) the sexual intercourse with that other person?
- (B) the emotional attachment to that other person?

Discussion

In this study we examine to theories that have proposed to explain gender differences in romantic jealousy. The evolutionary theory says that males are more likely to be jealous when sexual infidelity has occurred and females are more likely to be jealous when emotional infidelity occurs because both sexes have developed different mating strategies to overcome different adaptive problems. If this is true we would expect that the answers to question 1 and question 2 would be similar to those responses given by previous populations studied (Bailey, Gaulin, Agyei, & Gladue, 1994; Buss Larson, Western, & Semmelroth, 1992; Buss,

Schackelford, Kirkpatrick, Choe, Lim, Hasegawa, et al., 1999; Buunk, Angleitner, Oubaid, & Buss, 1996; DeSteno & Salovey, 2002; Geary, Rumsey, Bow-Thomas, & Hoard, 1995; Harris & Christenfeld, 1996; Pietrzak, Laird, Stevens, & Thompson, 2002; Shackelford, Buss, & Bennett, 2002; Voracek, Stieger, & Gindl, 2001; Wiederman & Allgeier, 1993; Wiederman & Kendall, 1999).

The double-shot hypothesis says that the previous findings in studies using forced-choice methods are an artifact of measurement. Specifically it says that the real reason for the gender differences in romantic jealousy is that participants in these studies are most concerned by the type of infidelity, sexual or emotional, that most clearly signals that the other type of infidelity, emotional or sexual, is also happening. If the double-shot hypothesis is correct, then we would expect to find that responses to question 3 would regress toward the mean. Men would be equally or more concerned over emotional infidelity as they were over sexual infidelity in the first two questions. Likewise, women would be equally or more concerned over sexual infidelity as they were over emotional infidelity in the first two questions.

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Synaesthesia: Tasting Music, Smelling Colors, and Hearing Flavors

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Honors Research Paper

Prof. Greta Climenhaga

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Synaesthesia: Tasting Music, Smelling Colors, and Hearing Flavors

Each person perceives the world in a completely unique and personal way. Each person's perception is different from the next, but can you imagine what it would be like to taste music, smell colors, or hear flavors? Believe it or not this is exactly what many people experience every day. The experience is called synaesthesia and the people who experience it are called synaesthetes.

Synaesthesia is a neurological integration of some of the senses, sometimes described as a "mixing" of the senses (Cytowic, 1989). Synaesthetes may be able to see sounds, hear colors, taste sounds, or taste something they have touched. The experience of one stimulus can provoke a different perceptual experience. Some hallucinogenic drugs such as LSD and mescaline can produce the fairly common effect of synaesthesia; however, people identified as synaesthetes experience this phenomenon every day without the aid of drugs.

Is it real?

Synaesthetes often perceive associations linking different intensities of tastes, pitches of sounds, and shades of colors that trigger singular sensations. For example, a synaesthete may be able to see a more concentrated shade of red as the tone of a sound grows higher in pitch, or a more intensely seasoned piece of food may make the synaesthete experience a higher pitch of sound than a more bland meal would. J. A. Miller, a taste-sound synaesthete (who also has grapheme-chromatic synaesthesia) said, "one day I was eating some lasagna that my mother had made for me, I was about 7 at the time, I told her that the food was making music in my mouth. She thought I was being metaphorical" (Personal communication, December 12, 2005). The experiences of synaesthetes are not figurative or merely associations; they are, more accurately,

unintentional and are constant throughout life, despite the fact that some younger synaesthetes seem to lose their capability to experience synaesthesia by or during adulthood. Depressant drugs (such as alcohol) tend to enhance the intensity of the perceptions.

It is most interesting to note that synaesthesia can even happen when one of the senses no longer physically operates correctly; for example, a person who has chromatic-lexical synaesthesia (sees colors when words are spoken) can still see the colors if he becomes blind in later life. This remarkable experience is sometimes known as perceiving “Martian colors.” This term was derived from a case of a synaesthete who was born color blind, but who saw particular ‘alien’ colors in his synaesthetic experiences that he never saw and was unable to see in the ‘real world.’

Synaesthesia is a very real phenomenon, but how do we know if a person genuinely has it? A legitimate case of synaesthesia will have certain qualities in common. First, a particular stimulus continuously induces a specific perception. Second, the experience takes place spontaneously. Third, the perceptions are unique to the individual; every synaesthete has their own color and shape perception associations (although recent studies show a remarkably high correlation between synaesthetes in their perceptions of certain colors and certain graphemes). Fourth, the synaesthete’s perceptions are unalterable and irreversible: the number 7 might evoke the color blue, but the color blue doesn’t evoke a number 7. Finally, the perceptions are permanent: they begin at a young age and don’t change throughout life (although they may disappear during or just after puberty) if at age 4 they perceived the color blue whenever they saw the number 7, then the number 7 will always evoke the color blue.

How many types are there? What are they?

There are a lot of different types of synaesthesia, of which the connection between grapheme (letters and numbers) and color is the most common type; this type is often called chromatic-grapheme synaesthesia or color-grapheme synaesthesia (Rich & Mattingley, 2002). In chromatic-grapheme synaesthesia a grapheme (letter, number, symbol, or word) elicits a highly specific color, called photism. One study suggested that the synaesthetes didn't have to see the grapheme in order to elicit a color response; just thinking about a particular letter, number or word could also produce a dramatic color experience (Dixon, Smilek, Cudahy, & Merikle, 2000). In one Australian study of 192 adult synaesthetes, 87% of the subjects experienced chromatic-grapheme synaesthesia. Of the 192 participants 11% experienced synaesthesia from limited subsets of words but not from letters and digits (Richa, A.; Bradshawb, J.; & Mattingleya, J.). Fewer than 2% of the total number of participants in Richa et al's article described synaesthetic experiences provoked only by stimuli other than letters, numbers, or words. The next most common type of synaesthesia is chronometric-chromatic or chronometric-color synaesthesia (when a connection between time units and color is made) and musical sounds and color. There are only a few types of synaesthesia that have not yet been discovered: temperature-tastes (tasting temperature flux), tastes-smells (smelling flavors), temperatures-smells (smelling temperature flux), and temperature-touch (feeling temperature flux).

There are also llexical-gustatory synaesthetes who experience certain tastes when they hear certain speech sounds or words (Ward & Simner, 2003); chromatic-lexical synaesthetes who have color associations for names of personally familiar people, and chromatic-auditory synaesthetes who experience colors when they experience certain sounds. These are by far not the only types of synaesthesia that exist but they are among the most common.

It is usually thought that there are five senses: touch, taste, vision, hearing, and smell. If we were to determine the number of possible combinations (vision-hearing, vision-touch, hearing-touch, etc.) then we would get 20 possible forms of synaesthesia; however, it would be deceptive to portray synaesthesia in such limited terms of pair associations between these senses.

There are several aspects for each sense and synaesthesia often is paired with one of these aspects and an aspect of another sense. For example synaesthetes who experience this phenomenon within the sphere of 'vision' may perceive colours, while others could 'see' shapes or movement. An additional problem with categorizing synaesthetic experiences is that synaesthesia may be activated by certain things which are not really considered sensory; words, numbers, letters, and names do not fall into the realm of the senses yet they may trigger sensory pairings in synaesthetes. Therefore, the possible number of various forms of synaesthesia is virtually unlimited. The most predominate variety of synaesthesia involves color, which can be assigned to letters, numbers, days of the week, proper names, people, certain sounds, or musical notes.

What is synaesthesia like?

It seems that living with synaesthesia might be confusing. Imagining how someone with synaesthesia might perceive certain letters and numbers is difficult for a non-synaesthete. According to the Synaesthesia Research Group of the University of Waterloo, Ontario, in synaesthesia's most predominant form (grapheme-chromatic synaesthesia) certain characters (letters or numbers) and/or certain words are shaded or tinged with specific colors. The alphanumeric color patterns are different for each individual. It is not uncommon for synaesthetes to account that they were not aware that their abilities were rare or abnormal until

they found out that other people around them didn't have them. Patricia Lynne Duffy (Author and synaesthete) recounts her experience: "one day, I said to my father, 'I realized that to make an 'R' all I had to do was first write a 'P' and then draw a line down from its loop. And I was so surprised that I could turn a yellow letter into an orange letter just by adding a line.'"

Anecdotal accounts and synaesthetes' personal reports have suggested that synaesthetes may possess a number of similar traits. In Cytowic's 1996 research it was recorded that synaesthetes are often females, left-hand dominant, poor at mathematics, poor at direction finding or map-reading, and prone to experiences of de' ja 'vu or prophetic dreams. It has also been suggested by both anecdotal evidence and 2 different studies that synaesthetes may tend to be better at art and are prone to be involved with creative or artistic hobbies or careers (Galton, 1880; Ramachandran & Hubbard, 2001), and that synaesthesia may be genetic since it runs in families, though it appears to skip a generation sometimes (Galton, 1880).

A large study conducted in Australia by Richa, et al. found that the synaesthetes were no more likely to be left-handed than non-synaesthetes, despite previous claims. Richa et al. did, on the other hand, discover that synaesthetes are more liable to be artistically disposed; this seems to agree with previous anecdotal reports. Their data also suggested that the pervasiveness of synaesthesia in the adult population of Australia is around 1 in 7150 men, and 1 in 1150 women, this evidence strongly supports the anecdotal reports that synaesthesia is more common in females than in males. Some of the evidence also found that synaesthetes were prone to difficulty in reading maps and trouble with direction finding. Synaesthetes were also more likely to report art as a strength and math as an area of weakness, since we do not know if this is an artifact of other confounding variables; for example, the higher ratio of females to males this finding is inconclusive (Richa et al.).

In Richa et al's research it was found that about 67% of synaesthetes claimed to have experienced occurrences such as de' ja 'vu or other psychic experiences. The phenomena were reported as occurring fairly frequently by about 34% of the participants and occasionally by about 33%. According to Adachi, Adachi, Kimura, Akanuma, Takekawa, & Kato, 60-80% of the general population report experiences of the phenomenon of de' ja 'vu, out of body experiences, and precognitive dreams; therefore, synaesthetes do not appear to be more inclined to precognitive experiences than non-synaesthetes are, this information counters the previous anecdotal evidence (Cytowic, 1989).

How many people have it?

There have been several studies on the predominance of synaesthesia; some studies estimate that synaesthetes may make up about 3% of the U.S. population. Conversely, other research has indicated that synaesthesia may be significantly less widespread. Baron-Cohen and colleagues (1996) placed an advertisement in a local newspaper and received 26 replies; with this response they estimated that the incidence of synaesthesia is 1 in 2000.

In an Australian study by Richa et al. (2005) the researchers did their research on subjects who responded to an article on synaesthesia produced in the magazine supplement of The Australian newspaper. The researchers received 158 completed responses; 86% of the responses were from women which gave them a sample with a 6:1 ratio. This corresponds with previous reports that there are greater numbers of female synaesthetes than males (Baron-Cohen et al., 1996). Richa et al calculated that the prevalence of synaesthesia in is 1 for every 1150 females, or .087%, and 1 for every 7150 males, or .014%.

What causes it?

Some researchers think the phenomenon of synaesthesia might originate from a young age. Some researchers believe that infants perceive the world like a synaesthete (Neonatal Synaesthesia hypothesis), with mixed senses, because their brains are not completely developed yet. The Neonatal Synaesthesia hypothesis contends that in early infancy, up to about 4 months, all infants experience sensations in the same way. Sounds can trigger auditory, visual, and tactile experiences. This theory builds on an existing theory called the Cross-Modal Transfer hypothesis, which postulates that objects can be recognized by an infant by using more than one sense (Meltzoff & Borton, 1979).

This indicates, that babies are capable of differentiating one thing from another by what they look like, even if they have formerly only touched them without having seen them. This belief is supported by research conducted on children by Rose, Gottfried, and Bridger (1978) who discovered that 12 month old infants look longer at objects that they have previously explored orally. Similar results were found by Meltzoff and Borton (1979) for 1 month olds. Lewkowicz and Turkewitz (1980) discovered that 1 month old infants do not show as much of a heart rate change when a dot of white light is followed shortly by a quick eruption of white noise that adults have previously rated as matched in intensity; however, they had marked heart rate increases when the light was followed by very low or very high intensity white noise. This research implies that infants respond to changes of intensity in stimulation regardless of what sense they are experiencing.

The Cross-Modal Transfer hypothesis contests Piaget's (1952) theory the each sensory system is independent at birth and gradually become integrated with each other. Instead, it offers defense for the view suggested by E. Gibson (1969), Bower (1974), and Werner (1973) that the

senses are integrated and undifferentiated at birth and that gradual differentiation of the perceptual systems is what is really happening. The neonatal-synaesthesia hypothesis builds on the cross-modal transfer hypothesis but purports that there is a reasonable biological origin for neonatal synaesthesia, which might be found if one looks at the transitory links between the neural structures of neonates in other mammalian species. Hoffman (1978) wrote, “During early infancy - and only during early infancy - ... evoked responses to spoken language (are recorded) not just over the temporal cortex, where one would expect to find them, but over the occipital cortex as well. There are similar reports of wide-spread cortical responses to visual stimuli during the first 2 months of life. Results such as these suggest that primary sensory cortex is not so specialized in the young infant as in the adult.” This does seem to suggest that the neonatal-synaesthesia hypothesis has some merit. As the infant gets older his senses gradually are separated from each other, but for some people the separation does not take place and therefore they remain partially undifferentiated in synaesthetes for their entire life.

Neurologist V. S. Ramachandran, who studies synaesthetes at the University of California, San Diego, has remarked that a “processes similar to synaesthesia might also underlie our general capacity for metaphor and be critical to creativity” (Ramachandran & Hubbard, 2003; BBC News, 2005). Ramachandran has also said that it is “not an accident” that synaesthesia is found eight times more often in artists and writers than in the general population, and appears far more frequently in creative people (BBC News, 2005).

In Richa et al’s (2005) research the incidence of synaesthesia in biological relatives is much higher than that estimated for the overall population. Of the 61 female respondents, 85% had at least one other female family member with synaesthesia. According to the Synaesthesia Research Group of the University of Waterloo, Ontario, Canada (2005), approximately one-third

of synaesthetes report that another family member experiences similar phenomena. Some estimates say that synaesthesia is eight times more likely to occur in females as it is in males. It also seems to run in families. Given both of these facts it has been suggested that synaesthesia is inherited via the sex-linked X chromosome (Ramachandran & Hubbard, 2003; Bailey & Johnson, 1997). This means that a mother can pass synaesthesia on to either a son or daughter, but a father can only pass it on to a daughter. This may explain why synaesthesia has sometimes been shown to be more common in women. This might also explain why synaesthesia appears to skip generations.

A study of 11-yr-old monozygotic twin sisters confirmed that while one of the twins reported that she has a specific color experience whenever she sees, hears, or thinks of certain digits, the other twin did not report such an experience while viewing, thinking about, or hearing any of the digits. The researchers believed that these findings suggested that if synaesthesia is sex-linked on the X chromosome then the dissimilarity in synaesthesia between the twins might be due to dormancy of the X chromosome or a genetic mutation of the synaesthetic gene in the non-synaesthetic sister (Smilek, D.; Moffatt, B.; Pasternak, J.; White, B.; Dixon, M.; Merikle, P., 2002). However a later study of 10-year-old monozygotic twin brothers established that one twin had grapheme-chromatic synaesthesia and the other did not; these findings negate the previous suggestion that the discordance of synaesthesia in identical twins is linked to X chromosome inactivation (Smilek, D.; Dixon, M.; & Merikle, P., 2005).

What are the advantages or disadvantages of synaesthesia?

People who do not experience synaesthesia might think that the experience is confusing or that it would make life difficult for the person experiencing it. In Richa et al's (2005) research

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Even though the experience of synaesthesia has its drawbacks it has its positive side too. Many synaesthetes report that they love being different, couldn't imagine life without experiencing it this way, or would not choose to give it up if they could. Many non-synaesthetes would probably agree that seeing the world in a truly unique way would be very interesting but for people who experience it every day it doesn't feel different or weird it's just the way they experience life.

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Synaesthesia: Tasting Music, Smelling Colors, and Hearing Flavors

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PSYC 329, Sensation and Perception

Honors Research Paper

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Synaesthesia: Tasting Music, Smelling Colors, and Hearing Flavors

Each person perceives the world in a completely unique and personal way. Each person's perception is different from the next, but can you imagine what it would be like to taste music, smell colors, or hear flavors? Believe it or not this is exactly what many people experience every day. The experience is called synaesthesia and the people who experience it are called synaesthetes.

Synaesthesia is a neurological integration of some of the senses, sometimes described as a "mixing" of the senses (Cytowic, 1989). Synaesthetes may be able to see sounds, hear colors, taste sounds, or taste something they have touched. The experience of one stimulus can provoke a different perceptual experience. Some hallucinogenic drugs such as LSD and mescaline can produce the fairly common effect of synaesthesia; however, people identified as synaesthetes experience this phenomenon every day without the aid of drugs.

Is it real?

Synaesthetes often perceive associations linking different intensities of tastes, pitches of sounds, and shades of colors that trigger singular sensations. For example, a synaesthete may be able to see a more concentrated shade of red as the tone of a sound grows higher in pitch, or a more intensely seasoned piece of food may make the synaesthete experience a higher pitch of sound than a more bland meal would. J. A. Miller, a taste-sound synaesthete (who also has grapheme-chromatic synaesthesia) said, "one day I was eating some lasagna that my mother had made for me, I was about 7 at the time, I told her that the food was making music in my mouth. She thought I was being metaphorical" (Personal communication, December 12, 2005). The experiences of synaesthetes are not figurative or merely associations; they are, more accurately,

unintentional and are constant throughout life, despite the fact that some younger synaesthetes seem to lose their capability to experience synaesthesia by or during adulthood. Depressant drugs (such as alcohol) tend to enhance the intensity of the perceptions.

It is most interesting to note that synaesthesia can even happen when one of the senses no longer physically operates correctly; for example, a person who has chromatic-lexical synaesthesia (sees colors when words are spoken) can still see the colors if he becomes blind in later life. This remarkable experience is sometimes known as perceiving “Martian colors.” This term was derived from a case of a synaesthete who was born color blind, but who saw particular ‘alien’ colors in his synaesthetic experiences that he never saw and was unable to see in the ‘real world.’

Synaesthesia is a very real phenomenon, but how do we know if a person genuinely has it? A legitimate case of synaesthesia will have certain qualities in common. First, a particular stimulus continuously induces a specific perception. Second, the experience takes place spontaneously. Third, the perceptions are unique to the individual; every synaesthete has their own color and shape perception associations (although recent studies show a remarkably high correlation between synaesthetes in their perceptions of certain colors and certain graphemes). Fourth, the synaesthete’s perceptions are unalterable and irreversible: the number 7 might evoke the color blue, but the color blue doesn’t evoke a number 7. Finally, the perceptions are permanent: they begin at a young age and don’t change throughout life (although they may disappear during or just after puberty) if at age 4 they perceived the color blue whenever they saw the number 7, then the number 7 will always evoke the color blue.

How many types are there? What are they?

There are a lot of different types of synaesthesia, of which the connection between grapheme (letters and numbers) and color is the most common type; this type is often called chromatic-grapheme synaesthesia or color-grapheme synaesthesia (Rich & Mattingley, 2002). In chromatic-grapheme synaesthesia a grapheme (letter, number, symbol, or word) elicits a highly specific color, called photism. One study suggested that the synaesthetes didn't have to see the grapheme in order to elicit a color response; just thinking about a particular letter, number or word could also produce a dramatic color experience (Dixon, Smilek, Cudahy, & Merikle, 2000). In one Australian study of 192 adult synaesthetes, 87% of the subjects experienced chromatic-grapheme synaesthesia. Of the 192 participants 11% experienced synaesthesia from limited subsets of words but not from letters and digits (Richa, A.; Bradshawb, J.; & Mattingleya, J.). Fewer than 2% of the total number of participants in Richa et al's article described synaesthetic experiences provoked only by stimuli other than letters, numbers, or words. The next most common type of synaesthesia is chronometric-chromatic or chronometric-color synaesthesia (when a connection between time units and color is made) and musical sounds and color. There are only a few types of synaesthesia that have not yet been discovered: temperature-tastes (tasting temperature flux), tastes-smells (smelling flavors), temperatures-smells (smelling temperature flux), and temperature-touch (feeling temperature flux).

There are also llexical-gustatory synaesthetes who experience certain tastes when they hear certain speech sounds or words (Ward & Simner, 2003); chromatic-lexical synaesthetes who have color associations for names of personally familiar people, and chromatic-auditory synaesthetes who experience colors when they experience certain sounds. These are by far not the only types of synaesthesia that exist but they are among the most common.

It is usually thought that there are five senses: touch, taste, vision, hearing, and smell. If we were to determine the number of possible combinations (vision-hearing, vision-touch, hearing-touch, etc.) then we would get 20 possible forms of synaesthesia; however, it would be deceptive to portray synaesthesia in such limited terms of pair associations between these senses.

There are several aspects for each sense and synaesthesia often is paired with one of these aspects and an aspect of another sense. For example synaesthetes who experience this phenomenon within the sphere of 'vision' may perceive colours, while others could 'see' shapes or movement. An additional problem with categorizing synaesthetic experiences is that synaesthesia may be activated by certain things which are not really considered sensory; words, numbers, letters, and names do not fall into the realm of the senses yet they may trigger sensory pairings in synaesthetes. Therefore, the possible number of various forms of synaesthesia is virtually unlimited. The most predominate variety of synaesthesia involves color, which can be assigned to letters, numbers, days of the week, proper names, people, certain sounds, or musical notes.

What is synaesthesia like?

It seems that living with synaesthesia might be confusing. Imagining how someone with synaesthesia might perceive certain letters and numbers is difficult for a non-synaesthete. According to the Synaesthesia Research Group of the University of Waterloo, Ontario, in synaesthesia's most predominant form (grapheme-chromatic synaesthesia) certain characters (letters or numbers) and/or certain words are shaded or tinged with specific colors. The alphanumeric color patterns are different for each individual. It is not uncommon for synaesthetes to account that they were not aware that their abilities were rare or abnormal until

they found out that other people around them didn't have them. Patricia Lynne Duffy (Author and synaesthete) recounts her experience: "one day, I said to my father, 'I realized that to make an 'R' all I had to do was first write a 'P' and then draw a line down from its loop. And I was so surprised that I could turn a yellow letter into an orange letter just by adding a line.'"

Anecdotal accounts and synaesthetes' personal reports have suggested that synaesthetes may possess a number of similar traits. In Cytowic's 1996 research it was recorded that synaesthetes are often females, left-hand dominant, poor at mathematics, poor at direction finding or map-reading, and prone to experiences of *de' ja vu* or prophetic dreams. It has also been suggested by both anecdotal evidence and 2 different studies that synaesthetes may tend to be better at art and are prone to be involved with creative or artistic hobbies or careers (Galton, 1880; Ramachandran & Hubbard, 2001), and that synaesthesia may be genetic since it runs in families, though it appears to skip a generation sometimes (Galton, 1880).

A large study conducted in Australia by Richa, et al. found that the synaesthetes were no more likely to be left-handed than non-synaesthetes, despite previous claims. Richa et al. did, on the other hand, discover that synaesthetes are more liable to be artistically disposed; this seems to agree with previous anecdotal reports. Their data also suggested that the pervasiveness of synaesthesia in the adult population of Australia is around 1 in 7150 men, and 1 in 1150 women, this evidence strongly supports the anecdotal reports that synaesthesia is more common in females than in males. Some of the evidence also found that synaesthetes were prone to difficulty in reading maps and trouble with direction finding. Synaesthetes were also more likely to report art as a strength and math as an area of weakness, since we do not know if this is an artifact of other confounding variables; for example, the higher ratio of females to males this finding is inconclusive (Richa et al.).

In Richa et al's research it was found that about 67% of synaesthetes claimed to have experienced occurrences such as de' ja 'vu or other psychic experiences. The phenomena were reported as occurring fairly frequently by about 34% of the participants and occasionally by about 33%. According to Adachi, Adachi, Kimura, Akanuma, Takekawa, & Kato, 60-80% of the general population report experiences of the phenomenon of de' ja 'vu, out of body experiences, and precognitive dreams; therefore, synaesthetes do not appear to be more inclined to precognitive experiences than non-synaesthetes are, this information counters the previous anecdotal evidence (Cytowic, 1989).

How many people have it?

There have been several studies on the predominance of synaesthesia; some studies estimate that synaesthetes may make up about 3% of the U.S. population. Conversely, other research has indicated that synaesthesia may be significantly less widespread. Baron-Cohen and colleagues (1996) placed an advertisement in a local newspaper and received 26 replies; with this response they estimated that the incidence of synaesthesia is 1 in 2000.

In an Australian study by Richa et al. (2005) the researchers did their research on subjects who responded to an article on synaesthesia produced in the magazine supplement of The Australian newspaper. The researchers received 158 completed responses; 86% of the responses were from women which gave them a sample with a 6:1 ratio. This corresponds with previous reports that there are greater numbers of female synaesthetes than males (Baron-Cohen et al., 1996). Richa et al calculated that the prevalence of synaesthesia in is 1 for every 1150 females, or .087%, and 1 for every 7150 males, or .014%.

What causes it?

Some researchers think the phenomenon of synaesthesia might originate from a young age. Some researchers believe that infants perceive the world like a synaesthete (Neonatal Synaesthesia hypothesis), with mixed senses, because their brains are not completely developed yet. The Neonatal Synaesthesia hypothesis contends that in early infancy, up to about 4 months, all infants experience sensations in the same way. Sounds can trigger auditory, visual, and tactile experiences. This theory builds on an existing theory called the Cross-Modal Transfer hypothesis, which postulates that objects can be recognized by an infant by using more than one sense (Meltzoff & Borton, 1979).

This indicates, that babies are capable of differentiating one thing from another by what they look like, even if they have formerly only touched them without having seen them. This belief is supported by research conducted on children by Rose, Gottfried, and Bridger (1978) who discovered that 12 month old infants look longer at objects that they have previously explored orally. Similar results were found by Meltzoff and Borton (1979) for 1 month olds. Lewkowicz and Turkewitz (1980) discovered that 1 month old infants do not show as much of a heart rate change when a dot of white light is followed shortly by a quick eruption of white noise that adults have previously rated as matched in intensity; however, they had marked heart rate increases when the light was followed by very low or very high intensity white noise. This research implies that infants respond to changes of intensity in stimulation regardless of what sense they are experiencing.

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