

NEWS, VIEWS AND COMMENTS

Reared-Apart Chinese Twins: Chance Discovery/Twin-Based Research: Twin Study of Media Use; Twin Relations Over the Life Span; Breast-Feeding Opposite-Sex Twins/Print and Online Media: Twins in Fashion; Second Twin Pair Born to Tennis Star; Twin Primes; Twin Pandas

Nancy L. Segal

Department of Psychology, California State University, Fullerton, CA, USA

A January 2017 reunion of 10-year-old reared-apart Chinese twin girls was captured live on ABC's morning talk show *Good Morning America*, and rebroadcast on their evening news program *Nightline*. The twins' similarities and differences, and their participation in ongoing research will be described. This story is followed by reviews of twin research concerning genetic and environmental influences on media use, twin relations across the lifespan and the breast-feeding of opposite-sex twins. Popular interest items include twins in fashion, the second twin pair born to an internationally renowned tennis star, twin primes and twin pandas.

Reared-Apart Chinese Twins: Chance Discovery

On December 6, 2016, I received an email message from Jennifer Doering of Wausau, Wisconsin. Jennifer is the mother of 10-year-old Audrey whom she had adopted from China when Audrey was just 15 months old. She had decided to give her daughter a special Christmas present consisting of Audrey's birth and adoption history information (e.g., the newspaper announcement of her availability for adoption, required by Chinese orphanages) that she could obtain only from China. But something unexpected occurred: During the course of her research Jennifer received a photograph of her daughter standing in front of the Chinese foster mother who had cared for her — but next to Audrey was another little girl who looked exactly like her. Further investigation revealed that the two girls might have been left in different locations, but had been brought to the same orphanage. Their Chinese names, Tong Min Gui

and Tong Min Mei, when combined form the word 'rose' — according to Jennifer, this is a traditional way of naming twins. In another odd twist, it happened that Audrey's photo in the newspaper was at the top of the page, while the photo of her presumed MZ twin, Gracie, was at the bottom.

Driven by intense persistence, interest, and curiosity, Jennifer used Facebook to track down the family who had adopted her daughter's alleged twin sister. The process took her just 48 hours. It turned out that Scott and Nicole

ADDRESS FOR CORRESPONDENCE: Nancy L. Segal, Department of Psychology, California State University, Fullerton, CA, USA. E-mail: nsegal@exchange.fullerton.edu

Rainsberry of Richland, Washington, had adopted Gracie about one week before the Doerings had adopted Audrey. Gracie's date of birth was 5 days earlier, but in my experience with the ongoing Fullerton Study of Chinese Twins Adopted Apart and Together, it is not unusual for separated Chinese twins to be given different birthdays — especially if found in different locations, that is, police stations or orphanage entryways. Abandoned infants' dates of birth are often estimated from their physical development and health status unless a note left with them provides their birth information.

Jennifer contacted the Rainsberrys, who were shocked at the photographs and videotapes that Jennifer forwarded to them. Most striking were the two photos of the girls published in the Chinese newspaper — placing them side by side made it impossible to distinguish between them. When Audrey and Gracie were shown photographs of each other they were perplexed. Audrey realized that the girl in the photo looked just like her, but was *not* her, while Gracie thought that the photo *was* her. Their first session together on Facetime was very emotional for both of these 10-year-olds.

The twins have many characteristics in common, beginning with a congenital heart condition known as tetralogy of fallot (TOF) with pulmonary atresia (PA). This heart defect involves four problems: a hole between the lower chambers of the heart, an obstruction from the heart to the lungs, the lying of the aorta over the hole in the lower chambers, and a thickening of the muscle surrounding the lower right chamber (American Heart Association, 2017). This condition requires several rounds of surgery, which both girls have had, although one twin is more severely affected than the other. However, TOF does not interfere with the twins' sports abilities and participation — Audrey participates in gymnastics and Gracie participates in soccer — although the girls get winded a little faster than other children.

Both the Rainsberrys and the Doerings have three older biological children — the Rainsberrys have two sons and a daughter (Lucas 15, Kaleb 18, and Chloe 13), while the Doerings have three sons (John 15, Steven 19, and Paul 20). Nicole Rainsberry is a paraeducator, working mornings in a public school kindergarten classroom and afternoons in small reading groups, and her husband Scott is a children's pastor. Jennifer Doering is a physician's assistant, and her husband Tom is a gynecologist. Both families believe, it is important to provide a good home to a child in need and both requested a special needs child when they began the adoption process. Interestingly, TOF may have been responsible for the twins' rearing by separate families, because it is likely that the agency in China felt it would be easier to place one special needs child, rather than two.

The twins and their families are participating in the study of Chinese Twins Adopted Apart at California State Uni-

versity, Fullerton (Segal et al., 2011). The sample now includes nearly 20 twin pairs, fairly evenly divided between MZ and DZ sets. The study is designed to prospectively track the behavioral and physical development of young twins separated early in life. In addition to their shared heart condition, Audrey and Gracie name math as their favorite school subject, and enjoy working with computers. During their first few sessions on Facetime (prior to meeting), they engaged in computer games, sometimes together and sometimes individually, a pastime they have continued since reuniting. The twins wear the same eye-glass frames, although their vision differs. They have similar food preferences, especially macaroni and cheese, and fettuccine alfredo, and both often wear their long straight hair in ponytails arranged toward the right side of their head. Like 25% of MZ twin pairs, Audrey is left-handed and Gracie is right-handed. These types of similarities and differences have been reported in previous reared-apart twin studies, demonstrating both genetic and environmental effects (Segal, 2012).

The families had planned to meet in March or April, 2017. However, I was able to make the twin reunion happen on January 11 by contacting ABC's morning news program, *Good Morning America*. The twins, their families, and I were flown to New York City to appear live on the show and to tape a segment for ABC's evening program *Nightline*. Prior to these events, I arranged for DNA testing to confirm that the two girls were MZ twins. Given that some individuals are chance look-alikes (Segal, 2013) and that some Chinese children suspected to be twins turn out to be unrelated (Segal, 2006), DNA testing was a critical step. Analysis of 15 STRs by Affiliated Genetics in Salt Lake City Utah indicated that the two girls are indeed MZ twins with greater than 99% certainty.

The twins' first meeting, captured live, was indescribable — the twins hugged and cried, touching the hearts of television staff and viewers everywhere. The link to the program was widely circulated on the internet; interested readers can access it at <https://www.facebook.com/GoodMorningAmerica/videos/10154249705492061/> and at <https://youtu.be/QHeNKMxsqYE>. Photographs of the twins with their families, with me and with each other holding the stars taken from the rooms where they remained apart prior to meeting, are displayed in Figures 1–3. All three photos were taken at *Good Morning America's* studio at Broadway and 44th Street in New York City. The twins were also treated to a tour of *American Girl Place* and filmed for the *American Girl* television channel. While there, Audrey and Gracie independently chose the same outfit for their dolls.

Each reared-apart twin pair is a unique take on the wide range of nature-nurture questions, filling in a bit more of the complex story of who we are and how we got that way. Gracie and Audrey are exemplary in this regard.



FIGURE 1

(Colour online) Audrey and Gracie with their families. Front row, left-right: Audrey's older brother Steven, Audrey, Gracie, Gracie's older sister Chloe, Gracie's older brother Lucas and Audrey's older brother John. Back row: Audrey's parents Jennifer and Tom Doering, Gracie's father Scott Rainsberry, Gracie's older brother Paul, Gracie's mother Nicole and Gracie's older brother Kaleb.

Photo credit: Nancy L. Segal



FIGURE 2

(Colour online) Identical reared-apart twins Gracie (left) and Audrey soon after meeting for the first time, with Dr Nancy L. Segal.

Photo courtesy: Nancy L. Segal

**FIGURE 3**

(Colour online) Gracie and Audrey each displaying the star that was on the door of their respective waiting room.

Photo credit: Nancy L. Segal

Twin-Based Research

Twin Study of Media Use

Media habits have changed greatly in the last few decades, due to the Internet, personal computers, and smart phones. This development raises the question of the extent to which media use and communication behaviors may be partly genetically influenced. A classic twin study by Kirzinger et al. (2012) was used to investigate this issue. Data were drawn from the National Longitudinal Study of Adolescent Health (Add Health) and the United States National Study of Health and Well-Being (MIDUS).

MZ twin correlations exceeded DZ correlations across all eight measures assessed in the Add Health twins (computer use, video, days watching TV, hours watching TV, Internet use, talking to others, and parties) and in the one measure assessed in the MIDUS twins (news), consistent with genetic effects. Further analyses showed that as much as one-third of the variance in media habits can be explained by genetic factors, with the remainder attributable to non-shared environmental effects. Internet use was the only measure that showed modest shared environmental influence (0.23). It was suggested that mass communication scholars direct greater attention to heritable factors underlying media use and communication behaviors,

especially since both are predictive of political and social behaviors.

Twin Relations Over the Life Span

Twins' narrative life histories are of interest at multiple levels, namely empirical research, clinical assistance, and human interest. A study of older twins' twin relationships was conducted in Sweden by Pietilä et al. (2012). The 35 twins, who were interviewed included seven intact MZ pairs, five individual MZ twins ($N = 19$), five intact DZ pairs and six individual DZ twins ($N = 16$). Twenty MZ twins (seven pairs and six individual co-twins) had been reared together, while 15 twins had been reared apart (five pairs and five individual co-twins).

Qualitative methods were used to identify three relationship types. The *nurturing* twin relationship characterized twins for whom emotional closeness was experienced as intimacy and independence; the *draining* twin relationship described twins for whom emotional closeness was seen as dependence; while the *superficial* twin relationship indicated twins who were distant and emotionally uninvolved. In general, these relationship types remained stable throughout the twins' life course. The majority of twins

were part of the nurturing group (10 MZ and 14 DZ), with the remainder distributed between the draining group (7 MZ and 0 DZ), and superficial group (2 MZ and 2 DZ). All twins in the draining group had been reared apart and the age at which they were reunited was not given.

This study suggests that there is overlap among the two zygosity groups with respect to the nature and quality of their twin relations. However, the sample size is quite small, and 11 potential participants had withdrawn. In addition, the twin relationship classification system is one of many; a different system may have yielded different findings. The fact that slightly more DZ than MZ twins fell into the nurturing group is at odds with the general finding that MZ twins, regardless of rearing status, maintain the closest of human social relationships (Segal, 2012)

Breast-Feeding Opposite-Sex Twins

Recent research has indicated that mammalian breast milk may be tailored to the sex of the offspring. For example, macaque mothers provide greater quantities of milk with higher calcium concentrations for daughters than for sons. However, they produce milk with higher gross energy and fat for sons than for daughters (Hinde, 2007, 2009; Hinde et al., 2013). These findings raise significant implications and questions for human opposite-sex twins, that is, are these particular co-twins short-changed relative to same-sex twins when it comes to the benefits of breast-feeding?

In an attempt to address this question, Kanazawa and Segal (2017) analyzed relevant twin data from the National

Longitudinal Study of Adolescent Health (Add Health). Height and weight were compared between one co-twin from 546 same-sex twin pairs (277 females and 269 males) and 233 opposite-sex twin pairs (120 females and 113 males). Self-report data had been gathered at each of four waves, from 1994 to 2008, and additionally measured by examiners at wave IV. Information from all five assessments was used in the study. Zygosity was assigned by parental opinion (1, *definitely identical* to 5, *definitely fraternal*), but was verified by DNA analysis at wave III. DNA testing found that only 9% or 34 of the twins' zygosity were in error; findings from the present study remained the same when limited to only DZ twins, or to those classified as 'definitely' MZ or DZ.

Controlling for sex, age, birth weight, and zygosity, the main results were that (1) breastfed same-sex twins are approximately one inch taller and 12 pounds heavier than breastfed opposite-sex twins, and that (2) length of breast-feeding had no effect on these measures. Thus, it appears that human breast milk may also be tailored specifically to the sex of the child and that opposite-sex twins, as well as mixed-sex, high-order multiples, may be somewhat disadvantaged in this regard. A curious finding was that *never* breastfed opposite-sex twins were somewhat taller and heavier than their same-sex counterparts, a finding that warrants additional investigation.

The present study has been published in the *Journal of Experimental Child Psychology* and is available online at <http://www.sciencedirect.com/science/article/pii/S0022096516302685>.

Print and Online Media

Twins in Fashion

Identical female twins Sam and Cailli Beckerman are well-known in the fashion world (Kurtz, 2016). Described as 'human glitter', these 36-year-old female twins are hired by various fashion and lifestyle brands to influence the social media on current and changing fashion trends. They dress in what has been termed an 'intergalactic' style — playful, cartoonish, and attention-getting. Their personalities are also closely aligned — both twins are unusually joyful and outgoing. Their interests and talents also match — at one time they were designers, but finding that too stressful they now prefer attending fashion shows, taking photographs, and meeting people.

It would be worth knowing the frequency with which twins enter into joint business ventures and other occupations with each other. The extent to which identical twinship contributes to their success would be a key factor to assess.

Second Twin Pair Born to Tennis Star

Roger Federer became a father of twins for the second time, less than five years after the birth of his first pair (Reuters, 2014). The younger twins are females, Myla Rose and Charlene Riva, while the older twins are males, Leo and Lenny. It is unknown if the twins were conceived naturally or via assisted reproductive techniques. The birth of both pairs elicited jokes about future double champions, a possibility not out of the question given that athletic ability and participation are partly influenced by genetic factors (Segal, 2000).

Twin Primes

A prime number is a number that is larger than 1, and can only be divided by itself and 1; for example, 2, 3, 5, 7, 11, and 13. In 1989, the mathematician Alphonse de Polignac spoke about pairs of primes ('twin primes') that are separated by just two digits, such as 5 and 7, 11 and 13, and 17

and 19 (Cook, 2015). However, continuing along the number line shows that these pairs occur less frequently and less often. For example, 2,237 and 2,239 are followed by 2,267 and 2,269, but the next occurrence is 31,391 and 31,393. After that, the next twin primes do not appear until 31,511 and 31,513. Euclid developed a proof showing that there are an infinite number of primes. It has been conjectured that the twin primes will always appear as you move along the line of numbers — this conjecture has withstood all attempts at proving it. UCLA math professor, Terence Tao, is known for his research in this area, having earned the Fields Prize, considered the Nobel Prize of Mathematics (Wolpert, 2006).

It is worth noting that the late neuroscientist Oliver Sacks described a pair of identical twin autistic savants in his book, *The Man Who Mistook His Wife for a Hat* (Sacks, 1985). According to Sacks, twins John, and Michael, while inept at simple calculations, were excellent calendar calculators — able to quickly provide which day of the week on which a randomly chosen date occurred. Moreover, the twins were able to exchange six-figure numbers, all of them primes. Sacks then presented them with an 8-digit prime to which the twins provided a 9-digit prime, continuing the exercise with longer prime numbers. However, the veracity of Sacks's account has been challenged, given that his ability to check the accuracy of the twins' responses at that time, without the availability of appropriate computer programs, would have been uncertain (Van Erp, 2012).

Twin Pandas

A second pair of twins was born in September 2016 to Lun Lun, a 19-year-old giant panda, in the Atlanta zoo (Associated Press, 2016). Lun Lun was artificially inseminated in March of that year by male panda Yang Yang, with whom she has had a total of seven offspring — all seven were the results of artificial insemination. The first pair of twins, Mei Lun and Mei Huan, was born in 2013 and resides at China's Chengdu Research Base of Giant Panda Breeding.

References

- American Heart Association. (2017). *Tetralogy of Fallot*. Retrieved from https://www.heart.org/HEARTORG/Conditions/CongenitalHeartDefects/AboutCongenitalHeartDefects/Tetralogy-of-Fallot_UCM_307038_Article.jsp
- Associated Press. (2016, September 5). 'Zoo Atlanta's Giant Female Panda Gives Birth to Twins, Again.' <http://www.latimes.com/nation/ct-pandas-born-zoo-atlanta-20160905-story.html>
- Cook, G. (2015, July 24). The singular mind of Terry Tao. *New York Times*. Retrieved from <https://www.nytimes.com/2015/07/26/magazine/the-singular-mind-of-terry-tao.html>
- Hinde, K. (2007). First-time macaque mothers bias milk composition in favor of sons. *Current Biology*, 17, R958–R959.
- Hinde, K. (2009). Richer milk for sons but more milk for daughters: Sex-biased investment during lactation varies with maternal life history in rhesus macaques. *American Journal of Human Biology*, 21, 512–519.
- Hinde, K., Foster, A. B., Landis, L. M., Rendina, D., Oftedal, O. T., & Power, M. L. (2013). Daughter dearest: Sex-biased calcium in mother's milk among rhesus macaques. *American Journal of Physical Anthropology*, 151, 144–150.
- Kanazawa, S., & Segal, N. L. (2017). Same-sex twins are taller and heavier than opposite-sex twins (but only if breastfed): Possible evidence for sex bias in human breast milk. *Journal of Experimental Child Psychology*, 156, 186–191.
- Kirzinger, A. E., Weber, C., & Johnson, M. (2012). Genetic and environmental influences on media use and communication behaviors. *Human Communication Research*, 38, 144–171.
- Kurtz, S. (2016, September 14). 'Human glitter'. The Beckerman twins are fashion week stars. *New York Times*. Retrieved from <https://www.nytimes.com/2016/09/15/fashion/beckerman-twins-new-york-fashion-week-social-media-influencers.html>
- Pietilä, S., Björklund, A., & Bülow, P. (2012). Older twins' experiences of the relationship with their co-twin over the life-course. *Journal of Aging Studies*, 26, 119–128.
- Reuters (2014, May 7). Roger Federer and wife welcome 'miracle' second set of twins. *Telegraph* Retrieved from <http://www.telegraph.co.uk/sport/tennis/rogerfederer/10812543/Roger-Federer-and-wife-welcome-miracle-second-set-of-twins.html>.
- Sacks, O. (1985). *The man who mistook his wife for a hat*. New York: Touchstone.
- Segal, N. L. (2000). *Entwined lives: Twins and what they tell us about human behavior*. New York: Plume.
- Segal, N. L. (2006). Laboratory findings: Not twin, twins, not twins. *Twin Research & Human Genetics*, 9, 303–308.
- Segal, N. L. (2012). *Born together-reared apart: The landmark Minnesota twin study*. Cambridge, MA: Harvard University Press.
- Segal, N. L. (2013). Personality similarity in unrelated look-alike pairs: Addressing a twin study challenge. *Personality and Individual Differences*, 54, 23–28.
- Segal, N. L., Stohs, J. H., & Evans, K. (2011). Chinese twin children reared apart and reunited: First prospective study of co-twin reunions. *Adoption Quarterly*, 14, 61–78.
- Van Erp, P. (2012, May 9). Oliver Sacks's twins and prime numbers. Retrieved from <http://www.pepijnvaneerp.nl/articles/oliver-sackss-twins-and-prime-numbers/s>.
- Wolpert, S. (2006). Terence Tao, 'Mozart of Math,' is first UCLA prof to win Fields Medal. UCLA Newsroom. Retrieved from <http://newsroom.ucla.edu/releases/Terence-Tao-Mozart-of-Math-7252>.