

CHAPTER 12

Twin Spouses and Unrelated Look-Alikes: New Views

When identical twins marry non-twin sisters (or non-twin brothers) their children become unusual close cousins and atypical “part-siblings.” I will talk about these, as well as findings related to the unique types of relatives that emerge when twins have children, that offer insights into the roots of social affiliation and social closeness. The curious twin-like pairs composed of two unrelated look-alikes add another interesting twist to what we know about the origins of personality development and self-esteem. I will also delve more deeply into the nature and quality of twin pair relationships, both inside and outside the womb.

1. *When identical twins marry non-twin sisters (or non-twin brothers) their children become unusual first cousins and atypical half-siblings.*

Reality Check: True

Short Answer: In Chapter 2 I reviewed the Children-of-Twins research design, created naturally when identical twins marry unrelated partners and both twins raise children. Recall that the two sets of children in such a case are legal first cousins, but they are also genetically equivalent to half-siblings (sharing 25% of their genes, on average) because they each have one genetically identical parent. I also described the rare situation in which identical twins marry identical twins, producing children who are genetically equivalent to full siblings (sharing 50% of their genes, on average). However, if identical twin brothers were to marry nontwin sisters then their children’s average biological relatedness would fall between 25% and 50%—not quite full siblings, but closer than cousins and half-sibs.

More of the Story: Chang and Eng Bunker are among the most famous conjoined twins, as I discussed in Chapter 1. They are known for many things. In 1843, these identical twin brothers married nontwin sisters, Adelaide and Sarah Yates, settled in Mount Airy, North Carolina and raised 22 children between them—Chang and Adelaide had 10 children and Eng and Sarah had 12. The two families maintained separate households, and to keep things fair they alternately spent 3-day periods in each home. According to Chang and Eng, the sisters’ parents’ main

objection to their marriage was the twins' Asian origin, not the fact that they were conjoined [1–3].

The genetic relatedness of these twins' children to one another is curious to consider. The fathers are identical twins, related by 100%, so the chance that children conceived by each twin share their paternal genes is 50%. The mothers are full siblings, related by 50%, so the chance that children conceived by the two sisters share their maternal genes is 25% (half of 50%). Averaging these figures yields 37.5%, the average genetic relatedness of children born to identical twins who marry full siblings.

The Bunker twins left hundreds of descendants that convene every year in Mount Airy for a family reunion. Several sets of twins (none conjoined) have been born in later generations of that family, such as fraternal twins Chang Bunker and Eng Bunker (Eng's great-grandsons), who attended the 25th annual reunion of the Bunker twins' descendants, held in 2014 at the First Baptist Church. This event included approximately 200 descendants of the original conjoined twins.

2. *Identical twins generally have closer social relationships with one another than fraternal twins.*

Reality Check: True

Short Story: Research shows that identical twins, on average, are socially closer and more emotionally involved with each other than fraternal twins. But like many other features of twinship that I have examined in this book, there is plenty of variation and overlap—some identical twins are not very close to one another and some fraternal twins are exceptionally close. I believe that the bases of these relationship differences come from identical twins' perceptions of their similar abilities, interests, and ways of looking at the world, all of which are genetically influenced at some level. In contrast, many fraternal twins lack the similarities in intellect, personality, and interests that draw and keep identical twins so closely together.

Since about 2013, I have been corresponding with Miriam Cohen, a 25-year-old identical female twin from a religious Jewish community on the East Coast of the United States. Miriam's description of her relationship with her sister Devorah Cooper beautifully captures the essence and subtleties of identical twinship:

“The love that a twin has for a [co-twin] sister is parallel to the love a mother has for her child! When I found my husband and got married a half of me wasn't complete because my twin didn't find hers... Becoming pregnant was the next step and there was always a small doubt: “what if it doesn't happen?” So when both of us married and became

pregnant it was magical and breathtaking. Thank G-d that she became pregnant a month after me, or my happiness wouldn't have been complete!" Miriam (left) and Devorah are the identical twins pictured on the cover of this book.

Reflections from a male fraternal twin reveal a different side to twinship. "While it was great in childhood, and I love my brother, I've always resented comparisons: "Who's smarter? Who's faster? Who's better looking? Who has more luck with women? It irritates me when people ask me those kinds of things. Many people seem to be really insensitive to that kind of stuff. Or maybe I'm just too sensitive. Consequently, I usually don't discuss being a twin with people I'm not close to."

Both of these comments could apply to identical *and* fraternal twins, underlining the social-interactional overlap between the two types. However, in both my research experience and personal contacts with twins and their families the different comments presented earlier better characterize identical pairs and fraternal pairs, respectively.

More of the Story: There is a large body of research showing that identical twins are socially closer in many ways than fraternal twins [4–6]. This is true regardless of the age, sex, and rearing status (together vs. apart) of the twins, as well as the varied theoretical orientations (e.g., psychodynamic, social-genetic) and methods (questionnaires, observation) particular to each study. And as I showed earlier, the loss of a twin is somewhat more devastating for identical twins, mirroring the research on social relations. Thus, these findings are very robust.

Contrary to the kinds of relations that typify the different pairs, I occasionally encounter identical and fraternal cotwins who claim to dislike—even loathe—each other. My first real experience with such twins occurred in the mid-1990s when I was invited as a guest on the *Oprah Winfrey Show*. The program was to be about twin relationships and I was intrigued. But witnessing the set-up piece from the green room just minutes before my airtime, I was horrified by what I saw: several sets of identical and fraternal twins described cruel and insensitive behavior toward one another—one identical female twin had actually pushed her sister out of their car while her sister was pregnant. Worried that the parents and twins who tuned into the show would get a distorted view of twinship, I informed viewers that these scenarios were rare exceptions, and hardly typical of how the vast majority of twins act toward one another.

At the same time, twin-to-twin relations are complex and what twins sometimes say about each other is not always what they mean. Harsh words toward his identical twin were voiced by a gentleman at one of my book signings, so it surprised me when he purchased two copies of my book—one for him and one for his twin brother. I was also fascinated by the relationship maintained by reared-apart identical twins Jack (raised Jewish in Trinidad) and Oskar (raised Catholic in Nazi Germany). Despite their very different historical and political opinions and outlooks, these twins stayed in close contact, even while they argued. These incidents highlight the intense attachment and devotion that twins feel toward one another, even if they do not always get along.

Two of my colleagues are clinical psychologists as well as identical twins, so they are uniquely suited to guiding twins through their tense times with each other. It is often easier to abandon a difficult relationship, but psychologically that does not seem to be a viable option when you are a twin—twins cannot divorce!

3. *Unrelated look-alikes (doppelgängers) are as similar in personality and self-esteem as identical twins.*

Reality Check: False

Short Answer: There is an unusual group of individuals whose faces and forms are nearly identical, giving them the appearance of identical twins—only they are *not* genetically related. These curious look-alikes have been beautifully photographed by French Canadian photographer François Brunelle for his project ironically titled, “I’m Not a Look-Alike!” The members of these pairs are usually identified when someone who knows Person A comes across Person B who looks a lot like Person A. I had this amazing experience at the University of Minnesota when I encountered a young woman in a supermarket who closely resembled a young woman I already knew. My colleague, Professor Bouchard and I asked the two women to complete part of the same test battery we gave to our reared-apart twins, but we could conclude little from just one case. We had no idea that there were a number of unrelated look-alikes out there.

Brunelle maintains a website for describing his project and recruiting new look-alikes for his photo gallery [7]. One of my students discovered this site while surfing the Internet and forwarded the link to me. I immediately wanted to study these pairs to address a serious challenge raised in opposition to twin studies—namely that identical twins

are alike in personality because people treat them alike, due to their matched physical appearance. However, I reasoned that if personality is shaped mostly by how one is treated then unrelated look-alikes should be as similar in personality and self-esteem as identical twins reared apart.

The answer is that unrelated look-alikes are very *dissimilar* in both personality and self-esteem. If people treat identical twins alike (and they do) it is because identical twins' matched behaviors evoke or encourage similar responses from others. As my late colleague David C. Rowe reminded us, "Personality and temperament reside in the brain, not in a face" (p. 48) [8]. Of course, some look-alikes will resemble one another in personality, interests, or values—I have worked with unrelated look-alikes who share vocational and leisure-time interests. However, the bottom line comes from the degree of similarity across many look-alike pairs, not just a few—*there is no meaningful connection between how much people resemble one another in appearance and how much they resemble one another in behavior* (Fig. 12.1).

More of the Story: Scientific collaborations are often formed in whimsical and unpredictable ways. I presented findings from my first unrelated look-alike project, in 2012, at the 14th International Congress of Twin Studies, in Florence, Italy. I showed the audience the data demonstrating that the pairs I studied showed no personality similarity at all. When the session ended Dr. Ulrich Ettinger from Bonn, Germany approached me to say that he had tested the *same* group of participants when he was in Canada, expecting them to be similar in personality—but when he discovered that they were not, he no longer pursued the project. I was instantly intrigued because his findings matched mine, so I asked him to send me his data, which he did. Our joint efforts resulted in a second paper involving personality similarity in unrelated look-alikes using the same participant pairs, but comparing their scores on two different personality questionnaires—his and mine [9]. This second paper replicated the results from the first study, lending confidence to the findings.

In my initial study conducted solo, 23 look-alike pairs completed the Questionnaire de Personnalité au Travail (PfPI or Personality for Professionals Inventory) and the Rosenberg Self-Esteem Inventory. The second study combined these data and Ettinger's personality data from the French version of the 60-item Neuroticism–Extraversion–Openness (NEO) Inventory. Both personality questionnaires yield



Figure 12.1 Bizarro's bizarre perspective on the origin of unrelated look-alikes. (Reprinted with permission from Dan Piraro. Image source: Bizarro.com).

scores across the Big Five personality traits of openness, conscientiousness, extraversion, agreeableness, and neuroticism.

The average correlations across the five personality traits were $-.05$ in the first study and $-.03$ in the second study. In contrast, the mean correlations for identical and fraternal twins raised apart and together are $.53$ and $.15$, respectively; even fraternal twins who do not look physically alike show some degree of personality similarity. The correlation for the unrelated look-alikes in self-esteem was $-.03$, in contrast with correlations of $.30$ – $.35$ for reared-together identical twins and $.11$ – $.16$

for reared-together fraternal twins. This pattern of findings supports the view that *identical twins' resemblance in personality and self-esteem comes from their shared genes, not from their similar treatment by others.*

It is worth restating this conclusion using different words: to the extent that identical twins are treated alike (and they are), their similar treatment comes from the fact that they elicit similar responses from others, based on their behaviors. Behavioral geneticists call this process *active or evocative gene–environment correlation*, the idea that we respond to people based on our perceptions of their moods, actions, and talents. When parents encourage shy children to be more socially active, restrain rambunctious children from speaking out of turn, or offer swimming lessons to children who love the water they are personifying active gene–environment correlation.

Together, these studies generate several important implications for families with identical and fraternal twins. If parents actively encourage their twin children to wear the same clothing, have the same friends, or join the same activities, this does *not* make the twins more alike in most personality traits than twins whose parents offer them different opportunities. If parents treat twins alike it is partly out of their desire for fairness, but partly because twins (mostly identical) evoke similar treatment from their parents. Studies show that even when parents misjudge their twins' twin type—that is, parents think that their identical twins are really fraternal, and vice versa—their ratings of their twins' personality traits tend to agree with the children's *actual* twin type [10].

I often tell mothers and fathers, “You do not bring up your children—your children bring you up.” Parents know that how they respond to and raise their obedient son does not work as well with their rebellious daughter. Either knowingly or not, parents adjust their rearing practices in accordance with each child's individual temperament and talents.

4. *Just like reared-apart identical twins, doppelgängers form close social relationships with one another once they meet.*

Reality Check: False

Short Answer: Very few of the unrelated look-alikes I have studied were socially attracted to one another or developed a close relationship. It seems that doppelgängers lack the “social glue” (i.e., the behavioral similarities and the perception of these similarities) needed to form and maintain close social relations with one another. Just looking like someone else does not mean that you behave alike, nor does it mean that you will become socially close.

More of the Story: The unrelated look-alikes photographed by Brunelle give us the unique opportunity to explore a fascinating question: Do these unusual pairs form close social relations with one another, like their genetically related parallels, that is, reared-apart and reunited identical twins?

In order to help us answer this question, I had the look-alike pairs complete a questionnaire regarding their initial and current feelings of social closeness and familiarity—the same form was completed by the reunited twins in my earlier study [9]. It turned out that only 17% of the look-alikes felt, or anticipated, feeling “very close” to one another when they first met. Even more revealing, this percentage increased only slightly, to 21%, when they described their current relationship—while the greatest increase occurred in the “not close” category. In contrast, over 70% of the identical reared-apart twins felt, or anticipated, feeling close to one another upon meeting, a percentage that increased to 80% for their current relationship [4]. I concluded that each identical cotwins’ perception of their similarities explained the different results.

Despite what the data revealed, I believe that other explanations warrant consideration. It could be argued that twins’ knowledge and confirmation of their twinship (e.g., through birth records or DNA testing) was an important factor in shaping the findings—that is, perhaps *knowing* someone is your twin could conceivably trigger feelings of closeness and familiarity. However, I do not agree with this view. First, the reunited fraternal twins were also aware of their twinship, yet fewer felt as socially bonded as the identical twins, probably because most fraternal twins are less alike behaviorally. Second, there are examples of twins and siblings who have been strongly attracted to one another without knowing they were related.

A pair of 20-year-old identical reared-apart Canadian twins, George and Brent, fell easily into a close friendship for a full year before considering the possibility that they were twins—they had thought all along that they were exceptional look-alikes. And before knowing they were related, 5-year-old reared-apart identical female twins from England became close school friends, despite their families’ efforts to keep them apart; both sets of parents knew that their daughters were twins. I will say more about these young girls in the final chapter.

Separated siblings and half-siblings do not look as alike as identical twins, but some who met each other at work formed close relations before knowing that they were biologically related. Furthermore,

as described earlier, strong social attraction between reared-apart opposite-sex twins has led to marriages between several such sets without their knowledge of being twins. In addition, my research on switched-at-birth twins who grew up in the wrong family shows that they are generally loyal toward the unrelated siblings with whom they were raised (their alleged fraternal twin), but lack the close understanding and compatibility that they quickly develop with their newly found identical twin. These examples suggest, but do not prove, that the mutual perception of similarities in intelligence, personality, and/or interests provides a basis for social attraction between people. The challenge is to find additional ways to confirm this conclusion; therefore, I am continuing my studies of unrelated look-alikes with the aim of doing so.

5. *Identical twins reared apart are as similar in personality as identical twins raised together.*

Reality Check: True

Short Story: Dr. Thomas J. Bouchard, Jr., Director of the Minnesota Study of Twins Reared Apart, used to say it is counterintuitive, but true, that identical twins reared apart are as alike in personality as identical twins reared together. Logic tells us that people living in the same home should resemble one another more than people living in separate homes, but an abundance of twin data tells a different tale: the reason why some family members share personality traits is because they share genes, *not* because they share environments. It is also true that some family members, despite years of living together, differ considerably in emotionality, extraversion, and/or traditionalism because while they share genes, they do not share genes associated with those traits. This is a great example of how twin research findings offer insight into nontwins' behaviors, telling us why we resemble some family members, even those we have never met, but not others.

More of the Story: One of the most provocative findings to have emerged from the Minnesota Study of Twins Reared Apart was that identical reared-apart twins are as similar as identical reared-together twins across 11 personality traits, as measured by the Multidimensional Personality Questionnaire [11]. The median correlations were .49 and .52 for the identical reared-apart and reared-together twins, respectively. These findings demonstrate that personality similarity is based on shared genes, not shared environments.

These results were largely misconstrued by the public and by some colleagues who believed that our findings dismissed the influence of the

social environment, parenting practices, and other experiential influences on personality development. However, we noted that the influence of the environment was evident in the size of the 11 correlations for the reared-apart identical twins, which were mostly about .50—this meant that half of the personality differences (variation) from person to person were explained by the environmental differences among them. But for the majority of traits we measured, such as well-being and traditionalism, it was mostly unique individual experiences (non-shared environmental factors) that mattered, possibly taking a class or living abroad. Thus, the environment helps shape personality, but not by making relatives who live together more alike—the events we experience individually tend to make us different from our family members, while the genes that we share tend to make us alike.

An exception in our results was that the personality trait of sociability *did* show evidence of shared environmental influence. This means that growing up with family members *does* increase similarity in some social behaviors. Showing high levels of affiliation toward a relative by acknowledging his or her birthday or anniversary would usually be responded to in kind, with high levels of affiliative behavior. Conversely, overlooking a family member's birthday or other important dates would probably be matched by comparable neglect. This mirroring of actions and inactions illustrates the shared environment or shared family effect on behavior.

Parents can sway children's behaviors in one direction or another, but they can rarely change their child's basic personality traits. Most mothers and fathers know this, especially parents of fraternal twins and virtual twins, who constantly witness the simultaneously different expression of personality traits in their two same-aged children.

6. *Identical twin aunts and uncles are more involved with their nieces and nephews (i.e., their cotwins' children) than fraternal twin aunts and uncles.*

Reality Check: True

Short Answer: As I've indicated throughout this book, identical twin aunts and uncles are the "genetic mothers and fathers" of their cotwin's children. In contrast, fraternal twin aunts and uncles enjoy the usual biological aunt/uncle–niece/nephew relationships with their cotwin's sons and daughters. It is, therefore, not surprising to find that identical twin aunts and uncles scored higher than fraternal twins aunts and uncles on a questionnaire designed to assess the twins' social closeness toward their nieces and nephews. Sample questions were, "This child thinks of him/herself

as one of my children,” and “I generally think of this child as my own,” to which the twins answered either true, somewhat true, or untrue.

I could not help but think of my own twin situation as I reviewed the results from this study. My fraternal twin sister Anne has a son whom I love very much, but I would never consider him to be my own child. I was also reminded of my conversation with an identical twin whose sister passed away, leaving several young children behind. The surviving twin was adamant about gaining custody of these children, feeling that she had greater claim to them than the children’s father. I never learned the outcome of this case, but it made a deep impression on me, causing me to think carefully about the driving force behind this twin’s behavior that I discuss in more detail later in this chapter.

More of the Story: Evolutionary psychology, a relatively recent discipline, formalized in the late 1970s and early 1980s, goes beyond the “what” of behavior to address the “why.” This discipline is dedicated to finding the psychological mechanisms that evolved to meet the environmental challenges and demands that confronted our ancestors. An evolutionary perspective helps us understand why reputation matters, why children are important, and why males and females respond differently to partner infidelity. Evolutionary psychology also provides insights into altruism and why the desire to help others evolved.

A longstanding dilemma for evolutionary researchers has been accounting for altruistic behavior, because acting altruistically involves some cost to the self while benefitting another. In 1964, the evolutionary biologist William D. Hamilton resolved this impasse by proposing that we are predisposed to be more altruistic toward close kin (i.e., individuals likely to carry common genes) than distant kin (individuals likely to share relatively fewer common genes)—this would be an indirect means by which one’s genes are transmitted to future generations. Hamilton also came up with the concept of *inclusive fitness*, defined as an individual’s reproductive success (transmitting copies of one’s genes to future generations by having children), plus the reproductive success of relatives other than children (the transmission of copies of one’s genes by close relatives who share some of these genes). Of course, people would not consciously calculate their degree of genetic relatedness toward a potential recipient before performing a kind deed—but perhaps perceptions of similarity trigger emotions giving rise to a range of helping behaviors that are more or less likely, depending on the relatedness and circumstances of the recipient.

I have always believed that identical and fraternal twins are ideal subjects for testing evolutionary-based hypotheses related to affiliation and cooperation. That is because the two twin types differ in their degrees of genetic relatedness, but their same age and social background hold many complicating factors constant. I, therefore, launched the “Twins Who Are Parents Study” to compare the social relatedness of identical and fraternal twin aunts and uncles toward their nieces and nephews [12–14]. Every participant completed a Closeness Questionnaire, specially designed for this study. The two main findings from this ongoing study are that (1) identical twins express greater overall closeness toward their cotwin’s children than fraternal twins, and (2) regardless of twin type, twins with female cotwins express greater closeness toward their cotwins’ children than do twins with male cotwins.

Identical twin aunts and uncles are as closely related to their nieces and nephews as the twin mother or father who conceived these children. It may be that these identical twins perceive similarities between themselves and these children, giving rise to the greater social closeness they express, relative to the fraternal twin aunts and uncles. (This is similar to the process that may underlie the close social relations between identical twins that I described earlier.)

The greater closeness indicated for the children of twin sisters than twin brothers is consistent with predictions from *paternity uncertainty*. In other words, males can never be sure that a child born to their partner is truly theirs because of concealed ovulation (there are no clear signs to indicate when a woman is ovulating), internal fertilization (human eggs are fertilized inside the body so it is unclear if and when fertilization occurs), and continuous female receptivity (human females can engage in sexual activity at any time in the menstrual cycle). In contrast, there is certainty that a child born to a sister is a true genetic relative—if a woman bears a child, of course it is *hers*—possibly enhancing feelings of social connectedness toward that child on the part of aunts and uncles.

I was surprised that the frequency of gift giving and the cost of gifts presented to nieces and nephews did not differ between identical and fraternal twin aunts and uncles. Perhaps such behaviors are guided by societal expectations, limiting gift giving to birthdays and holidays. However (regardless of their own sex), twins with female cotwins gave more gifts to their nieces and nephews than did twins with male cotwins, consistent with expectations from *paternity uncertainty*.

The data from this study have been analyzed 3 times as the sample size increased, yet the results did not change. Were I to replicate this study I would question the children about their social relationships with their identical or fraternal twin parent and twin aunt or uncle. I might ask a niece if she feels as close to her aunt as she does to her mother (her aunt's identical twin), or ask a nephew to compare his degree of physical resemblance to his uncle and to his father (his uncle's identical twin). This information would provide another approach to the class of questions concerning genetic influences on social relatedness. Such a study would further illustrate the many ways twin methods can be used in psychological research, and offer another example of how informative twins can be just by acting naturally.

7. *The enduring social bond between twins is shaped by their interactions in the womb.*

Reality Check: Unlikely

Short Answer: I was fascinated the first time I sat through a short film featuring pairs of fetal twins who seemed happily at play. It was the mid-1990s and I was at a meeting of the *International Society for Twin Studies*. One fetal twin initiated a movement, such as kicking the leg of the cotwin and causing the cotwin to move. Since then, I have seen more of these cinematic wonders made by Dr. Alessandra Piontelli from Italy and Dr. Birgit Arabin from the Netherlands. The different twins variously hug, kiss, and even take swings at each other.

It is tempting to believe that twins' prenatal interactions lay the basis for the social relationship they will later display as children and as adults. A mothers of twins club bulletin noted that twins "start *deliberately* (my emphasis) interacting at 14 weeks" [15]. And according to some members of the media, "There's been a long-held belief that twins have a special bond. And it looks like it *starts* (my emphasis) when they're in the womb together" [16]. Finally, a study of the effects of cobedding on preterm twins' stress (following heel lance to obtain blood for phenylketonuria testing) asserted that cobedding twins allows "recognition of familiar auditory and olfactory stimuli and a *continuation* (my emphasis) of the twin relationship that began in utero" (p. 598) [17].

These statements fuel a mythconception that is unlikely, but is also difficult to disprove conclusively. Twins *do* interact with one another in the womb, but there is no hard evidence that their physical interactions *before* birth lay the basis for the social interactions they experience *after* birth. At the start of their prenatal encounters, identical twins are more

behaviorally alike than male–female twins, but this difference disappears during prenatal life [18]. I believe that if twins’ prenatal behaviors were tied in a meaningful way to their later social relationship, then interactional differences between identical and fraternal twins should be observed in the womb—and they are not. Scores of studies tell us that identical twins share a closer social bond than fraternal twins—I would, therefore, argue that the social bond between twins develops *after* birth, as the similar tendencies and temperaments of identical twins draw them more closely together than fraternal twins (see number 2).

It is also important to consider the distinction between *interaction* and *social interaction*. Interaction can occur without awareness of others and actions can occur without intent (e.g., intrauterine kicking and punching). In contrast, social interaction requires awareness of others and actions can be expressed with intent (e.g., young infants’ social smiles and cries for attention). It is possible that some of what transpires between twins in the womb affects their relationship after birth—perhaps the odor or sound of a newborn twin, familiar from prenatal days, begins or continues their earliest interactions as some researchers have alleged. And perhaps prenatal experiences facilitate relations between reared-apart twins when they are reunited as adults. I believe that both possibilities are very unlikely, but we simply do not know.

More of the Story: As I indicated earlier, twins interact physically with one another before they are born—in fact, fetal movements are detected at about the 7th gestational week. At this time, most twins are too far apart in the womb to touch and most are separated by their amniotic membranes. But by weeks 11–13 most twins engage in physical contact with one another and react to that contact from the cotwin—Dr. Piontelli calls this “intrapair stimulation” (p. 35)—and by week 15 such behavior occurs constantly [18]. Twins move their arms and legs, touch their heads and limbs and hang on to their umbilical cords.

Prenatal twins’ interactive behaviors do not appear to be expressed with any intention or awareness of the other. Low oxygen tension in fetal blood, as well as pregnanolone and prostaglandin D2 that are provided by the placenta, keep the fetus sedated [19]. If prenatal cotwins’ interactive activities influence the nature of their postnatal relationship, then identical twins should show more sustained coordinated behaviors in the womb than fraternal twins, but that is not the case. Research conducted in 2012 found no evidence that fetal dichorionic twins’ body movements and rest–sleep cycles are coordinated, challenging some

previous reports. It seems, instead, that any synchronized behaviors displayed by twins are infrequent, brief, and unintentional [20].

I am, however, curious about some parents' observations of their young single surviving twin children who variously crave physical contact, show unusual interest in twins, and/or talk about twins often. Consider this comment sent to me by a surviving triplet:

"I forget how old I was when my mom told me, but when I was a young girl, she told me that I was a triplet and my triplet brother and sister were miscarried. In my crib, I would sleep with my head in the corner. As a young adult, I am very cuddly and if there's a sleepover where lots of people have to share one mattress, I'm very content being the one squished in the middle. I wonder if this could have something to do with being the Baby B in a set of triplets."

The triplet quoted above made a convenient connection between sharing prenatal quarters with two others and currently feeling comfortable in small spaces. However, a causal relationship cannot be assumed, especially since most miscarriages occur before the 12th week of pregnancy, limiting shared intrauterine time [21]. Dr. Piontelli suggests that the tactile sensations twins experience in the womb might be recalled at some level. That may be possible, but has not been demonstrated conclusively and so cannot be linked in a meaningful way to being born a twin or triplet.

8. *Twins growing up apart sense the absence of their cotwin.*

Reality Check: False

Short Answer: There is no evidence that twins separated at birth and raised in different homes are aware of being a twin. During my 9-year association with the Minnesota Study of Twins Raised Apart and beyond, I have met people who (as adults) were shocked to discover that they had a twin brother or sister. Many of them had been adopted and learned the news from adoption agencies while searching for their biological family members or from other sources.

My latest example of discovering one's twinship later in life concerns fraternal twins, Ann Hunt and Elizabeth (Liz) Hamel, born in England in 1936 [22]. Separated at 5 months of age, Ann was given up for adoption, while Liz was raised by the twins' single biological mother; Liz and her mother moved to the United States when Liz was in her 20s. Ann never knew she had a twin, while Liz (who learned this from her mother) believed that finding her sister in another country would be too difficult. But when Ann's daughter Samantha conducted a search for her mother's biological relatives she discovered that her mother had a twin

sister living in Oregon and tracked her down. The twins' reunion at 78 years of age, witnessed by their children, my research team, and the BBC, occurred on my campus in Fullerton, California, in May 2014. The event was thrilling, moving, and unforgettable. Ann and Liz are now featured in the *Guinness World Records* book as the world's longest separated pair of twins [23].

A sad ending to this story is that Liz passed away the following November, just 6 months after meeting her twin. But Ann is so grateful for the brief time they enjoyed together, as are their children who discovered new aunts, uncles, nieces, nephews, and cousins. When Ann turned 80, her beautifully decorated cake read, "Happy 80th Birthday, Ann & Liz."

More of the Story: We know that twins growing up together respond to one another as social beings quite early in infancy, possibly before nontwin infants for whom exchange of smiles and evaluation of peer behaviors have been observed at 6 months [24,25]. Pediatrician, T. Berry Brazelton, offered this description: "As early as three and four months of age, when one [twin] baby was out of the room the other seemed disoriented and looked around as if watching and waiting... when they were propped up facing each other, they played and cooed for long periods. At times, the pleasure they gave each other seemed more important than anything the parents could offer..." (p. 84) [26]. No doubt, twins' physical proximity enhances their mutual responsiveness, behavior that could conceivably evolve between some unrelated near-in-age infants.

Twins raised apart, even after spending their first 2–3 years together, would not recall such early interactions with one another. In June 2010 I met Tairi, an identical twin from Puerto Rico who was inadvertently switched at birth, but returned to her biological family at 18 months when the exchange was discovered. Not surprisingly, Tairi has no recollection of her first home or her first "twin"—memories are typically not recalled until children reach their 3rd birthday [27].

This discussion made me wonder—when do twins become aware that they are part of a multiple birth set? We do not know exactly when the concepts of twins and twinning are acquired, but we do know that they have to be taught. I can recall my mother explaining the "twin facts of life" to me when I was about 4 years old... And in my opinion, twins reared apart are our best test of that question. The reared-apart twins I have studied, such as Roger and Tony, Debbie and Sharon, and Samantha and Anaïs, despite having shared a womb, did *not* know that they were twins until they learned this from a relative, gained access to

their medical records, or underwent DNA testing after being mistaken for someone else. There is no evidence of intrauterine knowledge of twinship. True, some adopted away twins have told me that once they met their cotwin they felt that a missing piece in their lives had finally been filled. I believe them. But many adopted individuals experience such feelings of “inner emptiness,” even those from loving homes—and many people, not just reared-apart twins or adoptees, await the person, place, or event that will make their lives complete [28].

Some beliefs about twins, namely, those concerning the effects of prenatal environments on their evolving twin relations, cannot be fully examined because the technology needed to do so is unavailable. Perhaps one day we will have better methods for monitoring twins’ interactions in the womb, revealing findings that will surprise and excite us.

In the final chapter, I will address some unresolved issues in twin research, such as which investigator conducted the first twin study and the risk of breast cancer among mothers of twins and twins. I will also take a look at twin research today and offer an opinion about where it should be headed tomorrow. For example, research on twins with special needs is a growing area, given the dramatic increases in twinning rates, but there are misunderstandings about how disabled twins affect the family, especially the mentally and physically able cotwin.

Trends are also toward the increased use of twins in epigenetic, molecular, and genomic studies, but there are limits to what these studies can reveal, and these limits are important to understand. I will talk about that. The role that the classic identical–fraternal twin comparison will play in future twin research has come into question. However, knowing which behavioral and medical traits are interesting and important for genetic studies are decided largely from studying twins up close and listening to their life stories in person. That is also where the fun is. That is why I am convinced that the simple and elegant identical–fraternal twin comparison will never lose its allure. I will talk about that, too.

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