

CHAPTER 12

SYNESTHETIC PERSONIFICATION

The social world of graphemes

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INTRODUCTION

Native speakers of some languages think of houses as masculine, kitchens as feminine, and living-rooms as masculine. This is the case in Polish—one of many languages in which grammatical gender is assigned to nouns. Grammatical gender and other noun classes vary across languages. English does not have grammatical genders. French and Spanish have two—masculine and feminine, while language such as Polish or German have three (also including a neutral category). Some languages (e.g., Sesotho) have up to 20 noun classes (Sera et al. 2002). To a German or Polish speaker, moons are masculine, whereas to a Spanish speaker moons are feminine. If you are a native English speaker, moons and most other nouns depicting inanimate objects are probably genderless to you, unless you are bilingual. However, some individuals do attribute genders to certain words (e.g., the weekdays or month names) or even to graphemes (e.g., a or 3), regardless of whether their language has grammatical genders at all (and irrespective of the specific grammatical genders attributed to the word in other languages). This automatic attribution of gender is common among synesthetes, where it seems to be as involuntary as synesthetic colors and in many cases relatively stable over time. Moreover, synesthetes who experience this unusual form of personification often attribute not only genders but also a whole range of social and personal attributes. These may include personality traits (*B is shy*), family relationships (*B is A's child*), mental states (*K knows when to stop or say no*), moods (*K is happy*), and more. These features can be attributed to letters, numbers, other sequences, concepts, and certain objects.

It is now recognized that such instances of personification may qualify as a type of synesthesia in their own right (Amin et al. 2011; Simner and Holenstein 2007). Simner and Holenstein argued that its characteristics are in line with modern definitions of synesthesia. For example, Hubbard (2007) defines synesthesia as a condition in which stimulation of one sensory or cognitive stream induces an involuntary and idiosyncratic experience in one or more additional modalities or streams. These associations between a trigger and a synesthetic sensation (known as the “inducer” and “concurrent” respectively) remain consistent over time.¹ Grapheme personification fulfils these same requirements: the inducer and concurrent belong to different cognitive streams; the correspondences are idiosyncratic, involuntarily elicited, and consistent over time (although some synesthetes report that their graphemes’ personalities may develop with time or be subject to mood swings).

Variants of synesthesia involving some sort of personification have been described using partially-overlapping terminologies. Mary Calkins (1893) used the term *dramatization* to describe the personification of graphemes among synesthetes. Contemporary studies also describe several other instances of personification, with inducing stimuli including inanimate objects, body parts, weekdays, months, seasons, etc. Some attempts have been made to name and characterize the phenomenon with greater precision. Julia Simner and Emma Holenstein (2007) emphasized the ordinal and linguistic nature of most inducers that evoke synesthetic personifications (letters, numbers, weekdays, months, seasons etc.), labeling it *ordinal linguistic personification*. Given that the range of reported synesthetic inducers is wider than just ordinal linguistic sequences and includes everyday objects, Simner, Gartner, and Taylor (2011) recently suggested the new term *sequence-personality synesthesia*. A different feature of this phenomenon has been highlighted in a different designation—*social synesthesia* (Amin et al. 2011), in which emphasis is placed not on the nature of the inducer but rather on the social aspect, since it involves concepts from social cognition/perception such as personality traits, mental states, moods, social roles, etc. For clarity, in this chapter, we will refer to this variant of synesthesia as sequence-personality synesthesia or simply *personification*.

HISTORICAL BACKGROUND

Historical reports on synesthetic personification appeared as early as the nineteenth century. Two prominent figures in the field of psychology at that time were both interested in personification and synesthesia: American psychologist and philosopher Mary Calkins and Swiss psychologist—and friend of Carl Jung—Theodore Flournoy. The first

¹ For further discussion on the issue of defining synesthesia, please see Macpherson (2007), Simner (2012), or Sagiv, Ilbeigi, and Ben-Tal (2011).

studies of synesthetic personification were mostly exploratory and descriptive, primarily resulting in phenomenological descriptions of these synesthetic experiences (Calkins 1893; Flournoy 1893; Patrick 1893). In a group study of the “dramatization” of letters, numbers, and musical notes, Calkins (1895) attempted to identify the rules governing this type of synesthesia. In that particular sample, personifications for numbers were found to be twice as frequent as personifications for letters. Calkins hypothesized that numbers are more likely than letters to be the subject of emotional associations due to the greater level of “intellectual engagement” involved in number processing compared to letter processing. In her research, Calkins noted that synesthetes not only attribute personalities to graphemes, but also tend to like and dislike them. For example, she observed that the numbers 2 and 5 are often perceived as more likable than prime numbers such as 7, 11, and 13, and this may result from “the actual experience of facility in the use of even numbers, and of difficulties with the unyielding indivisibility of prime numbers” (Calkins 1895, 101). In the twentieth century, sequence-personality synesthesia is mentioned (though not identified as a distinct phenomenon) by the eminent Russian neuropsychologist Aleksander Luria in *The Mind of a Mnemonist* (1969), an elaborate case study of Solomon Shereshevskii, a synesthete who had at least five other different types of synesthesia. In the chapter dedicated to mental images, there is a passage in which Shereshevskii describes his personifications:

Take the number 1. This is a proud, well-built man; 2 is a high-spirited woman; 3 is a gloomy person (why, I don't know); 6 a man with a swollen foot; 7 a man with a moustache; 8 a very stout woman—a sack within a sack. As for the number 87, what I see is a fat woman and a man twirling his moustache. (Luria 1969, 31)

The historical accounts of sequence-personality synesthesia provided some observations about its phenomenology, but systematic empirical studies were not carried out. Although a cognitive mechanism underlying affective associations (positive versus negative) to graphemes was suggested (Calkins 1895), there was no widely accepted framework for explaining personification in synesthesia.

CHARACTERISTICS OF SEQUENCE-PERSONALITY SYNESTHESIA

Contemporary investigations into sequence-personality synesthesia have focused not only on providing phenomenological descriptions of synesthetic personifications (Cytowic 2002; Day 2005; Sagiv 2005), but have also aimed to objectively assess the synesthetic reports of personification by testing for their involuntary character and consistency over time—both considered core qualities of synesthesia (e.g., Rich et al. 2005). In other words, studies have aimed to show that these personifications automatically come to mind rather than being generated by conscious effort, and that they tend to

stay the same over time for any given synesthete (e.g., if 6 is a busy mother, it tends to always be so—at least for that particular synesthete). A number of recent studies have employed behavioral congruity paradigms as well as consistency tests similar to those used to study other forms of synesthesia (see later). Neuroimaging methods have also been employed to uncover the neural basis of the phenomenon.

Automaticity and the involuntary nature of personification

Most paradigms used to objectively assess the automaticity and involuntary nature of personification rely on the fact that personifications tend to be consistent over time, at least in some cases. In other words, some synesthetes show relatively consistent mappings between (at least) some inducers (e.g., graphemes) and concurrents (e.g., gender). Thus before turning to examine the automaticity of personification, the consistency of inducer–concurrent pairings needs to be demonstrated. Indeed the consistency of these reports has been confirmed in both single case studies (Simner and Holenstein 2007; Smilek et al. 2007) and group studies (Amin et al. 2011; Simner, Gartner, and Taylor 2011). In these studies, synesthetes are asked to describe their personifications for a list of stimuli, such as letters and numbers, and their reports (e.g., A is a bossy man, B is a happy mother...) are stored by the experimenter. The synesthete is then unexpectedly recalled for retesting some time later and given the same task. Their reports in this retest tend to mirror those they gave previously, even when the two testing sessions were separated by many months or even years. Given this method to establish that associations are consistent over time, other studies have next aimed to use this consistency to also demonstrate that the associations are automatic and involuntary, using innovative variants of the Stroop (1935) and Navon (1977) paradigms, as shown in Table 12.1.

In a Stroop interference test, the automaticity of synesthetic experiences is verified by comparing the average reaction times to stimuli that are either congruent or incongruent with the synesthetic experience. For example, in one Stroop task used by

Table 12.1 Behavioral assessment of the automaticity of personification in synesthesia

Study	Personification type	Testing method	Study size
Amin 2005	Grapheme-gender	Navon figure (stick figure gender discrimination task)	Group study (6 synesthetes)
Simner and Holenstein 2007	Letter-gender	Stroop paradigm (name gender discrimination task)	Single case (AP)
Smilek et al. 2007	Grapheme-personality	Tracking eye movement	Single case (TE)
Amin et al. 2011	Grapheme-gender	Priming paradigm (face gender discrimination)	Group study (5 synesthetes)

Amin et al. (2011), synesthetes saw a grapheme such as the letter A, which for their particular synesthete is feminine. This grapheme was followed by either a female face (in congruent trials) or a male face (in incongruent trials). Participants were asked to judge whether the presented face was a female or a male. Synesthetes were expected to be slower in responding to incongruent trials than when responding to congruent trials (Dixon et al. 2000; Smilek et al. 2001). As predicted, synesthetes had significantly slower average reaction times where the synesthetic gender of the letter-prime conflicted with the semantic gender of the face (i.e., on incongruent trials) compared with when synesthetic and semantic genders matched (i.e., on congruent trials) even though the grapheme primes were irrelevant to the task. This effect was not found in non-synesthetes, even when they chose the letters that were most masculine/feminine in their opinion to be included on experimental trials (rather than being randomly assigned to letter-gender pairing chosen by one of the synesthetes). The results from this study provide evidence that synesthetic gender-grapheme associations are involuntary and automatically elicited, a finding that differentiates synesthetic personification from the types of grapheme-gender associations that non-synesthetes may come up with if invited to do so.

In another Stroop type task, Simner and Holenstein (2007) presented a synesthetic participant, AP, with boy and girl names and asked her to press buttons marked either “male” or “female” to indicate the semantic gender of each name (e.g., Brian = male). Their aim was to assess whether semantic gender judgments can be affected by synesthetic genders, and whether this occurs automatically. In their materials, the semantic gender of the name was congruent with the synesthetic gender of its initial letter in half of the trials (e.g., Brian, where B is masculine); while in the other half of the trials it was incongruent (e.g., Mark, where M is feminine). Simner and Holenstein compared congruent and incongruent reaction times to see whether the synesthetic gender associated with the first letter interferes with semantic gender judgments for whole name. A congruency effect was indeed observed; reactions times were faster when the synesthetic gender of the first letter matched the name gender, suggesting that synesthetic genders are automatically generated and cannot easily be suppressed.

Simner and Holenstein (2007) could employ this type of Stroop-like paradigm only after they verified that for their synesthete AP, the genders of words (in this case names) are likely to take the gender of the first letter (a similar effect is noted in grapheme-color synesthesia, where the color of initial letters spreads throughout the whole word, giving the word its color; Rich et al. 2005). To determine this, AP was also asked to indicate how feminine/masculine a particular name felt to her (e.g., Betsy) on a scale from extremely female to extremely male. Target stimuli were names whose initial letter’s synesthetic gender was either congruent or incongruent with semantic gender of the name. The experiment showed that AP’s semantic masculinity/femininity was influenced by the synesthetic genders: AP perceives as more feminine female names starting with a female synesthetic gender (congruent condition) compared with female names starting with a male synesthetic gender (incongruent condition). This same pattern was found with male names. For example, if presented with the name Betsy, AP thought of Betsy as less feminine, because for her, the synesthetic gender of B is male and this interferes with

semantic gender. Although this type of letter-to-word transfer applies to the genders of names, it may not apply to linguistic sequences such as days of the week, months of the year. Such frequently used words are often associated with their own synesthetic gender (or color for that matter), which is independent of the gender associated with the first letter.

An alternative way of testing for the automaticity of grapheme-gender is a variant of the Navon-figures task. In this type of task, participants are presented with a larger recognizable “global” shape (e.g., the letter T) composed of smaller different “local” shapes (e.g., copies of the letter S). In the synesthetic version, participants saw (global) male or female stick figures made of (local) grapheme elements (Amin 2005; Sagiv et al. 2006). Crucially, the gender synesthetes associated with the graphemes making up the stick figures was either congruent or incongruent with the gender depicted by the stick figure. The task was to determine the gender of the stick figure. A congruity effect was observed here too; synesthetes were slower to decide what the stick figure gender was if it was composed of letters with the opposite gender. Thus, synesthetes find it hard to ignore the gender associated with graphemes, even when it is irrelevant and sometimes detrimental to the task.

Finally, Smilek et al. (2007) used eye-tracking to show that synesthete TE’s eye movements are biased by the emotional valence attributed to personified graphemes. TE fixated less often (but for a longer duration) on graphemes she considered to be more negative compared with more positive grapheme personalities. Together, these studies provide compelling objective evidence not only for automaticity but also for the reality of synesthetic personifications; i.e., grapheme personifications are not confabulatory in origin.

Prevalence of sequence-personality synesthesia

While sequence-personality synesthesia is recognized as one of the most common synesthesia types (Cytowic and Eagleman 2009; Simner, Gartner, and Taylor 2011), as yet, no large-scale study of the general population has been conducted that would provide an estimate of its prevalence. In 2007, Simner and Holenstein carried out a survey of 219 individuals. In this group they found three synesthetic personifiers, suggesting that about 1 in 73 people have personifications for ordinal sequences or objects. A similar prevalence (about 1.4%) can be found in a historical text showing that among 75 men and women, there was one female synesthete associating personalities to numbers (Patrick 1893).

Among the population of synesthetes, personification is fairly common: 33% of the 248 synesthetes studied by Amin et al. (2011) reported experiencing genders and/or personalities to graphemes. More than three-quarters of the synesthetes who attribute personalities and genders to graphemes also personified objects, such as fruit and vegetables, computers, household objects, and others. Graphemes and objects are personified on a daily basis, and the attribution of social and affective characteristics is conceptually

driven although some of the synesthetes testified that color,² shape, number parity, and sound of graphemes may play a role in determining the specific associations of personalities and genders. For example, in the questionnaire employed by Amin et al. (2011), 26% of synesthetes indicated that grapheme shape influenced the gender associated with them (e.g., rounded letters might be thought of as more feminine). According to self-reports gathered by Amin et al. (2011), sequence-personality synesthesia has been experienced by individuals when they were as young as 7 years old—around the time they acquire reading and writing skills. This is consistent with Hunt's (2005) hypothesis explaining synesthesia as a “semantically significant state of consciousness” that develops in mid-childhood (when children learn to read and write).

Categories of inducers and concurrents

Although synesthetic experiences can be induced by many different types of stimuli—emotions, flavors, musical sounds, temperature, and others—the most common inducers are linguistic constructs. We can differentiate between two different types of inducers in personification: linguistic inducers, such as graphemes, weekdays, months, and non-linguistic inducers, including body parts, inanimate objects, geometrical shapes, plants, colors, spatial concepts (e.g., left–right) and so on. Linguistic inducers, in contrast to non-linguistic inducers, often have a conventional order (e.g., alphabetical sequence) that may influence how synesthetes personify them (e.g., neighboring letters might have friendships or kinship relations, Simner and Holenstein 2007). Similarly, anecdotal evidence suggests that personified non-linguistic inducers (e.g., inanimate objects) tend to have some sort of relationship with their own kind; for example, coffee mugs might miss a broken mug from the same set (Amin et al. 2011). Another synesthete tested by Sobczak, Sagiv, and Williams (2011) described a family of mushrooms consisting of mother mushroom, father mushroom, and their children, which she perceived as having mental lives and interactions. A similar picture can be seen in linguistic inducers: for example, one of the synesthetes we tested noted that: “The personalities of all my letters and numbers centre around a “pecking order” based on age and leadership relationships. . . . All are “nice” personalities, quiet, confident, respectful, staying within their order. No moods. i.e., my letters, numbers, months and days have more “relationship” to one another than personalities.”

This description and our discussion of personification thus far show that the concurrent experiences are not purely sensory (i.e., they are not colors, tastes, and so on), but rather, they are conceptual properties (e.g., personality types). Moreover, they are at times social descriptions and this suggests that, in sequence-personality synesthesia, the concurrents belong to the interpersonal domain: they may reflect individual characteristics

² This is consistent with Simner and Hubbard's (2006) observation that graphemes' colors and genders interact. For example, they found that synesthetes are slower to state the synesthetic gender of letters if these are printed in colors from other letters with mis-matching (but not matching) genders.

(gender, personality, physical appearance, cognitive abilities, occupation, mental states, moods, attitudes, interests, inclinations) as well as “social interactions” between inducers (e.g., emotive and behavioral responses to other units; Amin et al. 2011; Simner and Holenstein 2007). Smilek et al. (2007) classified the social and affective characteristics attributed in sequence-personality synesthesia into four more specific types: physical (gender, physical appearance), personal (cognitive abilities, occupation, personality, mental states, moods, attitudes, interests, inclinations), relation (emotive and behavioral responses to other units), and social role (occupation, familial and non-familial relationships). From a comparison between the social attributes to graphemes in the historical and contemporary literature, it can be concluded that although synesthesia is congenital, life experiences can influence the personality traits that are being attributed to graphemes and other sequences (Simner and Holenstein 2007). Concurrents such as “society girl,” “policy girl,” “housekeeper” (in Patrick 1893, 509) are rather uncommon among synesthetes today.

THEORIES OF SEQUENCE-PERSONALITY SYNESTHESIA

After establishing the genuineness of sequence-personality synesthesia, researchers are attempting to provide an explanatory framework for the phenomenon. In order to explain how it arises, researchers look at the underlying neural mechanisms in addition to the phenomenological characteristics and behavioral consequences. One neurobiological framework for understanding sequence-personality synesthesia focuses on the *cross-activation hypothesis* (e.g., Hubbard, Brang, and Ramachandran 2011), whereas a more functional alternative approach describes the condition as a by-product of the developmental mechanisms for social cognition. These two approaches will be discussed next.

Neural cross-talk and neural over-excitation as models for sequence-personality synesthesia

It has been suggested that synesthesia occurs when activation of the brain areas associated with processing the inducers (e.g., graphemes) also results in activation of the brain areas associated with processing the concurrent (e.g., color); this process has been termed cross-activation (Hubbard, Brang, and Ramachandran 2011). Cross-activation may result from either direct (Hubbard and Ramachandran 2005; Rich and Mattingley 2002) and/or indirect “cross-talk” between brain areas (Grossenbacher and Lovelace 2001; Smilek et al. 2001). This may be facilitated by either structural or functional differences in connectivity in synesthetes’ brains. The functional model of cross-talk assumes

that there are no structural differences in the brains of synesthetes and non-synesthetes, with synesthetic cross-activations arising as a result of disinhibition of otherwise normal pathways (e.g., Ward, Huckstep, and Tsakanikos 2006; Cohen Kadosh et al. 2009). Conversely, the structural explanation of synesthetic cross activation highlights anatomical differences between the synesthetic and non-synesthetic brain; i.e., an additional feedforward neural pathway connecting the particular brain areas involved in processing the inducers and concurrents in a given type of synesthesia.

While functional neuroimaging studies showed that such an explanation for grapheme-color synesthesia is plausible (Hubbard et al. 2005), more recent studies provided direct evidence for hyper-connectivity (Rouw and Scholte 2007; Weiss and Fink 2009) using diffusion tensor imaging. These studies suggest that there are structural differences between synesthetes' and non-synesthetes' brains. However, future developmental neuroimaging studies seem to be necessary in order to clarify whether hyper connectivity precedes functional specialization and what the role of learning and practice is.

Could sequence-personality synesthesia also be explained within this framework? Simner and Hubbard (2006) argue that sequence-personality synesthesia is likely to arise as a result of cross-talk between the left inferior parietal lobule (in particular the angular gyrus) and temporo-parietal junction that mediate sequence information, and the "social brain" regions associated with mental states and personality trait attribution, such as the amygdala, somatosensory cortex, frontal, and parietal regions. It is suggested that the angular gyrus is a crucial area in inducing cross-modal pairings in sequence-personality synesthesia due to its importance in processing ordinal sequence information, which has been well documented in neuropsychological studies of semantic agnosia and acalculia (Cappelletti, Butterworth, and Kopelman 2001; Dehaene and Cohen 1997; Turconi and Seron 2002). Synesthetic concurrents in this variant of synesthesia include social and affective associations, therefore it is likely that neural correlates involved in generating these experiences overlap with the neural systems underlying social cognition. Previous neuroimaging experiments (e.g., Castelli et al. 2002; Martin and Weisberg 2003; Schultz et al. 2003) provided evidence that personification of non-randomly moving shapes (similar to Heider and Simmel's 1944 animations) activates some of the same brain areas that have been found to be active during interaction with or observation of other human beings. The inferior frontal cortex is crucial for personality judgments (Heberlein and Saxe 2005). Additionally, the temporo-parietal junction, posterior cingulate cortex/precuneus, the amygdala, prefrontal cortex, and fusiform gyrus may also play a role in generating social and affective concurrents reported in sequence-personality synesthesia.

The first case study examining empirically the neural substrates of sequence mapping synesthesia provided only partial support for these predictions. Amin et al. (2011) tested AA—a 38-year-old female synesthete who attributes genders to letters—using functional magnetic resonance imaging. The study identified the medial part of the superior parietal lobule—the precuneus—as a possible brain region mediating the attribution of gender to letters. Aiming to establish whether personifications in synesthesia arise

automatically, Amin et al. asked AA to perform a letter repetition detection task (rather than to focus on the synesthetic experiences of genders). Given that the synesthetic gender of letters was irrelevant to the task, the authors argue that the observed differences in precuneus activity when AA was presented with letters with genders and letters without genders may indeed reflect automatic processes associated with synesthetic personification. As the precuneus is associated with self-referential processing (information related to oneself) as well as with mental imagery (e.g., Cavanna and Trimble 2006), Amin et al. proposed two corresponding possible mechanisms for synesthetic personification. One possibility is that synesthesia is an extraordinary manifestation of mental imagery that is elicited automatically, and has well defined inducers and concurrences. The second hypothesis emphasizes self-referential functions; this variant of synesthesia may represent an unusual projection of one's own mental states onto graphemes and/or objects.

A similar explanation for the precuneus activation has been also proposed in another case study of a synesthete who personifies inanimate objects (Sobczak, Sagiv, and Williams 2011). The self-projection hypothesis is in line with current theory in social neuroscience on how we get to know the minds of others: we never perceive the minds of others directly since mental states are unobservable constructs, but we infer intentions, feelings and personality traits of others using self-referential accounts, by accessing our own mental states that serve as a model of the minds of others, and then project them on the target (Mitchell 2008). Could this suggest that the attribution of social and affective characteristics to graphemes in synesthesia is merely an extension of normal social cognition, in which projection of one's own mental states includes not only other humans but also non-humans entities as targets? The hypothesis that sequence-personality synesthesia is a misattribution of self-referential processing will be presented further in the following section.

Personification in synesthesia as a misattribution of self-referential processing

According to the neonatal synesthesia hypothesis (e.g., Maurer and Mondloch 2005), all newborn babies experience synesthesia or, at the very least, some sort of sensory confusion; they experience unisensory stimuli with all their senses as a consequence of having a cortex that is not fully developed. This ability disappears with the development of the nervous system as cortical areas acquire functional specialization. Could this also apply to synesthetic personification? Young children assign life and conscious mental states to non-living objects and concepts; this was referred to as “animism” in the early literature (Piaget 1929). Animistic thought in early childhood gradually decreases during cognitive development. According to this model of development, a child's progression from perceiving all functional objects as endowed with conscious life, goes through a stage of assigning these attributes only to objects that are in motion; subsequently, conscious life is only assigned to things that move on their own accord, and finally, animate characteristics are only attributed to living things. After this stage, the animistic mode of

cognition (similar to that of personification) is almost completely replaced by logical reasoning, and human-like qualities are rarely attributed explicitly to inanimate objects.

Piaget (1929) studied animistic thought in children and hypothesized that the excessive animistic mode of thinking (including personification) serves as a mechanism for constructing reality with the self as a model. This is in line with contemporary accounts of the way in which we construct social reality. The discovery of mirror neurons demonstrates this well. Mirror neurons fire both when we observe others performing an action and when we perform the same action ourselves. This constitutes a neural, mirror-like mechanism that has been suggested to facilitate the understanding of the actions, emotions and feelings of other people, presumably through a simulation process (for a review, see Bastiaansen et al. 2009). Personification in synesthetic adults may represent an excessive manifestation of the human tendency to perceive reality using the self as a model. This in turn derives from younger children's animistic thought which children use as an undeveloped filter through which they learn about the social world. In other words, synesthetic personification could represent a residual expression of childhood animism.³

The brain areas associated with self-referential processing such as the insula, the pre-cuneus, the inferior frontal cortex, and the posterior cingulate, have been found to be involved in implementation of animistic thought⁴ (Sobczak 2009; Sobczak, Sagiv, and Williams 2010). Furthermore, evidence from neuropsychology suggests that lesions of the right (and sometimes left) parietal cortex may result in peculiar misattributions of agency, which might itself sometimes involve animistic attributions. Specifically, patients with such lesions frequently display delusional misidentifications of body parts, thinking that their left arm or left leg does not belong to them. They often attribute their limbs to other people—their wife, examiner, or fellow patient. This condition—somatoparaphrenia is a subtype of asomatognosia (unawareness of one's limb ownership). Interestingly, some patients also assign personalities to their limbs and give misidentified arms or legs nicknames such as “George,” “Toby,” “Silly Billy,” “Floppy Joe,” etc. (Critchley 1955, 286). Misattribution of animacy and agency has also been found after frontal lobe damage. For example, Feinberg and Keenan (2005) describe a peculiar case of personification known as “phantom child syndrome” which is thought to represent a delusional reduplication of self. The patient believed that he is in the process of adopting a child with “problems.” Such patients deny that they have certain problems themselves, instead attributing them to the “phantom child.”

In summary, evidence from neuroimaging and neuropsychology is consistent with the idea that misattribution of the self could explain both benign synesthetic personification as well as some pathological forms of personification. However, this framework

³ The tendency to personify may be crucial for the development of normal social cognition. Indeed Amin et al. (2011) point out that synesthetic personification may be a small price to pay given the benefits of the “personification instinct”.

⁴ A similar pattern is found in synesthetes and non-synesthetes who are prompted to personify visually presented object images.

for understanding personification remains tentative and needs to be tested directly in future studies involving synesthetes.

SIMILARITIES AND DIFFERENCES BETWEEN SYNESTHETIC PERSONIFICATIONS AND NON-SYNESTHETIC PERSONIFICATIONS

Personification and animism involving the attribution of human-like social and affective characteristics to non-human entities can be observed not only in synesthesia, but also in non-synesthetes' everyday life. Examples include personification of objects, both in childhood and in adulthood (Piaget 1929; Bouldin and Pratt 1999; Epley et al. 2008), the attribution of masculine/feminine genders to nouns in many languages, as well as the attribution of agency, personality traits and moods to body parts (usually limbs) following brain injury. Personification is also widespread in various cultures as metaphors, and in folk legends and myths (Guthrie 1993). For example, according to one Russian superstition, if you drop a fork (masculine) a male guest will visit your house, but if you drop a spoon (feminine)—this will be a female guest (Corbett 1991). Personification is also utilized in design and “human factors engineering,” in which social rules are used when designing human–computer interactions (Nass et al. 1997), as well as in advertising and marketing (Ouwensloot and Tudorica 2001). Young children often think of inanimate objects as if they were humans, endowing them with life-like features (animism). It has been suggested that children's tendency to personify is a normal stage in cognitive development (Piaget, 1929), but can also be linked with social isolation; solitary children frequently create imaginary friends. Often these imaginary companions exist entirely in their imaginations, but sometimes the focus of their imaginations are physical objects such as dolls or other toys that have ascribed to them elaborate personalities and biographies (Bouldin and Pratt 1999). Additionally, among adults, loneliness and inability to create social bonds may be compensated by attaching social and affective characteristics to animals, inanimate objects and also religious agents (Epley et al. 2008).

In many languages, nouns have masculine/feminine grammatical genders that influence the way people think about inanimate objects: objects with feminine grammatical genders are thought to be more feminine, and objects with masculine grammatical gender are perceived as more masculine (Boroditsky, Schmidt, and Phillips 2003). This effect can already be observed in children of 8 to 9 years, who, when asked to assign voices to inanimate objects (presented together with their labels), ascribe voices to presented objects congruent with their grammatical genders (Sera, Berge, and de Castillo 1994). Boroditsky and her colleagues found that the adjectives used to describe nouns tend to be feminine when the noun concerned has feminine grammatical gender and more masculine when the noun has masculine gender. Furthermore, adjectives usually associated more with femininity (such as calm, friendly, good, happy, kind) tended to be

used for descriptions of rounded shapes, whereas adjectives associated with masculinity (e.g., angry, brave, frustrated, jealous, nervous, and resentful) were used when describing a spiky shape (Lyman 1979). Thus, shapes may be associated, at least implicitly, with some social and affective characteristics. Additionally, musical sounds can evoke attributions of moods (Odbert, Karwoski, and Eckersson 1942), and letters can induce associations of personality traits (Simner, Gartner, and Taylor 2011).

In this last respect, Simner and her colleagues examined whether synesthetes and non-synesthetes exhibited similar patterns of letter-personality correspondences. While non-synesthetes' (forced) personifications of letters were less elaborated and less consistent over time compared with synesthetes, both groups seem to share the underlying rules for the personality trait attribution to letters. Using Goldberg's Big Five personality traits questionnaire (Saucier 1994), Simner, Gartner, and Taylor found that both synesthetes and non-synesthetes tend to associate frequently occurring letters (e.g., the letter A compared with the letter Z) with personalities low in neuroticism and high in agreeableness; the main difference between the groups is therefore that in synesthetes, the personality-letter associations occur explicitly, whereas in non-synesthetes, they are implicit.

SUMMARY

In this chapter, we have attempted to provide a broad overview of personification in synesthesia, including the phenomenology, as well as behavioral and neural characteristics. Sequence-personality synesthesia appears to be consistent over time. Furthermore, the associations between inducer and concurrent are automatically and involuntarily elicited. The variety of inducers in this variant of synesthesia include linguistic (graphemes, weekdays, months, etc.) and non-linguistic inducers (inanimate objects, colors, body parts, etc.). The concurrent synesthetic experiences have affective and social characteristics, and fall into the following general groups: physical, personal, relational, and social role descriptions. Several lines of evidence suggest that some forms of personification occur in non-synesthetes too; examples include childhood animistic thought, mild forms of personification in everyday life, personifications of body parts, as well as gender attributions to linguistic constructs (i.e., grammatical gender). Synesthetes and non-synesthetes alike think of the letters that are more frequently used as rather agreeable and not neurotic. However, non-synesthetes do so only implicitly, compared with synesthetes, for whom these pairings occur involuntarily and they are aware of them explicitly in everyday life. A similar pattern is found when considering object personification; many synesthetes tend to spontaneously personify inanimate objects; non-synesthetes usually do not, but when prompted to personify both activate similar brain regions. Preliminary neuroimaging evidence suggests that sequence-personality synesthesia depends on the posterior parts of parietal cortex, namely precuneus, which is involved in mental imagery and self-referential processing. Synesthetic personification

may therefore represent a special case of mental imagery or the involuntary projection of one's own mental states onto graphemes and/or inanimate objects. As in other forms of synesthesia, it is conceivable that cross-activation of brain areas could underlie personification (e.g., cross-talk between the angular gyrus and some of the "social brain" areas). At the developmental level, it has been proposed that sequence-personality synesthesia may represent a residual expression of childhood animism, an early stage in social cognitive development. Although there are many differences between the accounts described here for sequence-personality synesthesia, they all seem to point to the observation that (as in other types of synesthesia) this variant may be utilizing a universal mechanism (e.g., Sagiv and Ward 2006). Admittedly, the study of synesthetic personification using cognitive neuroscience methods is only in its infancy. It would therefore be wise to regard these frameworks for understanding synesthetic personification as tentative, at least until further evidence becomes available.

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