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Bouba or kiki with and without vision: Shape-audio regularities and mental images

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ABSTRACT

95% of the world's population associate a rounded visual shape with the spoken word 'bouba', and an angular visual shape with the spoken word 'kiki', known as the bouba/kiki-effect. The bouba/kiki-effect occurs irrespective of familiarity with either the shape or word. This study investigated the bouba/kiki-effect when using haptic touch instead of vision, including the role of visual imagery. It also investigated whether the bouba/kiki shape-audio regularities are noticed at all, that is, whether they affect the bouba/kiki-effect itself and/or the recognition of individual bouba/kiki shapes, and finally what mental images they produce. Three experiments were conducted, with three groups of participants: blind, blindfold, and vision. In Experiment 1, the participants were asked to pick out the tactile/visual shape that they associated with the auditory bouba/kiki. Experiment 1 found that the participants who were blind did not show an instant bouba/kiki-effect (in Trial 1), whereas the blindfolded and the fully sighted did. It also found that the bouba/kiki shape-audio regularities affected the bouba/kiki-effect when using haptic touch: Those who were blind did show the bouba/kiki-effect from Trial 4, and those who were blindfolded no longer did. In Experiment 2, the participants were asked to name one tactile/visual shape and a segment of audio together as either 'bouba' or 'kiki'. Experiment 2 found that corresponding shape and audio improved the accuracy of both the blindfolded and the fully sighted, but not of those who were blind – they ignored the audio. Finally, in Experiment 3, the participants were asked to draw the shape that they associated with the auditory bouba/kiki. Experiment 3 found that their mental images, as depicted in their drawings, were not affected by whether they had experienced the bouba/kiki shapes by haptic touch or by vision. Regardless of their prior shape experience, that is, tactile or visual, their mental images included the most characteristic shape feature of bouba and kiki: curve and angle, respectively, and typically not the global shape. When taken together, these experiments suggest that the sensory regularities and mental images concerning bouba and kiki do not have to be based on, or even include visual information.

1. Introduction

95% of the world's population associate a rounded visual shape with the spoken word 'bouba', and an angular visual shape with the spoken word 'kiki' (cf. Fig. 1), known as the bouba/kiki-effect. The bouba/kiki-effect occurs even when people have not had any experience with either the shape or word (Ramachandran & Hubbard, 2001).

These shape-spoken word associations were first reported by Köhler in 1929, who presented two shapes to his participants – one rounded and one angular (similar to those in Fig. 1) – and asked them to pick out either 'baluma' or 'takete'. Since then, researchers have found the same associations with other word pairs as well; for example, 'maluma' and 'takete', 'uloomo' and 'takete','maa-boo-maa' and 'tuh-kee-tee', and 'bouba' and 'kiki' (e.g. Davis, 1961; Maurer, Pathman, & Mondloch, 2006; Nielsen & Rendall, 2011; Ramachandran & Hubbard, 2001). These shape-spoken word associations were named the 'bouba/kiki-effect' by Ramachandran and Hubbard in 2001. The bouba/kiki-effect precedes language learning and occurs across languages (e.g. Bremner et al., 2013; Davis, 1961; Maurer, Pathman, & Mondloch, 2006; Ozturk, Krehm, & Vouloumanos, 2013; Ramachandran & Hubbard, 2001). It occurs with both bouba and kiki, that is, not just with the curved bouba (cf. people's preference for visual curves over visual angles: e.g., Bar & Neta, 2006; Bertamini, Palumbo, Gheorghes, & Galatsidas, 2016; Quinn, Brown, & Streppa, 1997; Silvia & Barona, 2009). In fact, the bouba/kiki-effect depends on the particular combination of vowels and consonants [e.g. it does not occur with 'bibi' and 'kuku' (e.g. Nielsen & Rendall, 2011; Ozturk, Krehm, & Vouloumanos, 2013; Ramachandran & Hubbard, 2001)]; in fact, it seems that the sound of the word, or its

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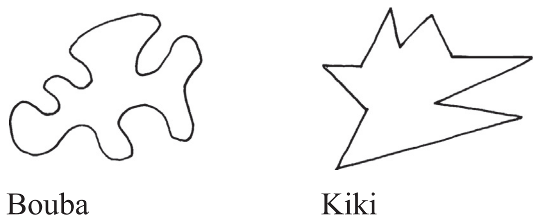

Fig. 1. Bouba and kiki.

melody, is the most crucial, as opposed to the word itself.

The bouba/kiki-effect appears less robust when using haptic touch instead of vision (Fryer, Freeman, & Pring, 2014). In haptic touch – the combination of touch and movement (Katz, 1989; Millar, 1997, 2008) – tactile information is perceived serially (Lederman, Browse, & Klatzky, 1988; Millar, 1984): People who use haptic touch have to link together numerous finger pad-sized pieces of tactile information in order to recognise, for example, each curve in the bouba shape and each angle in the kiki shape.

Fryer, Freeman, and Pring (2014) asked 42 participants who were visually impaired (ranging from congenital to recent onset, and from total blindness to partial sight), and 80 who were fully sighted to explore four bouba and kiki pairs by haptic touch, that is, 2D cut-outs and 3D models based on the original bouba and kiki shapes (Köhler, 1929; Ramachandran & Hubbard, 2001. Cf. Fig. 1): Pairs A and B were 3D and 2D tactile shapes, respectively. Pairs C and D were identical in tactile shape, but differed in tactile texture (smooth v rough and smooth v spiky, respectively). All four pairs were presented separately inside a cotton bag, thereby preventing any exploration by vision. Those who were visually impaired picked out the 'correct' tactile bouba/kiki in ~64% of all trials, and those who were fully sighted in ~90%. Fryer, Freeman, and Pring (2014) argued that the significantly less robust bouba/kiki-effect among those who are visually impaired, compared to the fully sighted, is due to a lack of visual imagery. Those who are fully sighted can notice regularities in their environment that are not easily accessed with little, or no vision. In a related vein, Fontana (2013) asked 11 blindfolded-sighted participants to grasp a robotic stylus programmed to draw trajectories of the bouba and kiki shapes, and to signal which trajectory they associated with the spoken word 'takete'. After a two-minute kinaesthetic training period with the two bouba and kiki trajectories, 82% of the participants showed a kinaesthetic-auditory bouba/kiki-effect.

It is still not clear, however, whether there is an instant bouba/kiki-effect when using haptic touch: Fryer, Freeman, and Pring (2014) calculated the effect across trials. It is also not clear whether people notice tactile-auditory regularities, and whether these regularities affect the bouba/kiki-effect: Fryer, Freeman, and Pring (2014) did not compare the tactile-auditory bouba/kiki-effect on, for example, the first versus the last trial, and Fontana (2013) did not compare the post-training kinaesthetic-auditory bouba/kiki-effect to a pre-test, nor to a control group. To this end, it is not clear whether visual imagery in fact is needed for the tactile-auditory bouba/kiki-effect to occur. Those who were fully sighted in Fryer, Freeman, and Pring's (2014) study did not wear a blindfold, and thus could easily observe the experimenter's rounded and angular lip movements when announcing the bouba and kiki words (cf. Ramachandran & Hubbard, 2001). Inevitably, this brings up the question of whether they in actual fact showed a tactile-visual-auditory bouba/kiki-effect: indeed, perceiving information from three senses simultaneously, instead of drawing upon any visual imagery. Further, in Fryer, Freeman, and Pring's (2014) study, of the 42 participants who were visually impaired only six had congenital total blindness (thus no visual imagery at all), one had congenital visual shape perception, one had congenital face recognition, and 34 had experienced full vision; 13 of whom still had face recognition. In other words; 36 of the 42 participants may have had at least some visual imagery, and 14 of these may have been able to observe at least some of the experimenter's rounded and angular lip movements when announcing the bouba and kiki words (cf. Fryer, Freeman, & Pring, 2014; Ramachandran & Hubbard, 2001). This also brings up the question of whether the majority of the participants who were visually impaired in Fryer, Freeman, and Pring's (2014) study failed to draw upon their visual imagery, whether they too in actual fact showed a tactile-visual-auditory bouba/kiki-effect, and/or whether they, for example because of perceiving limited visual information, failed to fully integrate all of the multisensory tactile, visual, and auditory information.

This study, therefore, investigated in three experiments: first, whether there is an instant bouba/kiki-effect when using haptic touch, including the role of visual imagery (Experiment 1). It also investigated whether people notice tactile/visual-auditory bouba and kiki regularities, and whether these regularities affect the bouba/kiki-effect (Experiment 1); second, whether these regularities affect the recognition of tactile/visual bouba and kiki shapes (Experiment 2); and third, what mental images these regularities produce, as depicted in tactile/visual drawings (Experiment 3). In order to generate tactile/visual-auditory bouba and kiki regularities (cf. Fryer, Freeman, & Pring, 2014), and not merely, for example, kiki-shape/kiki-word particularities (Ramachandran & Hubbard, 2001), this study included two types of tactile/visual (outlined; filled), and two types of auditory bouba and kiki (word; and non-word sound). The three experiments were conducted in fixed order across participants, that is, to keep under control as much as possible the participants' amount and type of experience with the tactile/visual-auditory bouba and kiki regularities (cf. Fryer, Freeman, & Pring, 2014).

2. Experiment 1: the bouba/kiki-effect

This first experiment investigated:

- Is there an instant tactile/visual-auditory bouba/kiki-effect, and how is this bouba/kiki-effect affected by visual imagery?
- Are the tactile/visual-auditory bouba and kiki regularities noticed at all, that is, do they affect the tactile/visual-auditory bouba/kiki-effect?

2.1. Method

2.1.1. Design

Experiment 1 was designed as a pre-test-post-test quasi-experiment, with three groups of participants:

Blind (to which the participants were not randomly assigned), blindfold, and vision. The treatment, or training aimed to generate tactile/visual-auditory bouba and kiki regularities, and thus included a series of repeated and related types of bouba and kiki (outlined; filled and word; sound). In addition, there were three repeated within-group measures, testing the effect of:

- repeated tactile/visual type (outlined) and varied auditory type (word; sound) of bouba and kiki;
- new tactile/visual type (filled) and varied auditory type (word; sound) of bouba and kiki; and,
- tactile/visual-auditory bouba and kiki regularities, that is, varied tactile/visual type (outlined; filled), and varied auditory type (word; sound) of bouba and kiki.

2.1.2. Participants

Thirty-six individuals who were compensated for their time, participated. Twelve were congenitally blind (7 females, mean age = 47.1 years) – ten were born blind and two were blinded less than four months after birth. Of these twelve participants, five had total blindness, three had light perception (perceiving a light source), and four had light projection (perceiving where a light source is situated: