

# Adults recognize toddlers' song renditions

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[journals.sagepub.com/home/pom](http://journals.sagepub.com/home/pom)**Helga Gudmundsdottir<sup>1</sup> and Sandra Trehub<sup>2</sup>**

## Abstract

The present study explored the singing ability of toddlers 16 months to 3 years of age by examining North American adults' ability to identify toddlers' renditions of familiar tunes sung with foreign lyrics. After listening to each toddler's song, half with familiar melodies and half with unfamiliar melodies, adults attempted to name the songs. Their identification was highly accurate, refuting the prevailing view that toddlers focus on words at the expense of tunes. The singing range of these non-English-speaking toddlers and that of their English-speaking counterparts approximated the pitch range of the target songs, which is inconsistent with the reportedly small singing range of toddlers. Toddlers' apparent singing proficiency in the present context may stem from the use of home-based recordings and child-selected songs.

## Keywords

*early childhood, pitch, range, singing, toddlers*

There has been relatively little research on singing ability in early childhood despite some consideration of the influence of social context (Björkvold, 1992; Sundin, 1998; Young, 2002) and musical structure (Moog, 1976; Moorhead & Pond, 1941/1978; Whiteman, 2001). Early singing development is generally characterized by deficiencies relative to mature skills (Leighton & Lamont, 2006), although large individual differences are acknowledged (Flowers & Dunne-Sousa, 1990; Leighton & Lamont, 2006). These descriptions of early singing, however limited, function as critical resources for music educators (Campbell & Scott-Kassner, 1994; Flohr, 2005; Phillips, 1992; Rutkowski & Runfola, 1997). Nevertheless, there are dangers in basing early curricula on young children's apparent limitations in singing proficiency and vocal range because of possible underestimations of their abilities and potential (Kim, 2000, p. 155).

Descriptions of early singing ability vary widely. Despite reports of some toddlers singing standard songs well before 2 years of age (Moog, 1976; Papoušek, 1996; Stadler Elmer, 2011)

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and most 3-year-olds matching pitches (Moog, 1976) and using the full singing range (Jersild & Bienstock, 1931), the prevailing belief is that singing development exhibits a protracted developmental course, with conventional song structure typically absent until the third year (Davidson, McKernon, & Gardner, 1981; De Vries, 2005). For example, 2- to 3-year-olds are not considered capable of reproducing more than a phrase or two of a learned song (Davidson et al., 1981). "Even at twenty-nine months, children do not have a reliable melodic version for each song, whether or not they are attempting to imitate the melodic contour" (McKernon, 1979, p. 54).

Deficiencies in singing usually co-occur with a limited singing range. For example, the singing range of children younger than 5 years has been described as very small (McKernon, 1979), no larger than seven semitones (Flowers & Dunne-Sousa, 1990), or as small as four semitones at first-grade entry (Rutkowski & Miller, 2003). Such limitations in range would impede listeners' recognition of many standard songs. *Twinkle, Twinkle, Little Star*, for example, has a pitch range of nine semitones, and some popular children's songs have an even larger range (e.g., *Yankee Doodle*, *Pop Goes the Weasel*).

According to the contour scheme theory (Davidson, 1985), young children use their small vocal range to reproduce the approximate contours of the target songs, compressing the intervals of the original song. Another perspective is that 5-year-olds who sing poorly use their small speaking range to reproduce the lyrics of songs (Welch, Sergeant, & White, 1998), in line with the view that song learning begins with mastery of the words (Welch, 1998; Welch, Rush, & Howard, 1991; Welch, Sergeant, & White, 1996). The presumed order of acquisition of song elements is words first, followed by rhythm, pitch, and tonality (Davidson, McKernon, & Gardner, 1981; Welch et al., 1998), with key-stability emerging no earlier than 5 to 6 years of age (Dowling & Harwood, 1986). Children's gradually expanding singing range compounds the problems of studying age-related changes in the singing voice (Buckton, 1977; Flowers & Dunne-Sousa, 1990; McKernon, 1979; Rutkowski & Miller, 2003; Wassum, 1979).

Theories of song learning and singing development do not consider the possibility of alternative developmental paths, for example, that some children reproduce song melodies before mastering the words. However, there are descriptions of children who began by singing melodies without words or with nonsense syllables (Barrett, 2010; Kelley & Sutton-Smith, 1987; Stadler Elmer, 2011; Young, 2002).

In addition, there may be many exceptions to the general description of children beginning with a narrow singing range that expands gradually as a result of maturation or training. For example, some 4-year-olds exhibit a singing range as large as 17 semitones (Hacki & Heitmüller, 1999) rather than the four- to seven-semitone range reported for this age group (Flowers & Dunne-Sousa, 1990; Rutkowski & Miller, 2003). Interestingly, the 4-year-olds with a large singing range had a speaking range of about seven semitones (Hacki & Heitmüller, 1999), which suggests that the range reported in previous singing studies approximated that of speech rather than singing. Limited pitch range is unlikely to stem from vocal limitations because vocal play in infancy often spans one or two octaves (e.g., Fox, 1990).

Studies reporting small singing ranges suggest that children use a smaller vocal range for singing songs than for vocal play. In other words, children may not be using their full vocal range when singing standard songs with lyrics. An alternative explanation is that children may not feel comfortable using the full extent of their vocal range when prompted to sing a song in a testing situation. An intervention study that trained 3-year-olds in 40 short singing sessions found that their vocal range expanded from less than four semitones to almost 12 semitones during the course of a couple of months (Jersild & Bienstock, 1931). This implies that singing

ranges are not as static at certain points in development as song acquisition theories suggest. Furthermore, it is possible that the large vocal range observed in free play could be applied to singing by means of training, exposure, or engagement in singing activities.

Conventional methods of evaluating singing in early childhood may obscure important developmental changes (Flowers & Dunne-Sousa, 1990; Welch, 1998). For example, the use of elicited rather than spontaneous singing and newly learned rather than well-known songs, and the focus on deviations from adult performance may result in underestimations of young children's skills. Experiential factors linked to language and culture may also affect the onset and progress of singing (Chen-Hafteck et al., 1999; Mang, 2006). For example, the pitch range and pitch accuracy of Shona-speaking preschoolers in rural Zimbabwe (Kreutzer, 2001) exceed those of same-age American children (Flowers & Dunne-Sousa, 1990), plausibly due to differences in the musical environment, methods of assessment, or both.

Although it is generally acknowledged that toddlers 2 to 3 years of age attempt to sing standard songs (Björkvold, 1992; Moog, 1976; Moorhead & Pond, 1941/1978; Sundin, 1998; Whiteman, 2001; Young, 2002), there is little consensus on whether they can carry a tune. Most scholars claim that toddlers focus largely on word reproduction, producing unrecognizable melodies (e.g., Davidson, 1985; Flowers & Dunne-Sousa, 1990; Rutkowski & Miller, 2003; Welch et al., 1998). Toddlers vary their pitch level, but their pitch patterns are too coarse for melody identification. If words are critical to the identification of toddlers' songs, then adults should be unable to recognize their songs in an unfamiliar language even when they feature familiar tunes.

Recognition of a tune depends on preservation of its melodic contour (Dowling & Fujitani, 1971; Morrongiello, Trehub, Thorpe, & Capodilupo, 1985) and rhythmic structure (Dowling, Barbey, & Adams, 1999). In other words, a sung performance that preserves the contour and rhythmic outline of the original song is likely to be recognized even if the pitch intervals deviate somewhat from the target intervals. Although rhythmic patterns are important to the identification of familiar songs, pitch patterns contribute more to song recognition than rhythmic patterns do (Hébert & Peretz, 1997).

The present study focuses on toddlers' ability to produce recognizable as opposed to accurate renditions of songs. The principal objective was to ascertain whether North American English-speaking adults could identify familiar songs sung by toddlers in an unfamiliar foreign language. This required audio samples from non-English-speaking toddlers. A secondary objective was to ascertain the singing range of these toddlers. Audio samples from English-speaking toddlers were also necessary to establish whether their singing range differed from that of non-English-speaking toddlers. To date, most studies of singing in young children have focused on English speakers. However, children in some non-English-speaking cultures reportedly sing more capably than English-speaking children, perhaps because of their greater exposure to singing (Kreutzer, 2001) or their experience with a tone language (Chen-Hafteck et al., 1999; Kreutzer, 2001; Mang, 2006).

## Method

Two studies were conducted. The first aimed at investigating whether North American adults could identify familiar songs sung by toddlers with foreign, unfamiliar lyrics. In the second study, recordings of English-speaking toddlers singing the song *Twinkle, Twinkle, Little Star* were collected and analyzed with regard to pitch range. The purpose was to establish whether samples from English-speaking toddlers differed in pitch range from the samples of non-English-speaking toddlers.



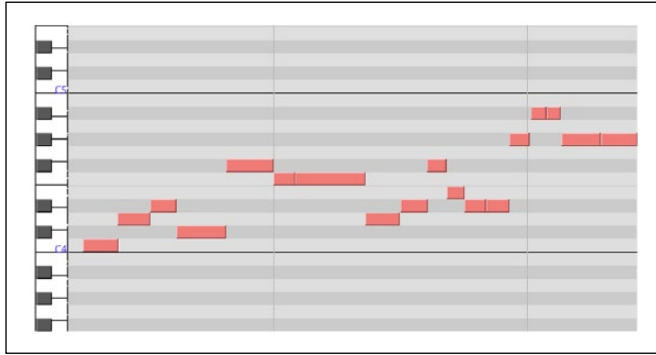
**Figure 1.** Depiction of the melody of *Twinkle, Twinkle, Little Star*, sung in Icelandic by a 28-month-old boy (see Audio Example 1 in online supplementary materials).

### Study 1

The study investigated whether adults could identify familiar melodies sung by toddlers with foreign, unfamiliar lyrics as well as the pitch range used by toddlers. To this end, samples of familiar and unfamiliar songs by children 16 to 36 months of age were collected in several languages. The stimuli consisted of renditions of four children's songs: two with highly familiar tunes (*Twinkle, Twinkle, Little Star* and *Happy Birthday*) and two with tunes unfamiliar to North American listeners, all sung with foreign lyrics. The songs, which were sung in Danish, German, Icelandic, Norwegian and Swedish, were recorded in children's homes. To the best of our knowledge, no toddler had exceptional musical abilities.

**Participants.** The participants were 25 North American adults, recruited without regard to music training, who were multilingual, native speakers of English, Spanish, or French with no knowledge of German or Scandinavian languages. The participants reported no expertise with young children and none of them were early-childhood specialists.

**Stimuli.** The stimuli consisted of 24 samples of singing from 24 (German and Scandinavian, non-English-speaking) children: six unique versions of each of four songs, two with highly familiar tunes – *Twinkle, Twinkle, Little Star* and *Happy Birthday* – and two with tunes that are unfamiliar to North American listeners but highly familiar in Germany and Scandinavia – *Alle fugler* (Norwegian)/*Alle Vogeln* (German) and *Bjornen sover* (Danish)/*Allir krakkar* (Icelandic). These samples were drawn from audiovisual home recordings of children 16 to 36 months of age that were posted on YouTube or sent directly to the first author. The recordings were of complete songs or significant portions of the songs by 24 different children. Audio files extracted from the audiovisual files were amplitude normalized and adjusted to ensure comparable audibility and quality across samples. The final audio files were incorporated into internet-based survey software (SurveyGizmo, 2006) that allowed for the presentation of audio files and accompanying questions. The aforementioned audio files were also used for electronic analysis of pitch range. Brief excerpts of the audio samples can be found in the online supplementary materials. Example 1 features a 28-month-old boy singing *Twinkle, Twinkle* in Icelandic and Example 2 features a 25-month-old girl singing *Happy Birthday* in Icelandic. Graphic representations of Examples 1 and 2 are shown in Figures 1 and 2, respectively.



**Figure 2.** Depiction of the melody of *Happy Birthday*, sung in Icelandic by a 25-month-old girl (see Audio Example 2 in online supplementary materials).

**Procedure.** Participants in the song identification task were instructed to use headphones in a quiet room. The listening tasks were executed in one sitting and in the same manner for all participants. Samples were presented in a single random order, with each sample followed by their responses. After hearing each audio file, participants were asked if they recognized the song (*yes*, *no*, or *not sure*). Then they were asked to type the name of the songs they recognized, and to rate their difficulty of identifying a song on a four-point scale (1 or *very difficult* to 4 or *very easy*). They received no feedback about their performance, which was submitted anonymously.

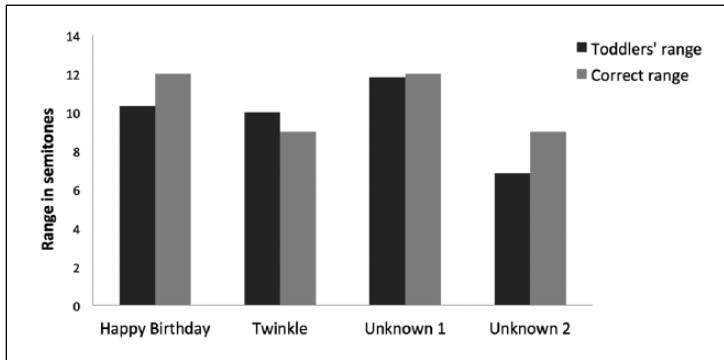
## Results

Adults' identification of the familiar melodies (*Twinkle, Twinkle, Little Star* and *Happy Birthday*) with foreign lyrics (Danish, Icelandic, Norwegian or Swedish) was 93% correct. Those who correctly identified the songs rated the trials as very easy (70%), somewhat easy (23%) or somewhat difficult (7%). By contrast, only 5% of adults provided names for the unfamiliar tunes, the names differing from the actual song name and from any other respondent's choice. The 7% of instances in which adults failed to identify familiar songs were no more likely to come from younger children than from older children in the sample. In effect, there were no differences in accuracy or the reported ease of song identification as a function of toddlers' age, perhaps because of ceiling effects.

Pitch analysis of toddlers' songs (complete versions) was accomplished with Melodyne software created by Celemony (Melodyne, 2009). The highest and lowest fundamental frequencies were identified in each performance, with the resulting pitch values rounded to the nearest semitone. Pitch identification was verified by two expert judges to preclude errors from background noise or erroneous octave placement. Toddlers' mean singing range for the four songs sung in foreign languages approximated the ranges of those songs, as can be seen in Figure 3. Inspection of the data revealed no obvious differences in range for younger and older toddlers, but comparisons were constrained by toddlers' use of different songs.

## Study 2

For the second study, 18 recordings of *Twinkle, Twinkle, Little Star* sung in English were selected from YouTube without respect to performance quality so long as the singer was 40 months or



**Figure 3.** Mean singing range of non-English-speaking toddlers (six per song) compared to the ranges of target songs.

younger and the recording was relatively free of background noise (for the purpose of pitch analysis). The first 18 recordings to meet those criteria were used for the present analysis. The age of these singers was 20 to 40 months.

*Pitch analysis.* The 18 sound files were analysed using the pitch recognition software Melodyne. The highest and lowest sung pitches were identified in each performance with pitch values rounded to the nearest semitone. Pitch identifications were verified by two expert judges to eliminate errors in automatic pitch detection stemming from possible background noise or erroneous octave placement. The pitch range of each performance was calculated in semitones.

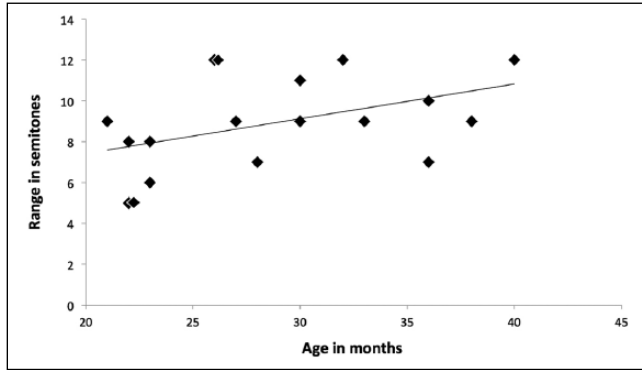
## Results

The notated version of the target song, *Twinkle, Twinkle, Little Star*, has a range of nine semitones. The average singing range of the 18 children who sang *Twinkle, Twinkle* was 8.9 semitones ( $SD = 2.38$ ), which was remarkably close to the target song range. Note, however, that approximating the target pitch range does not imply accuracy in interval production. In fact, the brief audio excerpts in the online supplementary materials reveal interval errors. Example 3 features a 23-month-old girl singing *Twinkle, Twinkle* in English; Example 4 features a 26-month-old girl singing the same tune with unrecognizable words, possibly with *The Alphabet Song (ABC)* in mind.

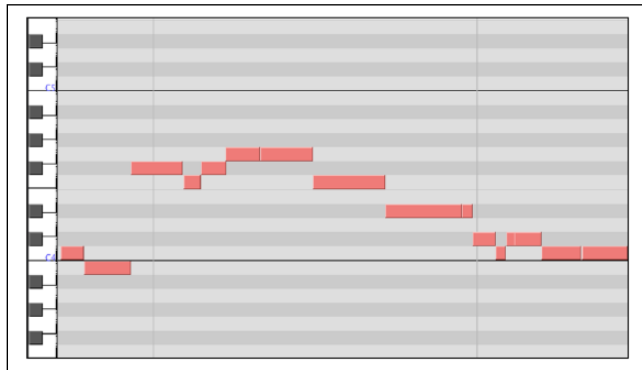
Individual performance, which is shown in Figure 4, revealed that eight children sang within one semitone of the target song range, five used a smaller range, and five used a larger range. The smallest range, five semitones, was used by two children, and the largest range, 12 semitones, by four children. The pitch range of the entire sample (i.e., all 18 performances considered) was 16 semitones, from Bb3 to D5. Age, in months, correlated significantly with pitch range,  $r(16) = .445$ ,  $p < .05$ , perhaps because older children were more likely than younger children to exceed the range of the target song. Such extensions in pitch range typically resulted from key instability. All 18 renditions preserved the melodic contour of the original song. Figure 5 depicts the opening phrase of *Twinkle, Twinkle* by a 23-month-old English-speaking boy.

## Discussion

Adults succeeded in identifying familiar songs sung in an unfamiliar language by 16- to 36-month-old toddlers. Their success is inconsistent with the claim that toddlers reproduce the



**Figure 4.** Singing range as a function of age for English-speaking toddlers who sang *Twinkle, Twinkle, Little Star*.



**Figure 5.** Depiction of the opening phrase of *Twinkle, Twinkle, Little Star*, sung by an English speaking 23-month-old boy.

words of songs but their tunes are not recognizable (Davidson et al., 1981; Welch et al., 1998). Instead, the findings are in line with case reports of toddlers’ recognizable tunes (Barrett, 2010; Kelley & Sutton-Smith, 1987; Stadler Elmer, 2011, 2012; Young, 2002). Although adults readily identified toddlers’ melodies, it is unlikely that they would be able to identify the sung words in isolation (i.e., without the familiar melody), even in a familiar language. Indeed, toddlers’ songs featured recognizable tunes with words that were garbled to varying degrees. The present findings are in sharp contrast with the proposed order of acquisition of song elements: words, rhythm, contour, and intervals (Davidson et al., 1981; Welch et al., 1998).

Toddlers captured the essence of songs by holistic renditions that lacked precision in interval or phonetic detail. The toddler in Example 3 sang an English version of *Twinkle, Twinkle* with a clearly recognizable tune and nonsense syllables sometimes substituted for words. Interestingly, the toddler in Example 4 sang the same tune with nonsense syllables that suggested *The Alphabet Song*, which shares the same tune as *Twinkle, Twinkle*. Mispronounced words are common in toddlers’ speech (e.g., MacDonald et al., 2012; Messum & Howard, 2012). It is important to note, however, that the words of songs are often meaningless for the toddlers and preschool children who sing them, functioning as fillers for the available pitch slots. For example, children sing *The Alphabet Song* a year or more before they understand that the words correspond to letters of the alphabet. The opacity of song lyrics continues well into

the school years for some songs such as the infamous *Mairzy Doats* (Griffin & Bock, 2000), where the metrical patterns of the music are at odds with conventional stress patterns of the speech, resulting in faulty speech parsing. Interestingly, the words of *Mairzy Doats* remain incomprehensible to children even as they sing about the opaque lyrics: “if the words sound queer or funny to the ear, a little bit jumbled and jivey”. *Three Blind Mice*, another children’s song from the past, rarely induces children to fret about the violence inflicted by the farmer’s wife “who cut off their tails with a carving knife”. The relative salience of song lyrics may depend less on children’s age than on situational factors including modes of exposure or instruction.

Pitch analyses of toddlers’ singing revealed a pitch range approximating the range of the target songs. This finding differs markedly from the reduced singing range posited for preschool and young school-age children (Davidson et al., 1981; Flowers & Dunne-Sousa, 1990; McKernon, 1979; Rutkowski, 1990; Rutkowski & Miller, 2003; Welch et al., 1996; Welch, Sergeant, & White, 1997). In fact, most of the toddlers in this study reproduced pitch ranges comparable to those of adults who sing in tune as opposed to poor singers who characteristically compress the pitch range of the target song (Buckton, 1977; Pfordresher & Brown, 2007; Wassum, 1979).

Surprisingly, some of the youngest toddlers in the group produced renditions that were relatively accurate in pitch but highly inaccurate in syllabic content. Almost all toddlers captured the rhythmic organization of songs, which undoubtedly aided adults’ recognition (Dowling et al., 1999; Hébert & Peretz, 1997). Because toddlers’ renditions reproduced the overall pitch and rhythmic structure of the target songs, they do not shed light on the proposed precedence of rhythm over pitch patterning in song production (Davidson et al., 1981; Hargreaves, 1986, 1996; McKernon, 1979; Welch, 1994, 1998). Some of the toddlers’ renditions, as in Example 1, were particularly slow in tempo, which is inconsistent with the claim that slow tempi are especially challenging for young children in perception as well as production (Drake, Jones, & Baruch, 2000). In fact, the slow tempi may have contributed to the success of these singing toddlers. Adult occasional singers improve their pitch accuracy when instructed to sing slowly (Dalla Bella, Giguère, & Peretz, 2007).

Toddlers’ singing, as revealed in the present study, raises questions about the development of singing, notably *what* develops with age and increasing experience. Unlike adults and older children whose singing has been examined to date, the toddlers who provided song samples in the present study were recorded in their familiar, everyday environment. They were not in a controlled testing situation, as is the case with older children in earlier studies. Even if toddlers are imprecise in reproducing the target intervals of songs, it is impossible to conclude that they are unable to generate the requisite precision. For example, 4- to 6-year-old children sometimes treat contour-preserving alterations of familiar melodies as correct renditions (Trehub, Morrongiello, & Thorpe, 1985), which implies that it takes years for many children to understand which melodic variations are acceptable in their culture and which are not.

In sum, toddlers’ production of familiar songs was considerably more accurate and identifiable than one would expect on the basis of the available literature. One potential objection to this claim is that parents shared the best instances of their children’s singing as opposed to the most common examples. It is customary, however, to use children’s best performance rather than their average performance when assessing their cognitive, linguistic, or motor abilities. For adults who are poor singers, performance can be variable across instances (Berkowska & Dalla Bella, 2013; Pfordresher, Brown, Meier, Belyk, & Liotti, 2010). An important task for future research is to ascertain whether toddlers exhibit pitch stability or variability when singing the same songs on different occasions. Further examination of the pitch patterns in



toddlers' singing is necessary for a better understanding of the prevalence of proficient singing in toddlers.

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