

**DEVELOPMENT OF VOWEL AND PHONEME POSITION CONTEXTS
BASED PICTURABLE KANNADA WORD LIST FOR INTERVENTION
OF CHILDREN WITH SPEECH SOUND DISORDERS**

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CERTIFICATE

This is to certify that the dissertation entitled “**Development of Vowel and Phoneme Position Contexts Based Picturable Kannada Word List for Intervention of Children with Speech Sound Disorders**” is a Bonafide work submitted as a part of the fulfilment for the degree of Master of Science (Speech Pathology) of the student registration number: P01II24S123014. It has been carried out under the guidance of a faculty of this institution. It has not been submitted earlier to any other university for the award of any diploma or degree.

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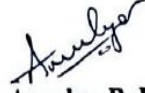
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CERTIFICATE

This is to certify that the dissertation entitled “**Development of Vowel and Phoneme Position Contexts Based Picturable Kannada Word List for Intervention of Children with Speech Sound Disorders**” has been prepared under my supervision and guidance. It is also certified that this dissertation has not been submitted earlier to any other university for the award of any diploma or degree.

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DECLARATION

This is to certify that the dissertation entitled “**Development of Vowel and Phoneme Position Contexts Based Picturable Kannada Word List for Intervention of Children with Speech Sound Disorders**” is a result of my study done under the guidance of Dr Amulya P Rao, Assistant Professor, Department of Language Pathology, All India Institute of Speech and Hearing, Mysore. This dissertation has not been submitted earlier to any other university for the award of any diploma or degree.

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TABLE OF CONTENTS

Chapter	Title	Page Number
	List of Tables	i
	List of Figures	ii
1	Introduction	1
2	Review of Literature	9
3	Method	17
4	Results & Discussion	21
5	Summary and Conclusion	44
	References	48
	Appendix	57

List of tables

Table No.	Title	Page Number
4.1	Target phonemes selected for the wordlist	21
4.2	Total number of words finalized	22
4.3	Demographic details and facilitating vowel context order for the selected target sound	23

List of figures

Table No.	Title	Page Number
4.1	Percentage of accurate production of target sound /k/ in the initial position across various vowel contexts by P1.	24
4.2	Percentage of accurate production of target sound /k/ in the medial position across various vowel contexts by P1.	24
4.3	Percentage of accurate production of target sound /d/ in the initial position across various vowel contexts by P1.	25
4.4	Percentage of accurate production of target sound /d/ in the medial position across various vowel contexts by P1.	26
4.5	Percentage of accurate production of target sound /f/ in the initial position across various vowel contexts by P2.	27
4.6	Percentage of accurate production of target sound /f/ in the medial position across various vowel contexts by P2.	27
4.7	Percentage of accurate production of target sound /d/ in the initial position across various vowel contexts by P2.	28
4.8	Percentage of accurate production of target sound /d/ in the initial position across various vowel contexts by P2.	29
4.9	Percentage of accurate production of target sound /f/ in the initial position across various vowel contexts by P3.	30
4.10	Percentage of accurate production of target sound /f/ in the medial position across various vowel contexts by P3.	30
4.11	Percentage of accurate production of target sound /r/ in the initial position across various vowel contexts by P3.	31
4.12	Percentage of accurate production of target sound /r/ in the medial position across various vowel contexts by P3.	32
4.13	Percentage of accurate production of target sound /f/ in the initial position across various vowel contexts by P4.	33

4.14	Percentage of accurate production of target sound /ʃ/ in the medial position across various vowel contexts by P4.	33
4.15	Percentage of accurate production of target sound /ɹ/ in the initial position across various vowel contexts by P4.	34
4.16	Percentage of accurate production of target sound /ɹ/ in the medial position across various vowel contexts by P4.	35
4.17	Percentage of accurate production of target sound /l/ in the medial position across various vowel contexts by P5.	36
4.18	Percentage of accurate production of target sound /ɹ/ in the initial position across various vowel contexts by P5.	37
4.19	Percentage of accurate production of target sound /ɹ/ in the medial position across various vowel contexts by P5.	37

CHAPTER 1

Introduction

Speech is the primary and first-learned modality for the expression of language by hearing language users. It consists of an organized set or system of sounds that are used to convey meaning. (Bernthal et al., 2017). An acceptable speech should have good fluency, prosody, voice and accurate articulation.

Articulation and its importance

Articulation in the simplest form can be described as the modification of the interrupted air stream into different sounds by the movement of articulators such as tongue, lip, jaw, teeth, soft palate etc. It is a series of overlapping ballistic movements which place varying degrees of obstruction in the path of the outgoing air stream and simultaneously modifies the size, shape and coupling of the resonating cavities (Nicolosi et al., 1978). Articulation is said to be normal as long as the speech sound produced by the speaker is conveying the meaning intended by him. Normality or abnormality are variable terms which depend on various factors such as the background and experience of the speaker and listener, the geographic location, the age and other factors.

Articulation is essential to human communication since clear speech sound production promotes both intelligibility and meaningful interaction. As Kent (1997) explains, clear articulation makes it easier for listeners to understand a speaker's message and reduces the chances of miscommunication. Hegde (2008) noted that people who speak clearly are frequently seen as more capable and self-assured, underscoring the importance of articulation in social, academic, and professional success. If articulation gets affected, then, it leads to communication breakdown.

Speech Sound Disorders (SSD)

McLeod and Baker (2017) define Speech Sound Disorder (SSD) as any combination of difficulties with perception, articulation/motor production or phonological representation of speech segments, phonotactics and prosody that may impact speech intelligibility and acceptability. According to DSM-V (2013), SSD is an umbrella term which is classified as, Articulation Disorder and Phonological disorder. Articulation disorder is related to phonetic error with no language components being affected and having consistent and a smaller number of errors. On the other hand, Phonological disorder is related to the language and its rules while presenting with inconsistent speech production and with inconsistent number of errors.

SSD is found to be one of the most common types of speech disorders in children, both in Western countries as well as in India. National Institute on Deafness and Other Communication Disorders, NIDCD (2010) have reported that the prevalence of speech sound disorder is 8-9% in young children. The recent prevalence report by Jayashree et al. (2015) revealed 18.6% of the total children surveyed in and around Mysuru, Karnataka, India, had speech sound disorders. In an Australian cohort study, the prevalence of SSD at 4 years of age was found to be 3.4%. Among the 4-year-olds identified with SSD, slightly less than half were males. However, the comorbidity of SSD with language disorder was twice as high in males compared to females (54.1% vs. 28%) (Eadie et al., 2015).

Further, in a recent study, the prevalence of SSD in primary school children was reported to be 1.3%, with significantly higher prevalence in males aged 61-72 months. “Substitution” of sounds was found to be more common compared to “omission” (Aslam et al., 2020). Prevalence of SSD was 13.5% out 1387 children with speech disorder (Mohamadi et al., 2016). Prevalence of SSD was significantly higher in boys than girls with 2.8% (at-risk 7.9%) in boys and 1.7% (at-risk 4.6%) in girls (Kim et al., 2017).

The estimated prevalence of persistent SSD was 3.6% (Wren et al. 2016). In a descriptive study, 7881 primary school students in Yazd were evaluated for speech disorders. Among them the prevalence of total speech disorders was 14.8% within which 13.8% had speech-sound disorder (Golestan et al., 2011). Thus, the literature review on the incidence and prevalence of children SSD highlights the necessity to carry out early identification and management of the same.

Several treatment approaches to SSD have been developed and have been empirically proven to be effective. ‘Contextual Approach’ or ‘Contextual Utilization’ is one among them (Bleile, 2006). This technique lies on the foundation that sounds in normal speech are coarticulated in which speech sounds demonstrate physiological and acoustic changes depending on the preceding or succeeding sounds of a particular speech sound. For instance, in the phrase "red car," the [d] generally gets assimilated into the following [k], where the voice [d] assimilates into the voiceless [k] (Bill & Kris, 2008). These coarticulatory influences across speech sounds have been studied and reported extensively both in typically developing children as well as in children with SSD.

Contextual facilitation in typically developing children

Literature review highlights the existence of some phonetic contexts that facilitate production of certain speech sounds during the typical development (Bleile, 1991b, 1996, 2006; Bauman-Waengler, 2012). The extensively studied phonetic contexts are phoneme positions and vowel contexts.

Phoneme Positions as contextual facilitation

Initial position has been documented to be the most facilitating phoneme position for the acquisition of majority of sounds in English, Quebecois French, and Dutch (Bleile, 2006; Dodd, Holm, Hua, & Crosbie, 2003; McLeod, Sutton, Trudeau, & Thordardottir, 2011; Smit, Hand, Freilinger, Bernthal, & Byrd, 1990; Stoel-Gammon, 1985; Watson & Skucanec, 1997b). Even in the Dravidian language

Kannada, initial position has been found to facilitate the production of bilabials, velars, palatal /ʃ/ whereas, medial-position facilitate the production of palatals, dentals, dental /s/ and glottal sounds. Further, retroflex acquisition has been documented to be facilitated in both initial and medial positions in children between 12-to18- months (Shishira & Sreedevi, 2013), 18-to 24- months (Sushma & Sreedevi, 2013) and 2-to 6-years (Deepa & Savithri, 2010). In Malayalam language, acquisition of /tʃ/ and /dʒ/ are found to be highly facilitated in the medial position first compared to the initial whereas, fricatives /s/ and /ʃ/ are acquired first in the initial position and then in the medial (Divya & Sreedevi, 2010; Neenu, 2011).

Vowel contexts as facilitating context

Front, back and central vowels are reported to facilitate the acquisition of English alveolars, velars and bilabials respectively (Davis & MacNilage, 1995). In an Indian study, it has been found that in the babbling stage, vowel [a] is favored with most of the consonants while vowel [i] with dentals (Anjana & Sreedevi, 2008). In the initial fifty-word phase, bilabials in the central vowels' contexts are produced more frequently while coronals and velars in the context of high front vowels (Shishira & Sreedevi, 2013).

Contextual facilitation in Children with Communication Disorders

Several Western and Indian studies have documented regarding contextual facilitation in children with different communication disorders. The production of fricative /s/ and liquid /r/ was observed to be highly facilitating in the initial compared to final position in Arabic- speaking children with dyslalia (Ghandour & Kaddah, 2011). Stokes and Griffith (2010) confirmed that word-final positions and back vowel contexts facilitated fricative [ʃ] production. Back vowels have also been seen to be enabling the production of velar phonemes (Cleland, Scoobie, & Wrench, 2015).

In the Indian scenario, production and acquisition of velars in Malayalam speaking children with hearing impairment have been found to be aided in the context of /a/ vowel (Anu Rose & Sreedevi, 2017); fricatives in the initial position and affricates in the medial position (Merin & Sreedevi, 2017). Amulya and Sreedevi (2018) have documented that in Kannada speaking children with speech sound disorders production of velar was expediated in the context of vowel /a/ in the initial position; retroflex with vowel /u/ in medial position; affricate and fricative either in initial or medial position in the context of vowel /i/. Further, production of unvoiced retroflex /t/ was facilitated in the vowel contexts, /a/ and /o/ in the word initial position whereas with vowel context /u/ in the word medial position. In a recent study, Anitha and Sreedevi (2022) reported that the production of voiced retroflex stop /d/ was expediated in the context of /o/ in the word initial position and in the vowel context /u/ in the word medial position in Malayalam-speaking Down syndrome children.

Assessment of Facilitating Contexts in Children with SSD

Assessment of facilitating contexts in children with SSD can be carried out by administering Deep test of articulation. Such tests have been developed in various languages. The DEAP test of articulation is available in English (McDonald, 1964), Deep Test of Articulation in Kannada – Sentence form (Rohini & Savithri, 1989), Deep Test of Articulation in Malayalam – Picture form (Maya & Savithri, 1990), Deep Test of Articulation in Bengali – Picture form (Animesh & Savithri, 1991), Deep Test of Articulation in Nepali – Picture form (Bhavani & Savithri, 1995) and Deep Test of Articulation in Tamil – Picture form (Sangeetha & Savithri, 1995). Based on this assessment, stimuli will be selected to start off articulation therapy from the most facilitating context to the least facilitating context.

Management using Contextual Facilitation for Children with SSD

Contextual facilitation is one of the sound establishment techniques that facilitates the production of the target sound. This is language specific. There are many SSD intervention approaches that utilize this technique for sound establishment like sensorimotor approach (McDonald, 1964), cycles approach (Hodson & Paden, 1983), and paired stimuli approach (Irwin & Weston, 1971).

Need for the study

The literature review clearly highlights that the facilitating contexts clinically improve speech production in children with communication disorders (Bernthal & Bankson, 1981; Curtis & Hardy, 1959; House, 1981; Kent, 1982; Spriestersbach & Curtis, 1951; Swisher, 1973). Key environments (facilitating contexts) for English have been documented by Bleile (1991b, 2006) and Bauman and Waengler (2012), for Kannada by Amulya and Sreedevi (2018), for Malayalam by Anitha and Sreedevi (2022), Anu Rose and Sreedevi (2017) and Merin and Sreedevi (2017).

Further, the review emphasizes that the studies have been conducted predominantly to determine the facilitating contexts in diverse populations and different languages since coarticulation is language dependent. Though these facilitating contexts have also been used clinically, empirical studies on the same are less. Studies have not been carried out on developing stimuli for the same. Tailor-made stimuli are being employed in these studies. Preparing the stimuli that is contextually based itself is a time-consuming process. Stimuli of Deep test of articulation are employed for intervention sometimes. However, not all speech sounds are included from a given language, and some are in picture form while some are in sentence form. Syllable numbers are also not considered to construct these tests and thus, usability of such test stimuli in the case of younger age group is questionable.

In addition, the available word lists are in the form of drill books in English (Goda & Hegde M N, 2006), and in Indian languages like Telugu, Hindi, Kannada, and Malayalam are available for individuals with cleft palates (Paloor, 2011) and hearing impairment (Rajeev Ranjan & Arun Banik, 2014). However, contextual facilitation has not been considered while designing the word list for use in any of these articulation drill books. Recently, in Hindi, Anima and Amulya (2024) have developed contextual based word list of all the speech sounds in Hindi.

In Kannada, a Dravidian Language, contextual based stimuli that is currently available is from Deep test of Articulation in Kannada- Sentence Form (Rohini & Savithri, 1989) is the only currently available vowel context-based stimuli for assessment and therapy. The major focus is on the consonants in vowels, consonants, and cluster contexts through 305 basic sentences involving 108 cluster contexts. Further, the words such as /ḍabu/, /dʒaḍugara/, /agni/, /bəhumana/, /səho:ḍa:ri/, /na:nja/, /ḍarzi/, /t̪i.zo:ri/, /ʈok:a/ are not frequently used by the current generation kids. So, use of this test or its stimuli for children with SSD in the present era is questionable. Hence, there is a necessity to develop a culturally and linguistically appropriate word list based on vowel environment as well as phoneme position as they have shown to facilitate the acquisition and production of speech sounds in Kannada. Additionally, a context-based wordlist in Kannada needs to be provided based on the number of syllables in a word (bisyllabic, trisyllabic or tetrasyllabic) so that it may be applied to more cases of varying severity of speech sound disorders. For therapeutic considerations, the number of stimuli per context also needs to be greater, however, in the available stimuli of the Deep test of Articulation in Kannada-Sentence form (Rohini & Savithri, 1989) each of the following target phonemes - /g/, /d/, /ḍ/, /j/, /ɳ/, /s/, /ʃ/, /h/, /y/, /r/, /l/, /v/, /c/ are available in one word per each vowel context. Further, phoneme position is not considered in this and not all the frequently erred sounds as per the recent study (Amulya et al., 2019) has been considered.

All the above factors necessitate the need for the development of a picturable contextual-based wordlist in Kannada for the intervention of Kannada-speaking children with speech sound disorders. This would aid in reducing the time in developing the stimuli for the intervention as well as help in fastening the positive progress towards a more accurate production of the treatment targets. Hence, the current study has been taken up

Aim of the study

The study aims to develop a contextual-based picturable word list in Kannada for the intervention of children with developmental speech sound disorder.

Objectives

- To develop vowel and phoneme position contextual-based picturable word lists for the frequently erred sounds in Kannada-speaking children with developmental speech sound disorders.
- To check the utility of the developed contextual-based picturable word lists for the assessment and intervention of children with SSD

CHAPTER 2

Review of literature

Effective communication requires the creation of suitable contrasts and transitions between speech sounds (Perkell et al., 1995). Speech production, a complex motor skill, involves rapid and accurate articulator movement patterns which successfully leads to the production of such contrasts and transitions between speech sounds (e.g., Nittrouer, 1995; Smith & Zelaznik, 2004).

2.1. Speech Sound Disorders and their prevalence

Speech Sound Disorders (SSDs) being a broader term describes a variety of difficulties in children's speech production (McLeod & Baker, 2017). Numerous factors, such as organic abnormalities, emotional conflicts, acoustic and perceptual deficiencies, difficulties with phonetic discrimination, impaired motor coordination, inadequate modeling, suboptimal environmental conditions, or functional issues, may contribute to these variations in articulation. Underdeveloped speech production or perception systems that compel children to generate speech more directly or harm their phonological processes may also be the cause of SSD (Vance et al., 2005). For people of all ages, it presents serious difficulties that affect social connections, communication, and academic performance. A category of children with SSD struggle to produce intelligible speech, even without any sensorimotor deficiencies, neurological conditions, or anomalies of the face structure (Anthony et al., 2011).

SSD is one of the most prevalent communication disorders in early childhood or in preschool children (Broomfield & Dodd, 2004; Eadie et al., 2015; McLeod & Harrison, 2009; Shriberg et al., 1999). Eight to nine percent of preschool-aged children have found to exhibit SSD (National Institute on Deafness and Other Communication Disorders, NIDCD, 2016). Karbasi et al. (2023) reported that out of 14.8% of children with speech disorders, 1.2% of participants had stuttering, 0.3% had voice abnormalities, and 13.8% had speech sound issues. Further, males were found to have higher prevalence (16.7%) than females (12%). A few studies reported prevalence

rate of SSD to be between 2.3% to 24.6% (Eadie et al., 2015; Jessup et al., 2008; Keating et al., 2001; Law et al., 2000; McKinnon et al., 2007; Shriberg et al., 1997b; Shriberg et al., 1999). In the Indian context, according to a recent prevalence study by Jayashree, et al. (2015), 18.6% of children in and around Mysuru, Karnataka, have speech sound disorders. A study conducted in the rural areas of Gujarat reported that around 115 (92 males and 36 female, total 15.97%) individuals had speech and language problems (pediatric=86). Among them 27 (22 pediatric) had articulation problems (Sinha et al., 2017). A door-to-door survey was conducted in the islands of Lakshadweep to identify population at risk for communication disorder, a total of 22558 people were screened among which 136 people were found to have speech and language related problems. Among them 16.91% had articulation deficits (Konadath et al., 2017). A survey was conducted in the Andaman and Nicobar Islands. A total of 49495 people were screened for communication disorder among which 2092 (4.22%) were at risk of communication disorder and a total of 291 people were evaluated out of which 143 (49.1%) people had speech and language related problems and out of that, 143 people 18(29%) were found to have articulation deficits (Konadath et al., 2020). A cross-sectional study conducted in Ballari district, South India, Speech Sound Disorders (SSD) were identified as part of the broader category of speech and language disorders. Out of 2304 school children screened, 24 children (1.04%) were found to have speech and language disorders. Among these 24 children, 7 (males=7, females=0) were specifically identified with speech sound disorders (Ravi et al., 2021). A study conducted in the tertiary care hospitals of Mysore reported a total of 9511 cases diagnosed with communication disorders. Amongst them, 2580 cases were diagnosed with speech and language disorders and out 2580 cases 1.75% of clients were diagnosed with speech sound disorders (Narasimhan et al., 2023).

Further, longitudinal research shows that early intervention can dramatically lower the long-term prevalence of SSD, underscoring the significance of prompt and precise diagnosis (Rvachew & Brosseau-Lapr , 2012). To improve a child's speech, several interventions have been created, each with a different approach (Baker & McLeod, 2011; Wren et al., 2018). One of these is the "Contextual Approach," which makes use of the idea of coarticulation to make the target

sounds easier to produce. This approach involves using facilitating phonetic contexts to establish the production of speech sounds.

2.2. Phonetic contexts

Phonetic contexts, also known as phonetic environments or key environments are the surrounding speech sounds of a target sound (Bleile, 1996). Adjacent sounds or pauses that occur at the beginning or end of a syllable inside a word or phrase are examples of these settings. Phoneme position in a word also acts as a phonetic environment for the production of target sound. For example, if /k/ is the target sound in the word /sku:l/, its phonetic environment is formed by the preceding fricative /s/, the following vowel /u/, and the location context of /k/. Similarly, if /k/ is the target sound in the phrase /mikki mouse/, its phonetic environment is determined by its medial location, /mikki/, the adjacent vowel, /i/, the pause that follows the prefix, /ki/, and the first consonant or syllable of the subsequent word, /mous/. Whether they are vowels, consonants, or junctures (pause), these surrounding components have a big impact on how the target speech sound is articulated and perceived. Thus, analysing how certain sounds are created and heard in diverse linguistic settings requires an understanding of phonetic environments.

In addition, phonetic contexts have been found to have an impact on speech perception as well. Perception of both speech and non-speech sounds are strongly influenced by the preceding phonetic contexts, especially in the context of liquids /l/ and /r/ (Stephens & Holt, 2002). Their findings are consistent with the fact that the effect of phonetic contexts is majorly driven by spectral contrasts. This indicates that the auditory system processes and contrasts the spectral characteristics of sounds, leading to the perception of context effects.

Literature review indicates that various physiological methods such as EMG, X-ray, ultrasound, and articulograph have been employed to study the impact of phonetic contexts on speech sound production. The results of several comprehensive tests of tongue muscles employing electromyography (EMG) reveal the contextual influence for vowels and consonants in CVC syllables (MacNeilage & DeClerk, 1969). Fromkin (1966) discovered that the starting/initial

position had greater EMG activity than the final position when producing bilabial /b/. Using ultrasound imaging, Gick et al. (2008) found that usually developing 11-month-old infants produced more adult-like /r/ in the post-vocalic position. Irfana (2017) investigated Kannada retroflex sounds and their relationship with vowel /u/ using ultrasound imaging. The results reflected that retroflex sounds had a significant degree of coarticulation with the subsequent vowel /u/, when compared to other vowels. This implies that the tongue contour of retroflex sounds in Kannada is significantly influenced by the subsequent /u/, resulting in distinct articulatory patterns.

Furthermore, acoustic studies have also indicated similar results. Research done by Zue (1976), Halle, Hughes, and Radley (1957), and Fisher-Jorgensen (1954) have shown that the acoustic properties of consonants are significantly influenced by the vowel environment. Participants were instructed to differentiate between the voiced consonants /b, d, and g/ based on steady-state second formants that were close to the crucial loci for velar, alveolar, and bilabial locations of articulation in tests by Liberman (1957) and Delattre et al. (1955). In the Indian context, Manasa et al. (2007) examined the duration of fricatives in relation to the vowel /i/. Their findings indicate that fricatives such as /s/ have greater durations when followed by the vowel /i/. This was attributed to the phenomenon that is caused by the assimilatory effect of the vowel and fricative phonetic movements.

2.3. Facilitating vowel contexts and phoneme positions

The influence of vowel contexts and phoneme positions on speech sound production has been widely documented in the literature, highlighting their importance in both typical speech development and the intervention of speech sound disorders. Phonetic and phonological theories suggest that the production accuracy of speech sounds is not same across contexts, with facilitating vowel context and positional factors significantly influencing articulatory ease of production.

Certain word placements in the Dravidian language, of Kannada make it easier to learn various sounds. For example, medial locations help with production of palatals, dentals, dental /s/, and glottal sounds, whereas initial positions help within producing bilabials, velars, and the palatal

/ʃ/ (Ramasubramanian & Sreedevi, 1991). The importance of vowel contexts in promoting speech sound acquisition is also shown by Indian research. Vowel [i] is frequently used with dentals at the babbling stage, vowel [a] is frequently linked with several consonants (Anjana & Sreedevi, 2008). During the first fifty-word stage, high front vowels are employed with coronals and velars, while central vowels are commonly used with bilabials (Shishira & Sreedevi, 2013). For children between the ages of 12 and 18 months (Shishira & Sreedevi, 2013) and 18 and 24 months (Sushma & Sreedevi, 2013), retroflex sounds were reported to be easier to learn in both beginning and medial positions. The study conducted by Deepa and Savithri (2010) on Kannada-speaking youngsters, which focused on how word position influences the acquisition of various sounds. Different word positions affect the way in which different sounds are learned. This different word position facilitates the production of dental sounds, palatal sounds, glottal sounds, and dental /s/. These are more easily acquired in both initial and medial positions for children aged 12 to 18 months, 18 to 24 months, and 2 to 6 years. These findings are significant because they show how important phonetic contexts are for the development of speech sounds in Kannada-speaking children. According to Divya and Sreedevi (2010) and Neenu and Sreedevi (2011), in Malayalam, the fricatives /s/ and /ʃ/ are taught first in initial positions before medial ones, while the affricates /c/ and /ʈ/ are learned first in medial positions as opposed to initial ones.

The facilitating vowel context and phoneme position in western context varies compared to that of Indian context. Davis and MacNilage (1990) conducted a single case study on English speaking toddler aged between 14 to 20 months and showed that the production of velar, alveolar, and bilabial sounds preferentially co-occurred with high front, high back, and low central vowels. Similar results were observed in Dutch, French and Turkish babies (Kern et al, 2011).

A study conducted by Boysson-Bardies (1993) on 10 to 12 months old infants from Swedish, English and Yoruba language community confirmed that association of labials with central vowels in French, Yoruba and Swedish infants. Oller and Steffans (1993) observed a strong association between coronals and high vowels and labials with low vowels. Research conducted by Vihman (1992) showed a significant association of labials with central vowels and velars with

back vowels and no significant association of alveolars with front vowels.

Several investigations show that the effect of phoneme position on acquisition of various speech sounds differ across languages due to the phonotactic differences and also due some smaller variation in physiological aspects of phoneme production. Most sounds are learned in initial position of the word and then in the final position in English language (Bleile, 2006; Dodd, et al., 2003; Smit et al., 1990).

A study by Gallagher and Shriner (1975a) stated there is no effect of position with respect to lexical boundaries on the production of fricatives /s/ and /z/ at sentence level in a 3-year-old child. The same authors Gallagher and Shriner (1975b) reported about the position effect on production of /s/ and /z/. Fricative /s/ was reported to be produced 34% of the time accurately in the initial position of the word compared to final position, however the /z/ was produced accurately in final position of the word for 71% of the time. A study by Kent (1982) on contrastingly reported that the fricative /s/ was easily produced in word final position than in word initial position. The liquid [r] is easily produced in the word initial position compared to word final position (Kent and Bauer, 1985). There are a few studies which support that the liquid [r] is produced accurately in the initial position of words and there are few studies contradicting it. A study by McGowani, Nitttrouer, and Manning (2016) reported that liquid [r] is acquired in the final or post-vocalic position compared to prevocalic position. Consonant acquisition was easier and earlier in word initial position followed by medial position and then final position in French preschool aged children (McLeod et al., 2011).

2.4. Treatment based on contextual facilitation.

Selection of proper stimuli words for articulation intervention is very essential as it leads to positive and faster improvement in children with SSD. While choosing phoneme sequences to represent a target sound in a certain word location, the phonetic context must be taken into account (Preston et al., 2019). If a child has difficulty in producing a speech sound in all vowel contexts, then choose the syllable or vowel context which is theoretically facilitative. For example, /a/

promotes pharyngeal constriction which might facilitate production of /ɪ/ when combined with /a/. Fricative /s/ production is facilitated in the cluster /ts/ due to the preceding alveolar stop; and /ʊk/ mid-high back vowel can help with /k/ production (Browman & Goldstein, 1989).

Contextual facilitation has been studied in children with a variety of communication impairments in both Western and Indian contexts. In Arabic-speaking children with dyslalia fricative /s/ and liquid /r/ are more readily produced in initial position than in final ones (Ghandour & Kaddah, 2011). Stokes and Griffith (2010) confirmed that word-final positions and back vowel contexts aid to produce the fricative [ʃ] in school aged children with persistent speech sound disorder. According to Cleland et al. (2015), back vowels also aid in the production of velar phonemes in children with primary speech sound disorder. According to a study by Anu Rose and Sreedevi (2017), children with hearing impairment whose native language is Malayalam found it easier to produce velar sounds in the context of /a/. This was attributed to the fact that vowel /a/ offers a more favorable phonetic environment for the production of velars because it provides specific articulatory actions that are well-suited to velar production. In a similar study, Merin and Sreedevi (2017), reported that children with hearing impairment and native language Malayalam, found it easier to produce fricatives in initial positions, affricates in medial positions, and velars in the context of the vowel /a/. An Indian study by Amulya and Sreedevi (2018) reported that vowel /u/ greatly facilitated the acquisition of the retroflexes /ɬ/, /ɖ/, and /ŋ/ followed by vowels /i/, and /a/ especially in the medial position; vowel /a/ facilitated velar production in the initial position; vowel /i/ facilitated the production of fricatives and affricates irrespective of phoneme position. For Malayalam-speaking children with Down syndrome, the production of voiced retroflex stop /ɖ/ was facilitated in the context of vowel /o/ in word-initial positions and in the context of vowel /u/ in word-medial position (Anitha & Sreedevi, 2022).

In sum, literature review highlights the clinical application of phonetic environments that enable to improve speech output in children with communication disorders. In order to quickly determine treatment targets in English, researchers such as Bleile (1991b, 2006) and Bauman and Waengler (2012) have identified critical contexts, such as alveolar stops preceding front vowels at

the beginning of words and voiced fricatives between vowels.

Furthermore, many clinically applied SSD intervention approaches are grounded in the principles of contextual facilitation, which includes the sensorimotor approach (McDonald, 1964), the cycles approach (Hodson & Paden, 1983), and the paired stimuli approach (Irwin & Weston, 1971). The literature supports the clinical relevance of considering phonetic contexts (Bernthal & Bankson, 1981; Curtis & Hardy, 1959; House, 1981; Kent, 1982; Spriestersbach & Curtis, 1951; Swisher, 1973).

These facilitating contexts have been clinically applied using tailor-made stimuli, which are intrinsically challenging to develop. Context-based assessment tools such as the Deep Test of Articulation by McDonald (1964a) in English, Secord Contextual Articulation Test (Secord & Shine, 1997), and several deep tests of articulation in Indian languages such as in Kannada (Rohini & Savithri, 1989), Malayalam (Maya & Savithri, 1990), Hindi (Deepa et al., 1998), Bengali (Animesh & Savithri, 1991), Nepali (Bhavani & Savithri, 1995), and Tamil (Sangeetha & Savithri, 1995) have been developed. These test materials can be utilised for intervention purposes. However, their application to younger age groups is questionable because they do not include all speech sounds, some are just in word and image form, while some are in sentence form. Additionally, the number of syllables was not considered while forming these tests. In addition, in the Deep test of articulation in Kannada-sentence form (Rohini & Savithri, 1989), each of the following target phonemes - /g/, /d/, /d̪/, /j/, /ɳ/, /s/, /ʃ/, /h/, /y/, /r/, /l/, /v/, /c/ are present in each vowel context only once. Further, phoneme position is not considered in this and not all the frequently erred sounds as per the recent study (Amulya et al., 2019) has been considered.

Hence, to conclude all the above literature review demands development of a ready to use intervention picturable wordlist that is based on all the vowel contexts and in all the phoneme positions in Kannada language. This would aid in reducing the time in developing the stimuli for the intervention as well as help in fastening the positive progress of the treatment.

CHAPTER 3

METHOD

The development of Kannada contextual based wordlist was carried out in two phases:

Phase 1: Developing word lists along with digital pictures

Phase 2: Administration of the developed wordlist

Phase 1: Developing word lists along with digital pictures.

This phase involved a total of 5 stages. The first stage involved selecting the target sounds. The second stage comprised of developing word lists for those selected target sounds. In the third stage, familiarity rating of the words in the word list were done followed by the fourth stage where picturization of the selected words was carried out. In the last stage, the developed pictures were rated for their iconicity, simplicity and familiarity.

Stage 1: Selection of target sounds

The most commonly erred sounds in the descending order by Kannada speaking children are velars, retroflex, trills, affricates, and fricatives (Amulya et al.,2019). Thus, in the current study, the target sounds considered were velars (/k/, /g/), retroflex (/t/, /d/, /n/, /l/) fricatives (/s/, /ʃ/), trill(/r/), and affricates (/tʃ/, /dz/).

Stage 2: Development of contextual-based wordlist for the target sounds

The wordlists developed by Amulya and Sreedevi (2018) were used in the present study. However, words are available only with target sounds in vowel contexts of /a/, /ɪ/ and /u/ and not in /ɛ/ and /O/ contexts in the initial and medial positions of the words. Further, long vowel contexts /a/, /i/, /e/, /u/, and /o/ are not there. In addition, target sound /r/ and palatal fricative /ʃ/ were not considered in their study. Hence, in the present study, wordlists were developed for sounds and contexts that were not considered in the study by Amulya and Sreedevi (2018). For this, meaningful bisyllabic, trisyllabic, and tetrasyllabic words were selected from daily conversation and primary grade school books following Mysore-Bangalore Dialect. These words were selected in such a way that each target sound had target phonemes in the initial and/or medial positions in the following vowel contexts: /a/, /ɪ/, /u/, /ɛ/ and /O/ (5

short vowels) and /a/, /i/, /u/, /e/, and /o/ (5 long vowels). In each vowel context and phoneme position, a minimum of 3 or a maximum of 5 words were selected for each target sound.

Stage 3: Familiarity rating of the wordlist

The developed word lists were given to three native Kannada-speaking Speech and Language Pathologists (SLPs) for familiarity rating. A 3-point rating scale (highly familiar, familiar, or not familiar) was provided to them for the same. Words rated as either familiar or highly familiar by at least 2 SLPs were selected, and the wordlists were finalized for each target sound.

Stage 4: Picturization of the wordlist

For each word in the word list, three pictures without copyright issues were generated from AI tools, Chatgpt 4, Microsoft designer, Pixabay, and Gemini AI. Further, these generated pictures were reverse checked in Google to avoid copyright issues.

Stage 5: Iconicity, clarity and familiarity rating of the pictures developed for the wordlist

The selected pictures for stimuli words were given to three SLPs, with more than two years of experience in the field, for rating them on the parameters - clarity, iconicity and familiarity. A 3-point rating scale (3: highly familiar, 2: familiar, 1: Not familiar) was used for the same. The picture that received highest scoring for clarity, iconicity and familiarity from at least two Speech-Language Pathologists (SLPs) were selected. In this way, one picture for each word was finalized.

Phase 2: Administration of the developed wordlist.

Once the wordlists and pictures were developed, to check their utility, they were utilized for speech sound intervention of children with SSD. Ethical clearance was sought for the same by AIISH Ethical Clearance Committee with the ID SH/IRB/M.5/SLP.13/2025-26. The method used has been described below.

Study Design

Case study method was employed. This flexible method was chosen as the aim was to check the highly accurate impact of using the developed contextual-based picture stimuli in each of the participant over a period of 7 to 10 sessions. In addition, the present study focused

on establishing the accurate production of the target and not to test efficacy of any therapeutic approach/technique.

Participants:

Five Kannada speaking children diagnosed with developmental SSD were enrolled as participants for speech therapy. The age range of the children was 3- to- 6 years. They were recruited from the speech-language therapy section of All India Institute of Speech and Hearing (AIISH), Mysuru. Participants were selected based on purposive and convenient sampling. The inclusion and exclusion criteria of participants are as follows:

Inclusion criteria

1. Native Kannada speakers
2. Diagnosed with speech sound disorders (phonetic type)
3. The chronological age greater than 3years.

Exclusion criteria

1. Diagnosed with SSD with no history of sensory or neurological problems or any syndromic disorders.
2. No hearing, language, motor, Oro-motor, or any cognitive impairments, which was ensured using 'WHO Ten Disability Screening Checklist' (Malhi & Singhi, 2002). Language age was assessed by administering the 'Assessment checklist for speech-language skills' (Swapna et al. 2010).

A written consent was taken from parents of all the participants (Appendix 1). The consent form was given in their native language. Further, the study also adhered to the Ethical Guidelines for Bio-Behavioral Research Involving Human Subjects (Venkatesan & Basavaraj, 2009).

Procedure

First the erred sounds were documented by administering Kannada Diagnostic photo Articulation Test (KDPAT) (Deepa & Savithri, 2010). Out of the erred sounds documented for each participant, two sounds were selected as target sounds. For these two target-sounds the

presence of any facilitating context and its order was checked and documented (Appendix 2) using the developed contextual-based wordlist. Based on the order of facilitating context noted, stimuli words were selected for the intervention from the developed wordlist.

A total of 10 speech therapy sessions with a duration of 45 minutes was taken up. The initial mid-, and last sessions were audio recorded. Naming task was used. Speech therapy for the target sounds was initiated with words having highly facilitating vowel contexts in the initial position followed by the medial position for all the participants. A total of 5 trials were given for producing each target word. If the participant failed to provide an accurate evoked response, modeled responses were sought, where the clinician modeled the targets along with phonetic placement approach. The researcher documented the number of evoked accurate productions of the target sounds in each session. For each evoked correct response, a score of '1' and for evoked incorrect/modeled correct response a score of '0' was given (Appendix 3). Once the participant achieved 75% accuracy of the target word production in 3 consecutive sessions, intervention for that particular target sound was terminated. To note that the assessment and therapy sessions were provided by the primary researcher and not by any other clinician and hence, no subjective rating of using the developed material was taken. Further, the stimuli during all these sessions were projected through the laptop Acer aspire Lite with the screen size 15.6 inch.

Data analysis

Qualitative analysis of the data was carried out. Percentage of accurate production of target sounds in the facilitating contexts was calculated for each session and documented. These documented values were graphically represented. The number of sessions required to reach the plateau of $\geq 75\%$ in three consecutive sessions using the stimuli with facilitating contexts was noted down. This was matched with the criteria provided by Amulya and Sreedevi (2018) stating that a child can accurately produce the target sound in the facilitating context by the fourth speech therapy session.

CHAPTER 4

RESULTS

This chapter describes the results of the present study that aims at developing a contextual based picturable wordlist in the language Kannada for the intervention of children with Speech Sound Disorder. The results are explained under two phases as mentioned in the method section.

Phase I: Development of word list along with digital pictures

Phase II: Administration of the word list.

Phase I: Development of contextual based word list in Kannada.

This phase involved 5 stages in total. Result of each stage has been explained below.

Stage 1: Selection of target sounds

A total of 11 most frequently erred phonemes were selected as targets. The selected phonemes are provided in table 4.1.

Table 4.1

Target phonemes selected for the wordlist

Target phonemes selected	/k/ /g/ /t/ /d/ /ŋ/ /l/ /ʃ/ /dz/ /s/ /f/ /r/
---------------------------------	--

Stage 2: Development of contextual-based wordlist for the target sounds

A total of 357 words were selected from daily conversation, primary grade, UKG, LKG Kannada textbooks and dictionary. The chosen words were meaningful bisyllabic, trisyllabic, and tetrasyllabic with the target sounds in the initial, medial positions in the vowel contexts: /a/, /ɪ/, /ʊ/, /ɛ/ and /o/ (5 short vowels) and /a/, /i/, /u/, /e/, and /o/ (5 long vowels). All the selected words followed Mysore-Bangalore dialect.

Stage 3: Familiarity rating of the word list.

The words which received familiar and highly familiar ratings by at-least two SLPs were selected as target stimuli. Thus, out of 357 words 318 words were selected as the target stimuli (Appendix 4). The total number of words finalized for each target sound as per the context are provided in table 4.2

Table 4.2*Total number of words finalized*

Sl. No.	Phonemes	Total No. of Words per context	Vowel Contexts					Total number of words
			/a/	/i/	/u/	/e/	/o/	
1.	/k/ (initial)	26	6	5	5	5	5	43
	/k/ (medial)	17	5	4	3	3	2	
2.	/g/ (initial)	23	6	3	6	3	5	41
	/g/ (medial)	18	6	4	4	3	1	
3.	/d/ (initial)	10	4	1	2	0	3	22
	/d/ (medial)	12	3	3	3	3	0	
4.	/t/ (initial)	15	5	4	1	3	2	31
	/t/ (medial)	16	5	3	3	3	2	
5.	/ŋ/ (initial)	NA	-	-	-	-	-	12
	/ŋ/ (medial)	12	3	3	3	3	0	
6.	/l/ (initial)	NA	-	-	-	-	-	12
	/l/ (medial)	12	3	3	3	3	0	
7.	/ʃ/ (initial)	16	6	6	2	2	0	29
	/ʃ/ (medial)	13	2	4	4	2	1	
8.	/dʒ/ (initial)	24	6	5	4	5	4	36
	/dʒ/ (medial)	12	4	2	3	3	0	
9.	/s/ (initial)	26	6	5	6	4	5	39
	/s/ (medial)	13	4	5	4	0	0	
10.	/f/ (initial)	12	6	4	2	0	0	17
	/f/ (medial)	5	2	3	0	0	0	
11.	/r/ (initial)	17	6	3	1	5	2	36
	/r/ (medial)	19	6	5	3	3	2	

Stage 4: Picturization of the wordlist.

For each selected word 3 pictures were generated using AI tools like ChatGPT, Gemini AI, Pixabay, and Microsoft designer.

Stage 5: Iconicity, clarity and familiarity rating of the developed picturized wordlist.

The pictures which received highest score for iconicity, clarity and familiarity by at least 2SLPs were selected and finalized. The finalized pictures of different target wordlists are provided in Appendix 5.

Phase II: Administration of the wordlist

The usability of contextual-based Kannada picturable wordlist for assessment and intervention of children with SSD was tested on 5 participants (P1, P2, P3, P4, P5) diagnosed with phonetic type SSD. Before initiating speech therapy, for each participant, two target sounds were selected from the erred sounds and the contextual facilitation order for the same was

documented using the developed wordlists. Information regarding participants' age, the target sounds selected and the facilitating context order for those target sounds are provided in table 4.3.

Table 4.3

Demographic details and facilitating vowel context order for the selected target sound.

Participants	Age/Gender	Target sound/s/	Facilitating Order	Vowel Context
			Initial Position	Medial Position
		/k/	Nil	Nil
P1	2.8y/male	/d/	a>i>u>o	i>u>a>e
		/d/	i>a>o>u	i>a>e>u
P2	4y/male	/f/	a>u>i	i>a
		/f/	i>a>u	a>i
P3	3.5y/male	/r/	a>u>o>i>e	i>a>e>o>u
		/f/	i>u>a	i>a
P4	4y/male	/r/	i>e>a>u>o	o>a>u>e>i
		/l/		a>u>o>i
P5	6y/male	/r/	o>u>i>e>a	u>e>o>i>a

Speech therapy for the target sounds was provided in the order of facilitating vowel contexts (Table 4.3) for participant respectively. The impact of using this order of facilitation during speech therapy for each participant has been described and discussed in this section.

P1: Unvoiced velar /k/ and voiced retroflex /d/ were the target sounds for P1. A total of 8 sessions were taken for both the target sounds.

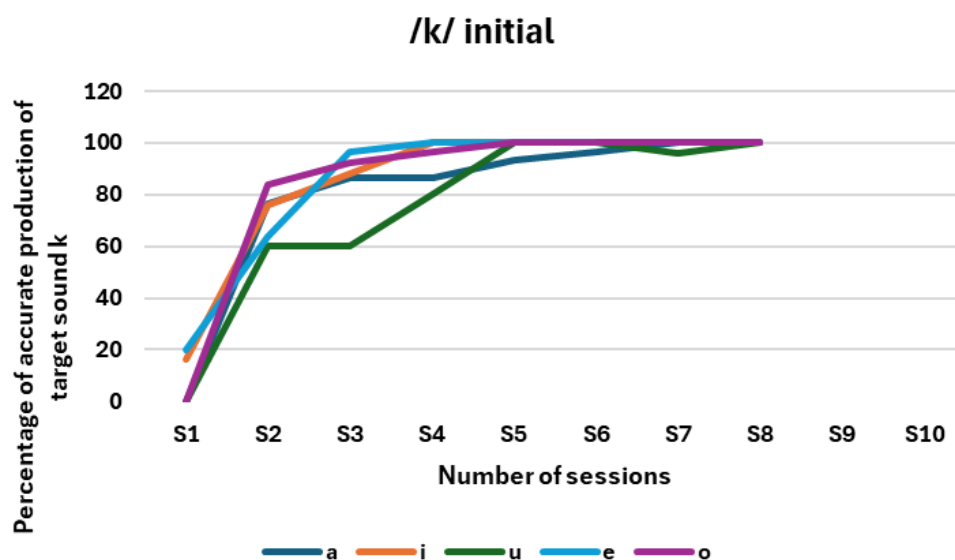
Target Sound /k/

For P1, no facilitating contexts were identified for the target sound /k/ (Table 4.3). Hence, each session was initiated with words having target sound in the initial position followed by medial position. Further, the vowel context order followed was /a/, /i/, /o/, /e/ and /u/.

Production of /k/ during each session in the initial and medial positions with each vowel context are represented in figures 4.1 and 4.2.

Figure 4.1

Percentage of accurate production of target sound /k/ in the initial position across various vowel contexts by P1.



From figure 4.1., it is shown that 75% of accurate production of the target sound started by session 2 for the vowel contexts /a/, /o/, /i/, by session 3 for /e/ and by session 4 for /u/.

Figure 4.2

Percentage of accurate production of target sound /k/ in the medial position across various vowel contexts by P1.

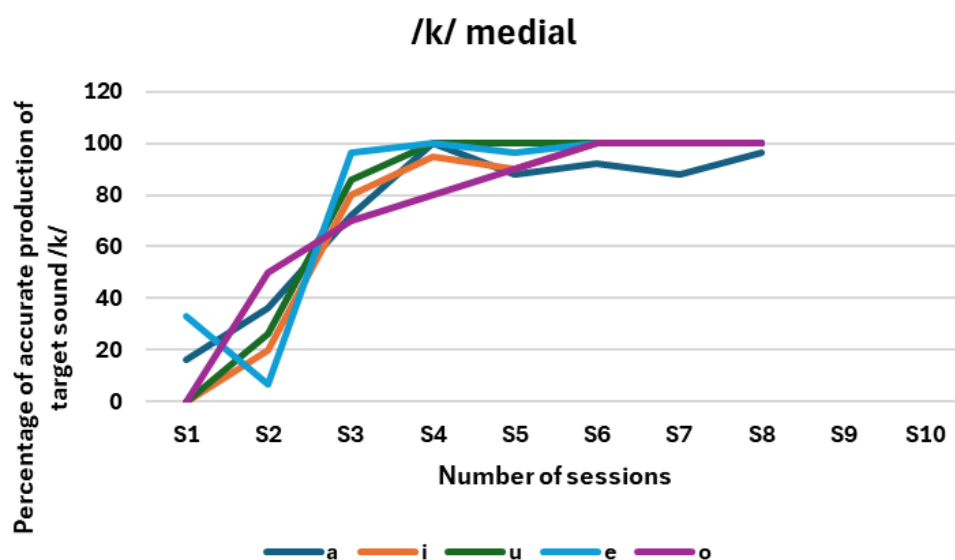


Figure 4.2 illustrates that 75% of the target sound was accurately produced by 3rd session in the vowel contexts /a/, /i/, /u/, and /e/, and by 4th session in the vowel context /o/.

Target Sound /d/

For target sound /d/, unlike /k/, the production in the initial position was found to be facilitating in vowel context order /a/, /i/, /u/, and /o/. On the other hand, the facilitating vowel context order in the medial position was /i/, /u/, /e/, and /a/. Responses of P1 across 8 sessions are depicted in figures 4.3 and 4.4

Figure 4.3

Percentage of accurate production of target sound /d/ in the initial position across various vowel contexts by P1.

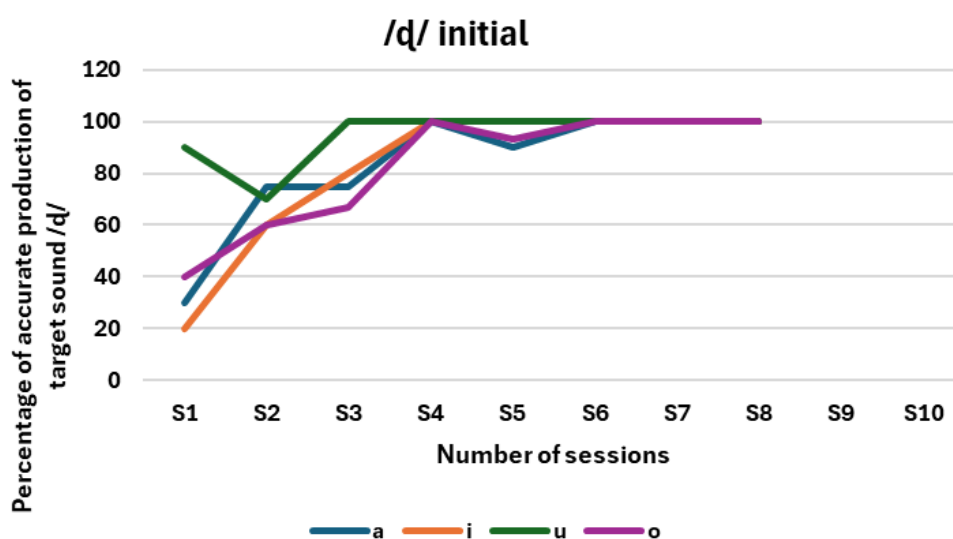
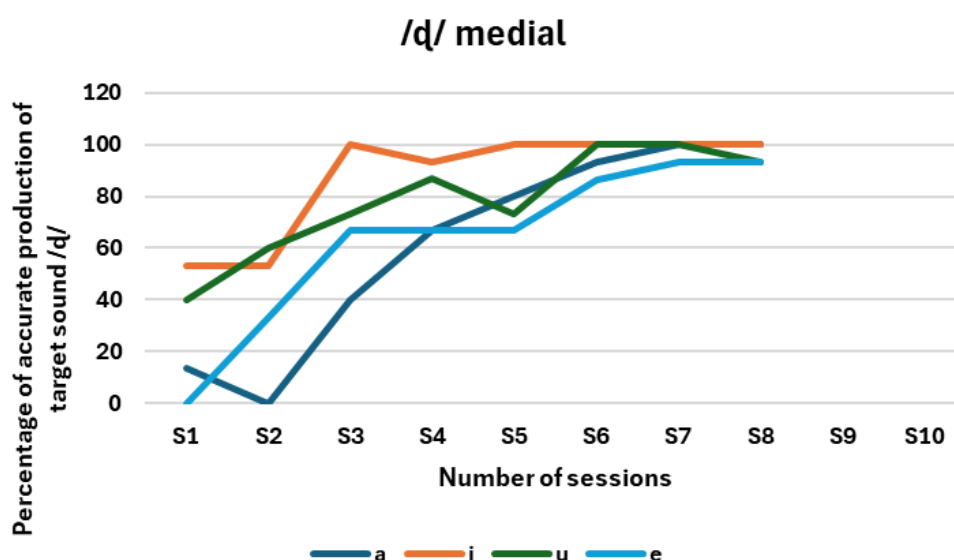


Figure 4.3 makes it evident that in the context of vowel /a/, 75% of accurate production of the target sound /d/ was accomplished by the 2nd session; in the vowel contexts /i/ & /u/, it was accomplished by the 3rd session; and in the context of vowel /o/, it was accomplished by the 4th session.

Figure 4.4

Percentage of accurate production of target sound /d/ in the medial position across various vowel contexts by P1.



From figure 4.4., it is clearly shown that 75% of accurate production of target sound /d/ was achieved by 3rd session in context of vowel /i/, and by 4th session in the context of vowel /u/. Further, in the context of vowel /a/ it was achieved by 5th session, and in in the context of vowel /e/, it was achieved by 6th session.

P2: Unvoiced fricative /ʃ/ and voiced retroflex /ɖ/ were the target sounds for P2. A total of 7 sessions were taken for both the target sounds.

Target Sound /ʃ/

The production of target sound /ʃ/ in the initial position was found to be facilitated in the vowel context order /a/, /u/, and /i/. However, the facilitating vowel context order in the medial position was /i/ followed by /a/. Responses of P2 across 7 sessions are depicted in figures 4.5 and 4.6

Figure 4.5

Percentage of accurate production of target sound /f/ in the initial position across various vowel contexts by P2.

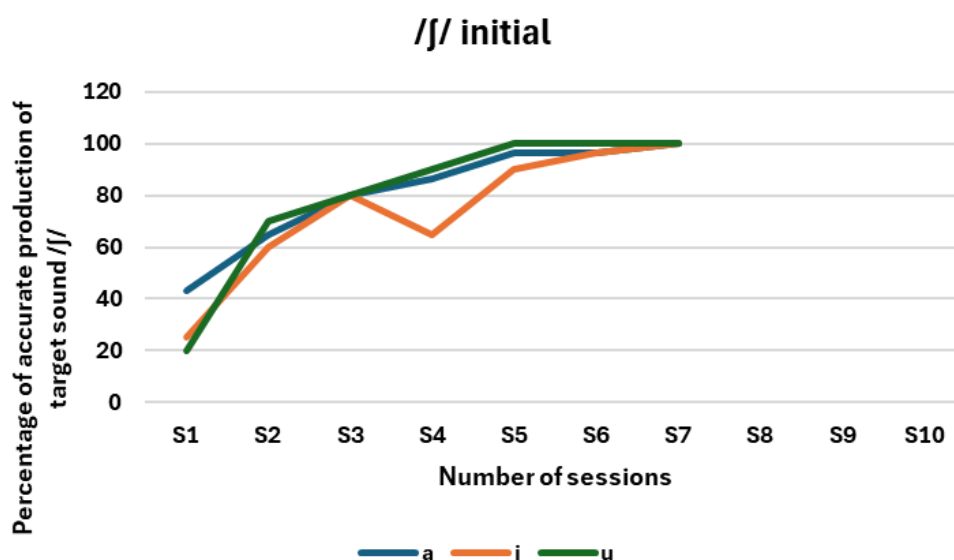
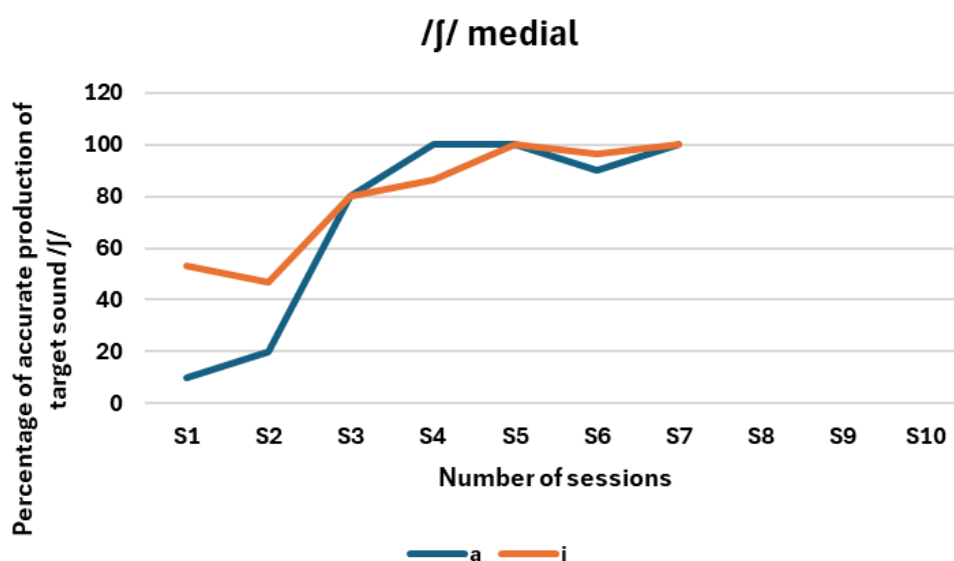


Figure 4.5 depicts that P2 could achieve 75% of correct production of the target in the vowel context /u/ by 3rd session, and in the vowel context /a/ by 4th session. By 5th session, it was accomplished in the vowel context /i/.

Figure 4.6

Percentage of accurate production of target sound /f/ in the medial position across various vowel contexts by P2.



It is clearly observed in figure 4.6 that 75% of accurate production of target sound /f/

was achieved by 3rd session in the vowel context /a/. However, in the context of vowel /i/ it was achieved by 4th session.

Target sound /d/

The production of target sound /d/ in the initial position was facilitated in the vowel context order /i/, /a/, /o/ and /u/. On the other hand, in the medial position, the order of facilitation was /i/, /a/, /e/ and /u/. Responses of P2 across 7 sessions are depicted in figures 4.7 and 4.8

Figure 4.7

Percentage of accurate production of target sound /d/ in the initial position across various vowel contexts by P2.

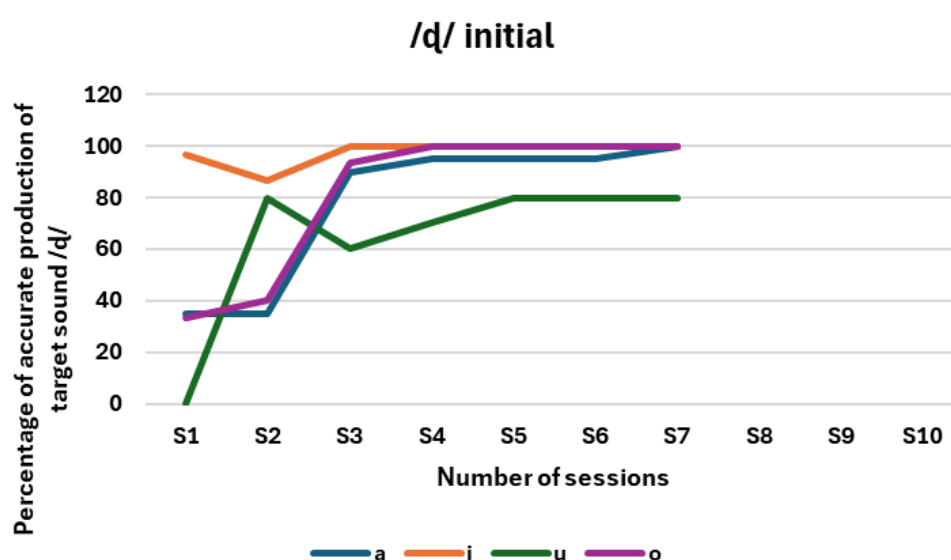


Figure 4.7 makes it clear that, in vowel /i/ context, 75% accurate production of the target sound /d/ was achieved by 2nd session, in vowel contexts /a/ and /o/ by 3rd session, and in vowel /u/ context by 4th session, maintaining $\geq 75\%$ accuracy for the next three consecutive sessions.

Figure 4.8

Percentage of accurate production of target sound /d/ in the initial position across various vowel contexts by P2.

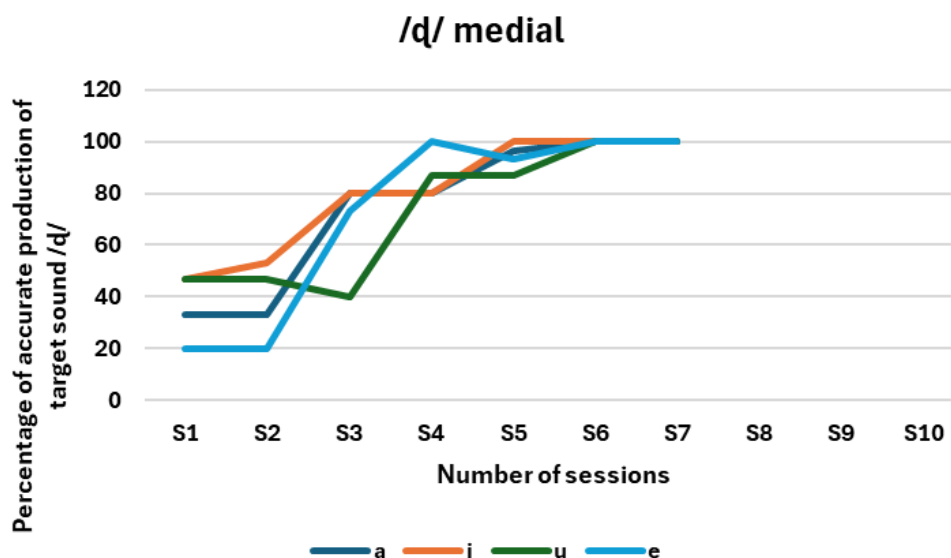


Figure 4.8 shows that, in the vowel contexts /i/ and /a/, the target sound /d/ was produced 75% of the times accurately by 3rd session, and in the vowel contexts /u/ and /e/, this was accomplished by the 4th session, maintaining $\geq 75\%$ accuracy throughout for the next three consecutive sessions.

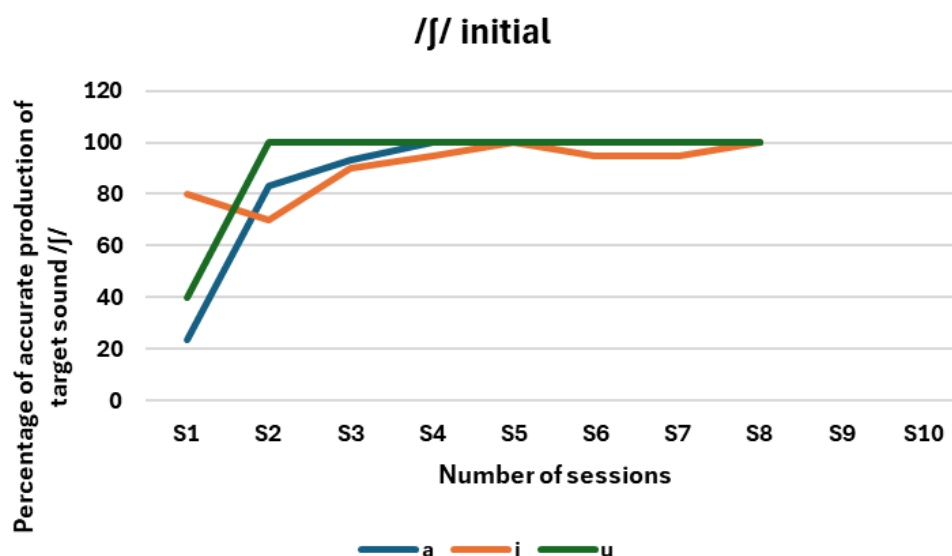
P3: Unvoiced fricative /f/ and voiced trill /r/ were the target sounds for P3. A total of 8 sessions were taken for both the target sounds.

Target Sound /f/

For P3, the production of target sound /f/ in the initial position was found to be facilitated in the vowel context order /i/, /a/, and /u/. However, the facilitating vowel context order in the medial position was /a/ followed by /i/. Responses of P3 across 8 sessions are depicted in figures 4.9 and 4.10.

Figure 4.9

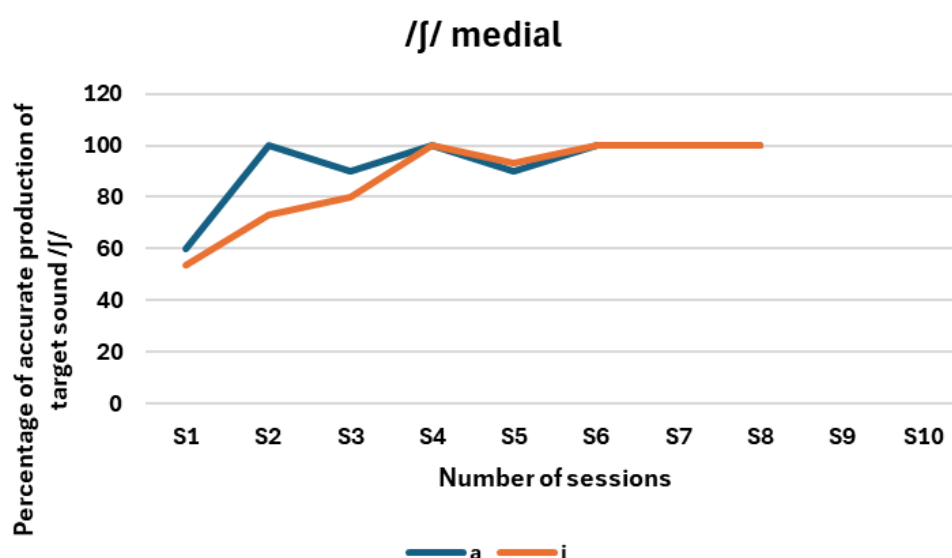
Percentage of accurate production of target sound /f/ in the initial position across various vowel contexts by P3.



According to figure 4.9, by 2nd session 75% accurate production of the target sound /f/ was achieved in vowel contexts /a/ & /u/, while by 3rd session it was achieved in vowel context /i/.

Figure 4.10

Percentage of accurate production of target sound /f/ in the medial position across various vowel contexts by P3.



From figure 4.10., it can be observed that 75% of accurate production of the target sound /ʃ/ was achieved by 2nd session in vowel /a/ context and in the context of vowel /i/, it was achieved by 3rd session.

Target sound /r/

For the production of the target sound /r/, in the initial position, the facilitating vowel context order was found to be /a/, /u/, /o/, /i/, and /e/. While, in the medial position it was found to be in the order /i/, /a/, /e/, /o/ and /u/. Responses of P2 across 8 sessions are depicted in figures 4.11 and 4.12.

Figure 4.11

Percentage of accurate production of target sound /r/ in the initial position across various vowel contexts by P3.

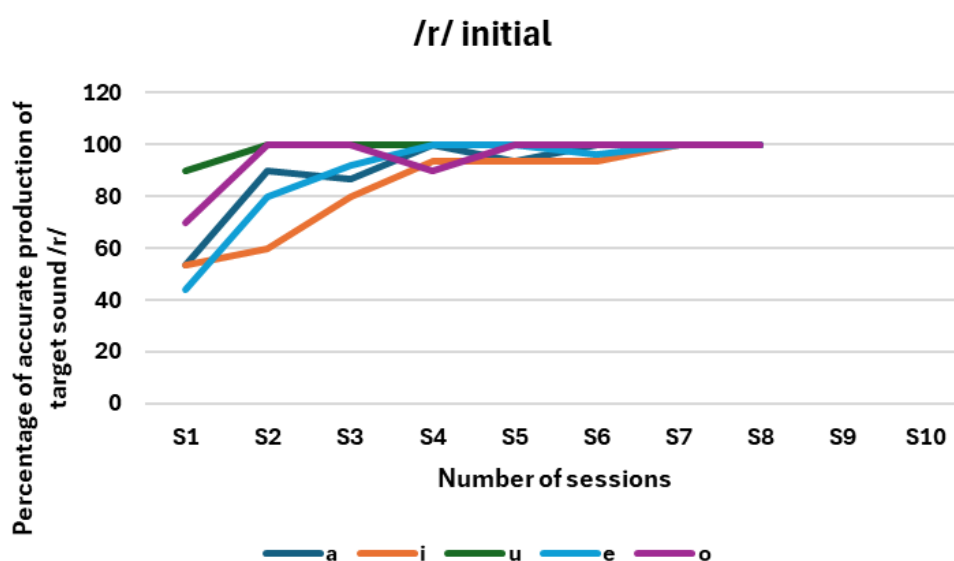


Figure 4.11 clearly illustrates that in the first session itself the target sound /r/ was produced accurately for 75% of the time in the vowel context /u/, while by 2nd session in the context of vowels /e/ and /o/, and by third session in vowel /u/ context.

Figure 4.12

Percentage of accurate production of target sound /r/ in the medial position across various vowel contexts by P3.

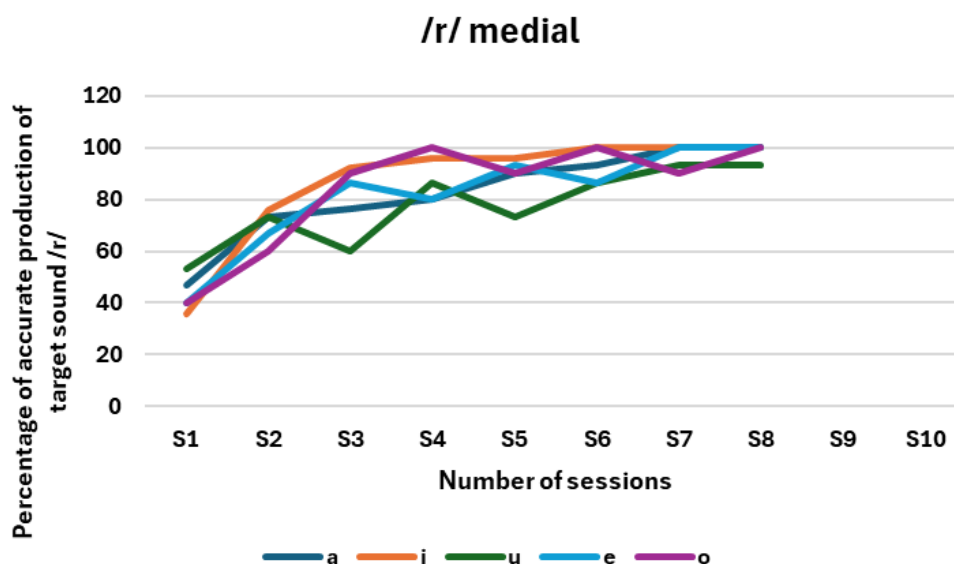


Figure 4.12 shows that 75% of accurate production of target sound /r/ was achieved by 2nd session for the vowel context /i/ and by 3rd session in the vowel contexts /a/, /e/, /o/ and lastly /u/ was achieved by 6th session.

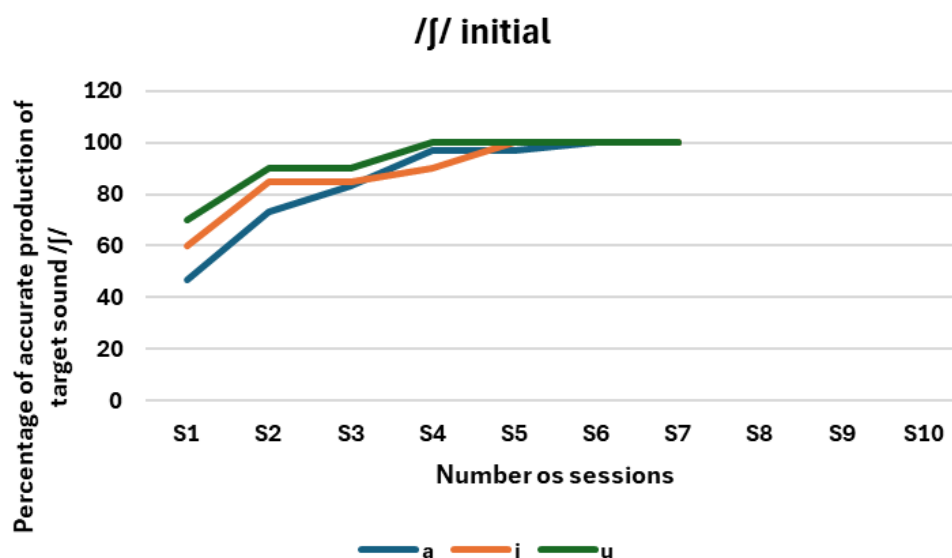
P4: Unvoiced fricative /ʃ/ and voiced trill /r/ were the target sounds for P4. A total of 7 sessions were taken for both the target sounds.

Target Sound /ʃ/

Similar to P3, the production of target sound /ʃ/ by P4 in the initial position was found to be facilitated in vowel context order /i/, /u/, and /a/. However, the facilitating vowel context order in the medial position was /i/ followed by /a/. Responses of P4 across 7 sessions are depicted in figures 4.13 and 4.14.

Figure 4.13

Percentage of accurate production of target sound /f/ in the initial position across various vowel contexts by P4.



From figure 4.13, it is seen that 75% of accurate production of target sound /f/ has been reached by 2nd session in the vowel contexts /i/ and /u/, and in the r vowel context /a/, it was achieved by 3rd session.

Figure 4.14

Percentage of accurate production of target sound /f/ in the medial position across various vowel contexts by P4.

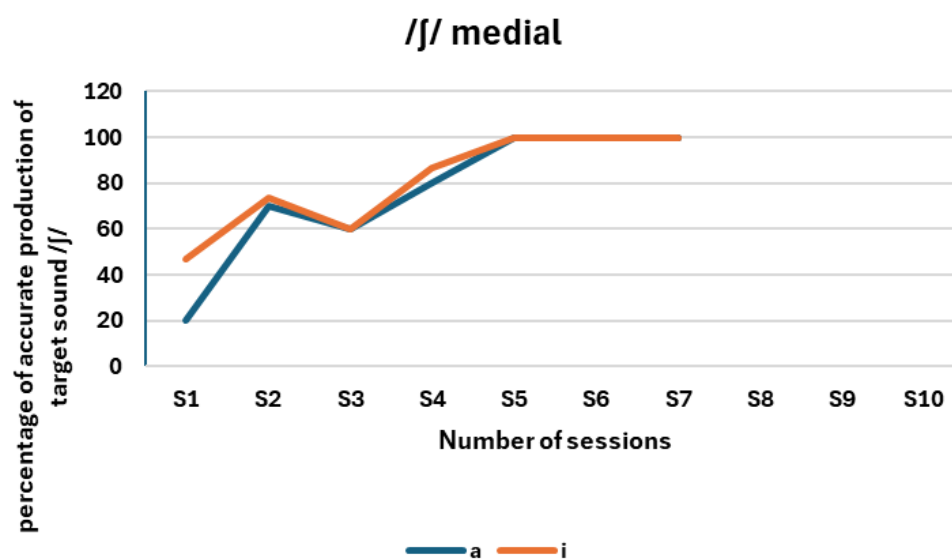


Figure 4.14 shows that, in both vowels /i/ and /u/ contexts 75% of accurate production of the target sound /ʃ/ was achieved by 4th session. Further, $\geq 75\%$ accuracy was maintained for next three consecutive sessions.

Target Sound /r/

For P4, the production of target sound /r/ in the initial position was found to be facilitated in vowel context order /i/, /e/, /a/, /u/ and /o/. However, in the medial position it was found to be in order /o/, /a/, /u/, /e/ and /i/. Responses of P4 across 7 sessions are depicted in the figures 4.15 and 4.16.

Figure 4.15

Percentage of accurate production of target sound /r/ in the initial position across various vowel contexts by P4.

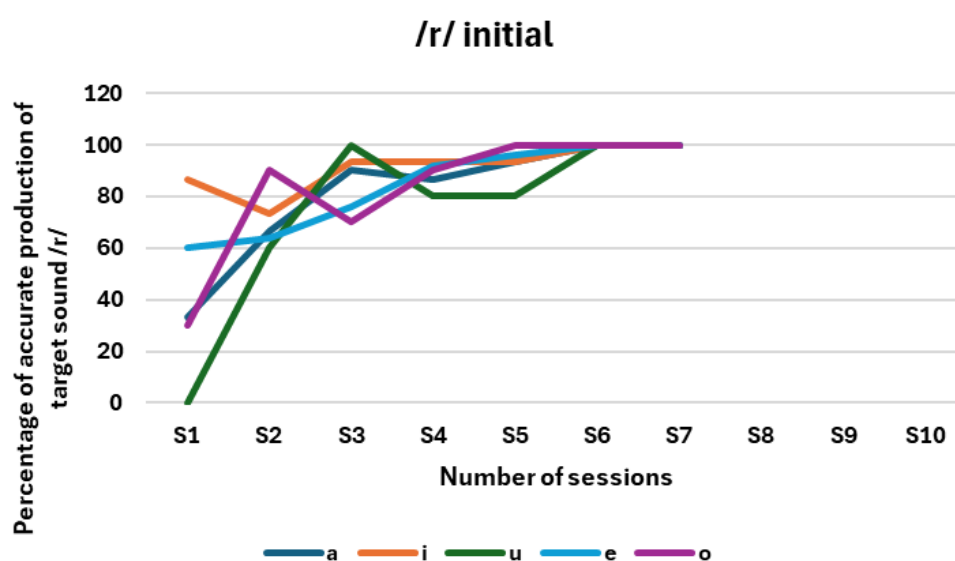


Figure 4.15 shows that 75% of accurate production of target sound /r/ was achieved by 3rd session in all the vowel contexts except /o/ which was achieved by 4th session.

Figure 4.16

Percentage of accurate production of target sound /r/ in the medial position across various vowel contexts by P4.

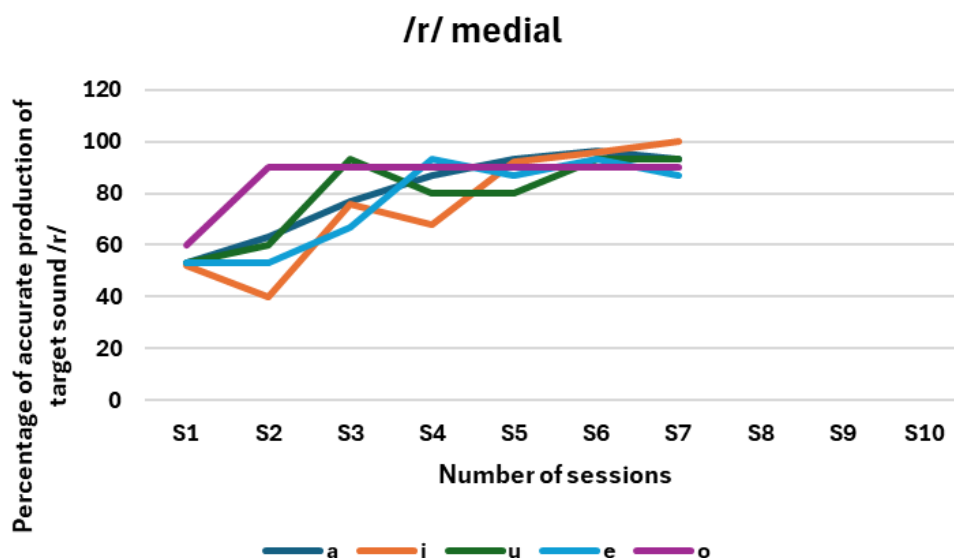


Figure 4.16 illustrates that 75% of the target sound /r/ was produced accurately by 2nd session in the vowel context /o/, and by 3rd session in the vowel contexts /a/ and /u/, by 4th session in the vowel context /e/, and by the end of 5th session in the context of /i/.

P5: Voiced retroflex /ɭ/ and voiced trill /r/ were the target sounds for P5. A total of 10 sessions were taken for both the target sounds.

Target Sound /ɭ/

For P5, the production of target sound /ɭ/ in the medial position was found to be facilitated in vowel context order /a/, /u/, /e/ and /i/. Responses of P5 across 10 sessions are depicted in the figure 4.17.

Figure 4.17

Percentage of accurate production of target sound /l/ in the medial position across various vowel contexts by P5.

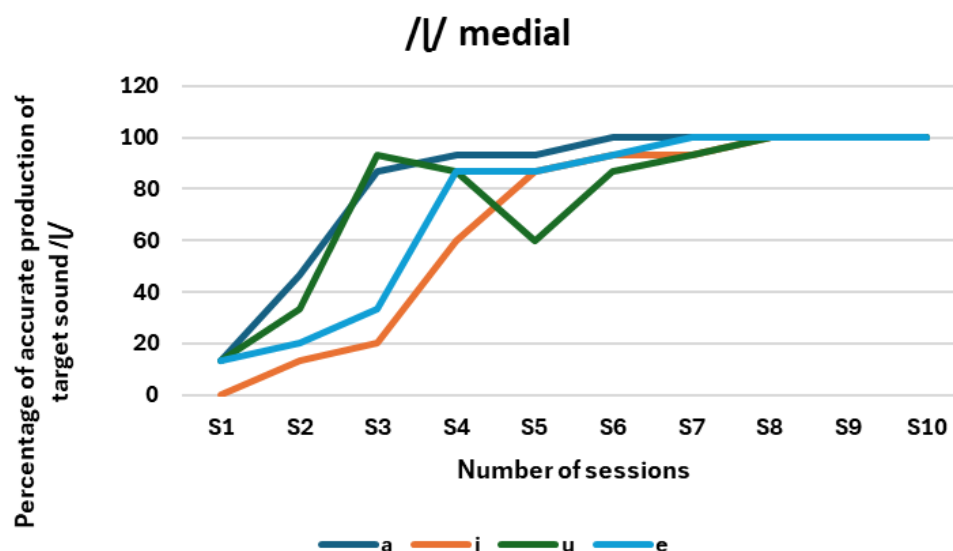


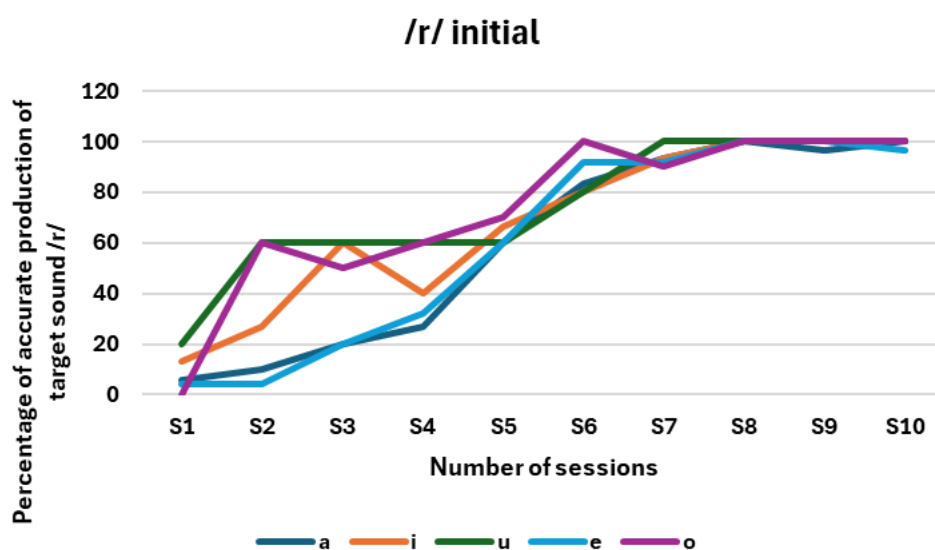
Figure 4.17 illustrates that in the vowel context /a/, 75% of accurate production of the target sound /l/ was attained by the 3rd session; in the vowel contexts /i/ and /e/, it was attained by the 4th session. In the vowel context /u/, it was attained by the 6th session.

Target Sound /r/

For P5, the production of target sound /r/ in the initial position was found to be facilitated in vowel context order /o/, /u/, /i/, /e/ and /a/ and in the medial position it was /u/, /e/, /o/, /i/ and /a/. Responses of P5 across 10 sessions are shown in the figures 4.18 and 4.19.

Figure 4.18

Percentage of accurate production of target sound /r/ in the initial position across various vowel contexts by P5.



From figure 4.18, it is clearly observed that 75% of accurate production of target sound /r/ was achieved by 5th session in the vowel context /o/ and, in the rest of the vowel context i.e. /e/, /a/, /i/, /u/, /e/) it was achieved by 6th session.

Figure 4.19

Percentage of accurate production of target sound /r/ in the medial position across various vowel contexts by P5.

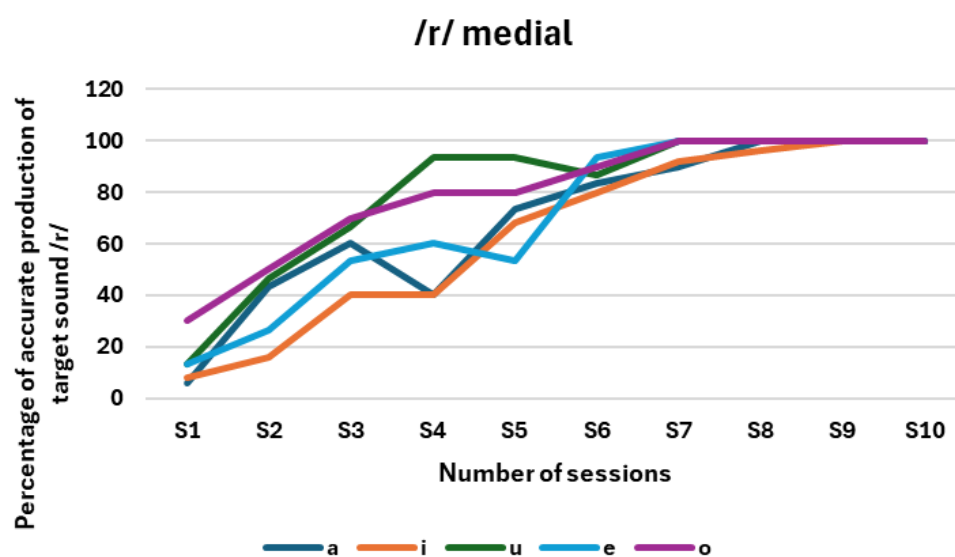


Figure 4.19 depicts that 75% of the target sound /r/ was produced accurately in the medial position by the 4th session in the vowel contexts /u/ and /o/, and by the 6th session in the vowel contexts /a/, /i/, and /e/.

CHAPTER 5

DISCUSSION

Discussion of the results pertaining to the utilization of the developed contextual-based picture stimuli for five participants with SSD has been done based on the target sounds taken for these participants. The target sounds that were corrected using the facilitating contexts in the current study were unvoiced velar /k/, voiced retroflex /ɖ/, trill /r/, palatal fricative /ʃ/, and lateral retroflex /ɭ/.

Target sound /k/

Velar /k/ was the target sound for P1. P1 achieved the production of target sound /k/ in the initial position of the word easily in the vowel contexts /a/, /o/, and /i/ (2nd session) followed by /e/ (3rd session) and lastly in the /u/ (4th session). Whereas, in the medial position it was easily facilitated in the vowel context /i/, /u/, and /e/_ (3rd session) followed by /a/ and /o/ (4th session) though no facilitating contexts were documented during the assessment.

It can be observed that the target sound was achieved faster in the vowel contexts /a/, /o/, /i/ than /e/ and /u/ in the initial position and /i/, /u/ and /e/ than /a/ and /o/ in the medial position. Further, 100% accurate production was achieved by 4th session in the vowel context /o/ than /a/ and /i/. This can be attributed to the physiological reasons behind the production of the target sound and the vowel context. Position of the tongue during the production of unvoiced velar /k/ is high back (Bauman-Waengler, 1992). The production of vowel /o/ involves protrusion of lips reducing the distance between the tongue and the palate, and the tongue is positioned in mid-high position at the back of the mouth thus, facilitating the production of unvoiced velar /k/ (Bauman-Waengler, 1992). This is in consonance with the study results of Kalaiah and Bhat (2017) who reported that Kannada consonant production is better in the context of vowel /o/. Further, it is also supported by the fact that velar stops in the beginning of the words are facilitated with back vowels following it in the same syllable (Bleile, 1996). Similarly, vowel /u/ facilitates the production of /k/ with more tense upper movement of back of the tongue and protrusion of lips. This is supported by the fact that back vowels are be more facilitative in nature to produce velar sounds (Cleland et al., 2015; Davis & MacNeilage, 1990, 2004).

In addition, vowel /a/ is found to be facilitating more in the initial position than in the final position. This is because of the physiological basis that during the production of vowel /a/, the tongue is free to move in any direction without any interference for producing velar /k/ (Bauman-Waengler, 2012). This view is further supported by Swisher's physiological reasoning (1973) affirming that the context minimally interfering with the error sound is facilitating. In addition, vowel /a/ is found to have less coarticulatory constraints (Sylak-Glassman, 2014) making it more facilitating. Also, the upward movement of dorsum of the tongue during the production of /k/ is noticeably visible due to relatively wide-open mouth during production of /a/ compared to the other two vowels /i/ and /u/ during the intervention. The current result is supported by the results of studies by Anu Rose and Sreedevi (2017) and Amulya and Sreedevi (2018) where they found vowel /a/ facilitating the production of velars in the initial position in Malayalam speaking children with hearing impairment and Kannada speaking children with SSD respectively.

Lastly high vowels /i/ and /e/ are also found to be facilitating for P1. This can be supported again by the physiological fact that during the production of vowels /i/ and /e/ the tongue blade is raised and the back part of the tongue is free for movement which is required for the production of velar /k/. Hence, when produced together, the whole tongue is raised which is much easier than making distinct movements of various parts of the tongue, thus making it facilitative in nature. Amulya and Sreedevi (2018) have also found vowel /i/ to be facilitating for the production of velar /k/ in children with SSD. In addition, it is also supported by one more fact that in typically developing Kannada speaking children, velars are found to co-occur more in high vowel contexts indicating it to be more facilitative during developmental stages (Shishira & Sreedevi, 2013).

With respect to the phoneme position, Shishira and Sreedevi (2013) and Sushma and Sreedevi (2013) reported initial position favoring the acquisition of velars during normal speech development which is has been found in the current study as well. It can be attributed to the fact that the target sound in the initial position receives the first neural commands with minimum influence by the preceding positions of articulators (Branigan, 1976). Further, initial syllables in

Kannada words are relatively more stressed, attended to, and extracted perceptually by toddlers (Echols & Newport, 1992).

Target sound /ɖ/

The retroflex sound /ɖ/ was taken as target for two participants, P1 and P2. For both the participants though the facilitating vowel contexts were same, the number of sessions required to achieve the target in these vowel contexts differed. For P1 it was achieved faster in the /a/ (2nd session) vowel context followed by /i/, /u/ (3rd session), however for the P2 it was achieved faster in /i/, /u/ (2nd session) followed by /a/, /o/ (3rd session). However, in the medial position it was achieved faster in the vowel context /i/ (3rd session) by both the participants.

It is observed that irrespective of the position of the target sound in the word, vowel /i/ has been found to be facilitating. This can be attributed to the fact that vowel /i/ is produced with high front tongue position which might facilitate the production of the target sound /ɖ/ which is also a high front sound. In addition, Davis & MacNeilage (1990, 2004) proposed that coronal sounds preferentially co-occur with front vowels. This is also evidenced by an Indian study by Shishira and Sreedevi (2013) who found that coronal sounds frequently co-occur with high vowels in typically developing making them facilitating.

Further, it is found to be facilitating in the context of vowel /a/ as well, which can be supported by the perceptual basis that retroflex sounds are poorly perceived in the high vowel context than low vowel context (Kalaiah & Bhat, 2017). This is in consonance with results of the study by Amulya and Sreedevi (2018).

In addition, following vowel /u/ and /o/ were also found to be facilitating in the production of retroflex /ɖ/ in the initial position. This again can be attributed to the physiological basis that both these vowels are high back vowels with protruded lips reducing the vertical distance between palate and tongue thus facilitating the production of curled tongue tip sounds. This is again validating the results of the study by Amulya and Sreedevi (2018).

Target sound /ʃ/

For three participants (P2, P3, P4), /ʃ/ was taken as the target sound. Though the facilitating vowel contexts are same, the order of their facilitation varied across participants. For P2 and P3 the target sound was achieved faster in the vowel contexts /a/ and /u/ (2nd session) followed by /i/. Whereas, for P4 it was achieved faster in the vowel contexts /i/ and /u/ (2nd session) followed by /a/. However, in the medial position for P2 and P4 the target sound /ʃ/ was achieved faster in the vowel context /i/ followed by /a/, in the case of P3 it was achieved faster in /a/ (2nd session) context followed by /i/.

Vowel /a/ must have been facilitating irrespective of the phoneme position as it shares a neutral tongue position providing it to move in any direction and angle (Bauman-Waengler, 2012). On the other hand, vowel /i/ must have been facilitating as the tongue placement of this vowel is shared by the target fricative /ʃ/. This is in consonance with clinical observations made by Bauman-Waengler (2012).

Vowel /u/ share lip rounding, posterior resonance, and compatible tongue shaping with the fricative /ʃ/ thus making it a facilitative context. This is in consonance with Bleile's (2006) clinical observation.

In terms of phoneme position, the target sound was also facilitated better in the initial position. This might be because of the fact that the initial position receives the first neural commands with minimum influence by the preceding positions of articulators (Branigan, 1976) making it more facilitating. Further, the current result is in consonance with the results of study by Shishira & Sreedevi (2013), Sushma & Sreedevi (2013), and Deepa & Savithri (2010) reporting that /ʃ/ facilitated better in the initial position. In Malayalam also, fricatives /ʃ/ was found to be acquired first in initial position (Divya & Sreedevi, 2010; Neenu & Sreedevi, 2011). However, it is not in consonance with Stokes & Griffith (2010) study who reported that back vowels and word-final positions facilitate the production of fricative /ʃ/. This might be because of the difference in the phonetics across languages.

Target sound /r/

Speech sound /r/ was taken as target sound for three participants (P3, P4, P5). For P3 the target sound /r/ was acquired first, in the vowel context order /u/ /o/, /a/, /e/ (2nd session) followed by /i/; for P4, in vowel context order /u/, /i/, /a/, /e/ (3rd session), and for P5, in the vowel context order /o/, /e/, /a/, /i/, /u/ (6th session). However, in the medial position it was achieved much faster in /u/ context in all the 3 participants.

The trill /r/ is produced by curling the tip of the tongue towards the alveolar ridge and making approximate contact. Trill /r/ is found to be highly facilitated in the high back vowel (/u/ and /o/) contexts than others. This can be due to the fact that these two vowels are produced with protruded lips reducing the vertical dimension of the oral cavity, thus, making it easy for the tongue to reach the alveolar ridge or the hard palate. In addition, back of the tongue is raised during the production of vowels whereas, dorsum or tongue blade along with tongue tip curls up for /r/. So, when combined together, the whole tongue is raised which is an easier movement compared to distinct movements of various parts of the tongue (Bauman-Waengler, 2012). In addition, Eisenson & Ogilvie (1977) have also reported that the contexts of unrounded vowel and high-back vowel facilitate the acquisition of trill /r/. Further, Bleile (2006) reports that production of /r/ is facilitated before high front vowels. This can also be observed in the current study results where high front vowels like /i/ and /e/ have facilitated the production of /r/.

Target sound /l/

For only one participant (P5), lateral retroflex /l/ was taken as the target. it was achieved faster in the vowel context /u/, /a/ (3rd session) followed by /e/ (4th session) and lastly in the vowel context /i/ (5th session). The retroflex /l/ is produced by curling the tongue tip along with retraction of the tongue. Back vowel /u/ involves raising back of the tongue along with reduction in the vertical dimension of oral cavity making it easy for the tongue to reach the correct placement of the target sound /l/. This is supported by the results of the study by Irfana (2017), reporting that the Kannada retroflex sounds showed greater coarticulation in the context of following vowel /u/ using ultrasound imaging. Further, vowel /a/ as explained for other target

sounds does not interfere with any tongue movement thus making it facilitating for the production of lateral retroflex /ɭ/.

To sum-up, the current study results highlight the importance of using appropriate stimuli during articulation therapy that facilitates the production of target sounds considered. Further, it adds on to the existing literature by validating the previous studies related to the use of facilitating vowel contexts and phoneme positions in faster (within 4 sessions) acquisition of speech sounds.

CHAPTER 6

SUMMARY AND CONCLUSION

Contextual facilitation has proven to be successful in faster acquisition of speech sounds by both typically developing (Shishira & Sreedevi, 2013; Sushma & Sreedevi, 2013) as well as children with communication disorders like SSD (Amulya & Sreedevi, 2018), intellectual disability (Anitha & Sreedevi, 2022) and hearing impairment (Anu Rose & Sreedevi, 2017; Merin & Sreedevi, 2017) in the Indian context. To apply facilitating contexts within the articulation therapy sessions, there is a requirement of contextual-based stimuli (wordlists) across various languages. However, there are no readily available contextual-based picturable wordlist in Kannada language that would aid SLPs in therapy. Hence, the current study was carried out to develop and validate contextual-based picturable wordlist in Kannada for the intervention of children with speech sound disorder in the age range 3-to-6 years.

With the Ethical clearance from the institute's Ethical Clearance Committee, the study was carried out in two phases, the first phase was to develop a contextual-based picturable wordlist, and the second phase was to check the utilization of the picturable wordlist. In the first phase, a total of 11 most frequently erred (target) sounds in Kannada language were selected. Those sounds were /k/ /g/ /t/ /d/ /n/ /l/ /ʃ/ /dz/ /s/ /ʒ/ and /r/. For these erred sounds culturally appropriate bisyllabic and trisyllabic words having targets in initial and medial positions in the vowel contexts, /a/, /i/, /u/, /e/ and /o/ (5 short vowels) and /a/, /i/, /u/, /e/, and /o/ (5 long vowels) were selected from various sources like daily conversation, primary grade, and Kindergarten Kannada textbooks and dictionary. A total of 357 words were selected out of which 318 words were finalized. Then for the finalized words, pictures without copyright issues were generated using the AI platforms - ChatGPT, Pixabay, Microsoft designer and Gemini AI. These AI developed pictures were given for rating to one special educator and two SLPs on the parameters - iconicity, clarity and familiarity. Pictures receiving the highest ratings were finalized.

Case study method was employed to test the utility of the developed picturable wordlist on 5 Kannada speaking children with developmental Speech sound Disorder. A total of 10 sessions of 45min duration was given to all the participants and therapy was given to all participants by the primary researcher of the study. For all the participants two target sounds were selected by administering KDPAT, then utilizing the newly developed wordlist facilitating vowel context order was found for the selected target sounds. Therapy was given from the most facilitating vowel context to least facilitating vowel context hierarchy. A total of 5 trials were given for producing each target word. The number of evoked accurate productions of the target sounds in each session were documented. For each evoked correct response, a score of '1' and for evoked incorrect/modeled correct response a score of '0' was given. Once the participant achieved 75% accuracy of the target word production in 3 consecutive sessions, intervention for that particular target sound was terminated. Further, this was matched with the criterion, that the target sound should be accurately produced in the facilitating context by 4th therapy session (Amulya & Sreedevi, 2019).

Results of the current study indicated that all 5 participants were able to acquire the target sounds for $\geq 75\%$ of the times in three consecutive sessions in the most facilitating contexts well within 4 sessions. Further, the results of this study added to the existing literature with respect to the facilitating vowel contexts and phoneme positions for Kannada speech sounds by validating the previous studies.

To conclude, the current study indicates that the developed wordlist has the potential to serve as a practical tool for SSD assessment and management. It also throws light on the fact that using appropriate contextual-based stimuli during SSD therapy sessions will ensure faster acquisition of the target speech sounds.

Clinical implication

1. The wordlist can reduce the time required for SLPs to develop or prepare Kannada words and their pictures for assessment and management of children with SSD.
2. The developed wordlist will provide a quick reference for the clinicians using contextual facilitation technique for intervention purposes.
3. The study can fill the gap in Kannada, where most available stimuli are outdated, in sentence form and not fully picturable, limiting their use with younger children.

Limitations of the study

1. Selected words follow only Mysore-Bangalore dialect.
2. The number of participants recruited for the study was less.
3. Although 11 commonly erred sound were there, therapy was only given for two target sounds.
4. The study mainly assessed production accuracy within therapy tasks and generalization to spontaneous speech, classroom communication was not carried out.
5. Therapy was administered only by the primary researcher, therapist-related bias and differences in therapeutic style may have influenced the outcomes.

Future directions

1. Future studies should include a larger number of participants from different age groups and dialectal backgrounds to improve generalizability.
2. Similar contextual-based picturable wordlists can be developed for other Indian languages to understand language-specific facilitating contexts.
3. Future research can be carried out to compare contextual based therapy with other therapy approaches/techniques to determine its efficacy.

4. Further, wordlists can be developed for the remaining Kannada speech sounds
5. Normative data for the same can be collected and convert these contextual-based picture stimuli into a test material.

REFERENCES

- Amulya, P., & Sreedevi, N. (2019). *Effect of vowel context and phoneme positions on articulation of phonemes in children with speech sound disorder: Pre-post therapy comparison* (Unpublished doctoral dissertation). University of Mysuru, Mysuru.
- Amulya, P., Prathima, S., & Sreedevi, N. (2019). Frequency of consonant production errors in children with speech sound disorder: A retrospective-descriptive study. *International Journal of Cognitive and Language Sciences*, 13(6), 1–1. s
- Anima, & Amulya, P. (2024). *Development of vowel and phoneme position contexts based picturable Hindi word list for intervention of children with speech sound disorder* (Unpublished master's dissertation). AIISH, University of Mysore.
- Animesh, B., & Savithri, S. R. (1991). The deep test of articulation in Bengali – Picture form. *Student Research at AIISH: Dissertation Abstracts*, 3, 1.
- Anitha, M., & Sreedevi, N. (2022). *Effect of vowel context and phoneme position on correct articulation of retroflex sounds in Malayalam-speaking children with Down syndrome* (Unpublished master's dissertation). AIISH, University of Mysore.
- Anjana, S., & Sreedevi, N. (2008). Phonetic characteristics of babbling in Kannada. *Student Research at AIISH: Dissertation Abstracts*, 6, 18–34.
- Anu Rose, P. (2017). *Facilitatory effect of vowel context on articulation of velars in children with hearing impairment* (Unpublished dissertation). University of Mysore, Mysore.
- Aslam, I., Mumtaz, N., & Saqulain, G. (2020). Prevalence of speech sound disorders among primary school children. *Journal of Islamabad Medical & Dental College*, 9(3), 195–200.
<https://doi.org/10.35787/jimdc.v9i3.283>

- Bauman-Waengler, J. (2012). *Articulatory and phonological impairments: A clinical focus*. Pearson.
- Bernthal, J. E., & Bankson, N. W. (1981). *Articulation disorders*. Prentice Hall.
- Bernthal, J. E., Bankson, N. W., & Flipsen, P. (2017). *Articulation and phonological disorders: Speech sound disorders in children* (8th ed.). Pearson.
- Bhavani, P., & Savithri, S. R. (1995). Deep test of articulation in Nepali – Picture form. *Student Research at AIISH: Dissertation Abstracts*, 3, 148.
- Bleile, K. M. (1991). *Child phonology: A book of exercises for students*. Singular Publishing Group.
- Bleile, K. M. (1996). *Articulation & phonological disorders: A book of exercises*. Singular Publishing Group.
- Bleile, K. M. (2006). *The late eight*. Plural Publishing.
- Boysson-Bardies, B. de. (1993). The role of articulation in speech perception. In B. de Boysson-Bardies, S. de Schonen, P. Jusczyk, P. McNeilage, & J. Morton (Eds.), *Developmental neurocognition: Speech and face processing in the first year of life* (pp. 123–132). Kluwer Academic Publishers.
- Branigan, G. G. (1976). Feature interaction during acquisition of phonology in children. *Journal of Child Language*, 3(1), 101–111. <https://doi.org/10.1017/S0305000900001360>
- Cleland, J., Scobbie, J. M., & Wrench, A. A. (2015). Using ultrasound visual biofeedback to treat persistent primary speech sound disorders. *Clinical Linguistics & Phonetics*, 29(8–10), 575–597.
- Curtis, J. F., & Hardy, J. C. (1959). A phonetic study of misarticulation of /r/. *Journal of Speech and Hearing Research*, 2(3), 244–257.

- Davis, B. L., & MacNeilage, P. F. (1995). The articulatory basis of babbling. *Journal of Speech and Hearing Research*, 38(6), 1199–1211.
- Davis, B. L., & MacNeilage, P. F. (1990). Acquisition of correct vowel production: A quantitative framework. *Journal of Speech and Hearing Research*, 33(1), 16–27.
<https://doi.org/10.1044/jshr.3301.16>
- Davis, B. L., & MacNeilage, P. F. (2004). The frame/content theory of evolution of speech production. *Behavioral and Brain Sciences*, 27(4), 499–511.
<https://doi.org/10.1017/S0140525X04000111>
- Deepa, A., & Savithri, S. R. (2010). Re-standardization of Kannada articulation test. *Student Research at AIISH Mysore*, 8(Part B), 53–65.
- Deepa Shankar, & Savithri, S. R. (1998). Deep test of articulation in Hindi: Picture form. *Student Research at AIISH: Dissertation Abstracts*, 4, 41.
- Delattre, P. C., Liberman, A. M., & Cooper, F. S. (1955). Acoustic loci and transitional cues for consonants. *The Journal of the Acoustical Society of America*, 27(4), 769–773.
<https://doi.org/10.1121/1.1908023>.
- Diagnostic and statistical manual of mental disorders (5th ed.). (2013). American Psychiatric Association. <https://doi.org/10.1176/appi.books.9780890425596>
- Divya, P., & Sreedevi, N. (2010). Articulatory acquisition in typically developing Malayalam-speaking children: 2–3 years. *Student Research at AIISH*, 8(Part B), 281–290.
- Dodd, B., Holm, A., Hua, Z., & Crosbie, S. (2003). Phonological development: A normative study of British English-speaking children. *Clinical Linguistics & Phonetics*, 17(8), 617–643.

- Eadie, P., Morgan, A., Ukoumunne, O. C., Ttofari Eecen, K., Wake, M., & Reilly, S. (2015). Speech sound disorder at 4 years: Prevalence, comorbidities, and predictors in a community cohort of children. *Developmental Medicine & Child Neurology*, 57(6), 578–584. <https://doi.org/10.1111/dmcn.12635>
- Echols, C. H., & Newport, E. L. (1992). The role of stress and position in determining first words. *Language Acquisition*, 2(3), 189–220. <https://doi.org/10.1207/s15327817la02032>
- Eisenson, J., & Ogilvie, M. (1977). *Speech correction in the schools* (5th ed.). Macmillan.
- Fisher-Jørgensen, E. (1954). *Acoustic analysis of stop consonants*. *Miscellanea Phonetica*, 2, 42–59
- Gallagher, T. M., & Shriner, T. H. (1975a). Articulatory movements and contextual constraints. *Journal of Speech and Hearing Research*, 18(3), 487–496.
- Gallagher, T. M., & Shriner, T. H. (1975b). Contextual variables related to articulatory proficiency. *Journal of Speech and Hearing Research*, 18(4), 820–830.
- Ghandour, H., & Kaddah, F. A. (2011). Factors affecting stimulability of erred sounds in common types of dyslalia. *Egyptian Journal of Ear, Nose, Throat and Allied Sciences*, 12(1), 61–67.
- Goda, S., & Hegde, M. N. (2006). *Sound stimuli for /p/, /b/, /f/, /v/, /s/, /z/: Book for treatment protocols for articulation & phonological disorders*. Plural Publishing.
- Golestan, M., Karbasi, S. A., & Fallah, R. (2011). The prevalence of speech disorder in primary school students in Yazd-Iran. *Acta Medica Iranica*, 49(1).
- Halle, M., Hughes, G. W., & Radley, J.-P. A. (1957). Acoustic properties of stop consonants. *The Journal of the Acoustical Society of America*, 29(1), 107–116. <https://doi.org/10.1121/1.1908694>

- Hardcastle, B., & Tjaden, K. (2008). Coarticulation and speech impairment. In *The handbook of clinical linguistics* (pp. 506–524). Wiley. <https://doi.org/10.1002/9781444301007.ch32>
- Hegde, M. N. (2008). *Introduction to communication sciences and disorders*. Plural Publishing.
- Hodson, B. W., & Paden, E. P. (1983). *Targeting intelligible speech: A phonological approach to remediation*. College-Hill Press.
- House, A. S. (1981). Reflections on a double negative: Misarticulation and inconsistency. *Journal of Speech and Hearing Research*, 24, 98–103.
- Irfana, M. (2017). *Coarticulation in Kannada and Hindi: An ultrasound imaging study* (Unpublished doctoral dissertation). University of Mysore.
- Irwin, J. V., & Weston, A. J. (1971). *A manual for the clinical utilization of the paired stimuli technique*. National Educator Service.
- Jayashree, C. S., Arunraj, K., & Madhusudarshan, R. (2015). Distribution of communication disorders in primary school children. *Journal of All India Institute of Speech and Hearing*, 34, 128–133.
- Kalaiah, M. K., & Bhat, J. S. (2017). Effect of vowel context on consonant recognition in Kannada. *Journal of International Advanced Otology*, 13(3), 398–404. <https://doi.org/10.5152/iao.2017.3695>
- Kent, R. D. (1982). Contextual facilitation of correct sound production. *Language, Speech, and Hearing Services in Schools*, 13(2), 66–76.
- Kent, R. D. (1997). *The speech sciences*. Singular Publishing Group.
- Kent, R. D., & Bauer, H. R. (1985). Vocalizations of one-year-olds. *Journal of Child Language*, 12(3), 491–526. <https://doi.org/10.1017/S0305000900006648>

- Kern, S., Davis, B., & Zink, I. (2011). From babbling to first words in four languages: Common trends, cultural variations, and linguistic processes. *Language Sciences*, 33(5), 770–779. <https://doi.org/10.1016/j.langsci.2011.05.003>
- Kim, S.-J., Ko, Y.-K., Seo, E.-Y., & Oh, G.-A. (2017). Prevalence of speech sound disorders in 6-year-old children in Korea. *Communication Sciences & Disorders*, 22(2), 309–317. <https://doi.org/10.12963/csd.17403>
- Konadath, S., Chatni, S., Lakshmi, M. S., & Saini, J. K. (2017). Prevalence of communication disorders in a group of islands in India. *Clinical Epidemiology and Global Health*, 5(2), 79–86. <https://doi.org/10.1016/j.cegh.2016.08.003>
- Konadath, S., Prabhu, P., Kasturi, V. J., Kannan, P., Gafoor, S. A., Raveendran, R., Rajendra, C., & Lokwani, P. (2020). Prevalence of communication disorders in Port Blair-Andaman and Nicobar Islands. *Clinical Epidemiology and Global Health*, 8(1), 233–238. <https://doi.org/10.1016/j.cegh.2019.08.005>
- Liberman, A. M. (1957). Some results of research on speech perception. *The Journal of the Acoustical Society of America*, 29(1), 117–123. <https://doi.org/10.1121/1.1908695>
- Manasa, S., Prathima, K., & Sreedevi, N. (2007). *Acoustic analysis of fricatives in Kannada* (Unpublished dissertation). All India Institute of Speech and Hearing, Mysuru.
- Malhi, P., & Singhi, P. (2002). Detection of disabilities in children using the Ten Questions Screen. *Indian Pediatrics*, 39(3), 271–275.
- Maya, S., & Savithri, S. R. (1990). Articulation test battery in Malayalam. *Student Research at AIISH: Dissertation Abstracts*, 2, 179.
- McDonald, E. T. (1964). *A deep test of articulation: Picture form*. Stanwix House.

- McGowan, R. S., Nitttrouer, S., & Manning, C. J. (2016). Development of /r/ in young children. *The Journal of the Acoustical Society of America*, 139(3), 1397–1408. <https://doi.org/10.1121/1.4943784>
- McLeod, S., & Baker, E. (2017). *Children's speech: An evidence-based approach to assessment and intervention*. Pearson.
- Merin, S. M. (2017). *Facilitatory effect of consonant position on articulation of affricates and fricatives in children with hearing impairment* (Unpublished dissertation). University of Mysore, Mysore.
- Mohamadi, O., Rahimi-Madiseh, M., & Sedehi, M. (2016). The prevalence of stuttering, voice disorder, and speech sound disorders in preschoolers in Shahrekord, Iran. *International Journal of Child, Youth and Family Studies*, 7(3–4), 456. <https://doi.org/10.18357/ijcyfs73-4201616169>
- Neenu, S. (2011). *Revalidation of Malayalam Diagnostic Articulation Test (3–4 years)* (Unpublished master's dissertation). University of Mysore, Mysore.
- Nicolosi, L., Harryman, E., & Kresheck, J. (1978). *Terminology of communication disorders*. Williams & Wilkins.
- Oller, D. K., & Steffens, M. L. (1993). Syllables and segments in infant vocalizations. In B. de Boysson-Bardies et al. (Eds.), *Developmental neurocognition: Speech and face processing in the first year of life* (pp. 83–100). Kluwer Academic Publishers.
- Preston, J. L., Brick, N., & Landi, N. (2019). Ultrasound biofeedback treatment for persisting childhood apraxia of speech. *American Journal of Speech-Language Pathology*, 28(4), 1462–1475. https://doi.org/10.1044/2019_AJSLP-18-0231
- Ramasubramanian, V., & Sreedevi, N. (1991). *Deep test of articulation in Kannada: Sentence form* (Unpublished dissertation). All India Institute of Speech and Hearing, Mysuru.

- Ranjan, R., & Banik, A. (2014). *Articulation drill book for children with hearing impairment*. (Unpublished manuscript). India Institute of Speech and Hearing.
- Ravi, S. K., Sumanth, P., Saraswathi, T., Basha Chinoor, M. A., Ashwini, N., & Ahemed, E. (2021). Prevalence of communication disorders among school children in Ballari, South India: A cross-sectional study. *Clinical Epidemiology and Global Health*, 12. <https://doi.org/10.1016/j.cegh.2021.100851>
- Sinha, S. K., Shivaswamy, J., Barman, A., Seth, D., Seshadri, D., & Savithri, S. R. (2017). Prevalence of communication disorders in a rural population at taluq level of Gujarat, India. *Clinical Epidemiology and Global Health*, 5(2), 73–78. <https://doi.org/10.1016/j.cegh.2016.08.006>
- Smit, A. B., Hand, L., Freilinger, J. J., Bernthal, J. E., & Byrd, A. (1990). The Iowa articulation norms project and its Nebraska replication. *Journal of Speech and Hearing Disorders*, 55(4), 779–798.
- Spiestersbach, D. C., & Curtis, J. F. (1951). Misarticulation and discrimination of speech sounds. *Quarterly Journal of Speech*, 37(4), 483–491.
- Stokes, S. F., & Griffiths, R. (2010). The use of facilitative vowel contexts in the treatment of post-alveolar fronting: A case study. *International Journal of Language & Communication Disorders*, 45(3), 368–380.
- Stoel-Gammon, C. (1985). Phonetic inventories, 15–24 months: A longitudinal study. *Journal of Speech and Hearing Research*, 28(4), 505–512.
- Swapna, N., Jayaram, M., & Prema, K. S. (2010). *Assessment checklist for speech-language skills (ACSLs)*. All India Institute of Speech and Hearing.

- Swisher, W. E. (1973). *An investigation of physiologically and acoustically facilitating phonetic environments on the production and perception of defective speech sounds* (Doctoral dissertation, University of Wisconsin).
- Sylak-Glassman, J. (2014). *Phonological features and their phonetic correlates*. Johns Hopkins University.
- Venkatesan, S., & Basavaraj, V. (2009). *Ethical guidelines for bio-behavioral research involving human subjects*. All India Institute of Speech and Hearing.
- Vihman, M. M. (1992). Early syllables and the construction of phonology. In C. A. Ferguson, L. Menn, & C. Stoel-Gammon (Eds.), *Phonological development: Models, research, implications* (pp. 393–422). York Press.
- Watson, M. M., & Scukanec, G. P. (1997). Profiling the phonological abilities of 2-year-olds: A longitudinal investigation. *Child Language Teaching and Therapy*, 13(1), 3–14.
- Wren, Y., Miller, L. L., Peters, T. J., Emond, A., & Roulstone, S. (2016). Prevalence and predictors of persistent speech sound disorder at eight years old: Findings from a population cohort study. *Journal of Speech, Language, and Hearing Research*, 59(4), 647–673. https://doi.org/10.1044/2015_JSLHR-S-14-0282
- Zue, V. W. (1976). Acoustic characteristics of stop consonants: A controlled study. *Speech Communication Group Working Papers, MIT Research Laboratory of Electronics*, 1, 1–46.

APPENDIX 1

INFORMED CONSENT

All India Institute of Speech and Hearing (AIISH)
Naimisham campus, Manasagangothri, Mysore.



Information to participants:

I, Mr. Dinesh N Naik, studying MSc in Speech-Language Pathology at All India Institute of Speech and Hearing, Mysuru, is conducting a study titled " Development of Vowel and Phoneme Position Contexts Based Picturable Kannada Word List for Intervention of Children with Speech Sound" under the guidance of Dr. Amulya P. Rao, Assistant Professor, Centre for augmentative and alternative communication and Sign language, AIISH, Mysuru. You are invited to participate in the study which aims to develop a contextual-based picturable word list in Kannada for the intervention of children with developmental speech sound disorder. The study will take 10 sessions for around 30-45 minutes. Participants will go under treatment for misarticulation, baseline assessment will be done before starting the treatment. Responses will be audio recorded for each session. The participant's identity will not be revealed at any time, and the audio will be kept confidential. The data obtained from the participants will not be disclosed, and access will be limited to individuals working on the study. Participation in this study is voluntary. You can refuse to participate or withdraw at any point in the study without penalty or loss of benefits to which you are otherwise entitled. The procedures of the study are non-invasive, and no risks are associated.

Informed Consent

I have been informed about the procedures of the study. The possible risks and benefits of my participation as a human subject in the study are clearly understood by me. I understand that I have a right to refuse participation as a subject or withdraw my consent at any time. I am also aware that by subjecting this investigation, I must give more time for assessments by the investigating team and that these assessments may not benefit me. I have the freedom to write to Chairman AEC, in case of any violation of these provisions without the danger of me being denied any rights to secure the clinical services at this institute.

I, _____ the undersigned, give my consent to be a participant in this investigation/study/program.

Signature of Parent/Guardian

Date:

Signature of Investigator (Student):

Name and Designation: Mr. Dinesh N Naik, 2nd MSc SLP

Signature of the guide

Name and Designation: Dr. Amulya P Rao, Assistant Professor in Language Pathology

APPENDIX 2

BASELINE ASSESSMENT FORM

Clients name:

Age/Gender:

Case no:

Date:

Clinician name:

Baseline:

Assess for any facilitating context for at least two sounds using contextual based word list. And note down the hierarchy of facilitating context.

Target sound	Word Position	/a/	/i/	/e/	/o/	/u/
Monosyllabic	Initial					
	Middle					
Bisyllabic	Initial					
	Middle					
Trisyllabic	Initial					
	Middle					

Hierarchy of facilitating context is noted in the baseline assessment. Therapy starts from the most facilitating context to the least facilitating.

APPENDIX 3

SESSION RECORD FORM

Client name:

Clinician name:

Age/Gender:

Date:

Instruction: Please mention the number of correct productions of target word corresponding to each vowel context and position.

Start with highly facilitating context and move to the least facilitating context.

Total number of trials for each target word: 5

Target sound	No Session	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
	Session 1					
	Session 2					
	Session 3					
	Session 4					
	Session 5					
	Session 6					
	Session 7					
	Session 8					
	Session 9					
	Session 10					

APPENDIX 4

DEVELOPED VOWEL CONTEXTUAL BASED WORDLIST IN KANNADA

(IPA)

/k/	/g/	/ɖ/	/t/	/ɳ/	/ɭ/	/ʃ/
Initial (a)	Initial(a)	Initial(a)	Initial(a)	Medial(a)	Medial(a)	Initial(a)
/kappe/	/ gaŋɽe /	/ ɖabbi /	/ ʈagaru/	/ baŋɳa/	/ kaɭɭa/	/ ʃandra/
/kaŋɳu/	/ gaŋɽe:ʃə /	/ ɖ ^h amaru/	/ ʈaval/	/ haŋa/	/ kaɭaʃa/	/ ʃapa:ti/
/kasa/	/gari/	/ ɖasʈbin/	/ ʈajar/	/ noŋa/	/ haɭadi/	/ ʃamaʈʃa/
/ka:lu/	/ga:ɭi/	/ ɖa:ku/	/ ʈa:ʈa/	Medial(i)	Medial(i)	/ ʃa:ku/
/ka:ru/	/ ga:ɖʒu /	Initial(i)	/ ʈa:bleʈ/	/ maŋi/	/ biɭi/	/ ʃa:pe/
/ka:ge/	/ ga:di /	/ ɖikki/	Initial(i)	/ ʒe:ɳi/	/ gaɭipaʈa/	/ ʃa:munɖi/
Initial(i)	Initial(i)	Initial(u)	/ ʈiket/	/ ra:ɳi/	/ giɭi/	Initial(i)
/kivi/	/ gida /	/ ɖumma/	/ ʈiffin/	Medial(u)	Medial(u)	/ ʃitte/
/kiri:ʈa/	/ giɭi /	/ ɖummi/	/ ʈi:ʈʃəʈ/	/ kaŋɳu/	/ muɭɭu/	/ ʃinna/
/ki:li/	/ gi:ʃu /	Initial(o)	/ ʈi:/	/ haŋɳu/	/ maraɭu/	/ ʃirate/
/ki:ʈa/	Initial (u)	/ ɖonku/	Initial(u)	/ maŋɳu/	/ beraɭu/	/ ʃi:la/
/ki:bo:rd/	/ gula:bi /	/ ɖ ^h o:lu/	/ ʈu/	Medial(e)	Medial(e)	/ ʃi:ʈi/
Initial (u)	/ gubbi /	/ ɖoɭɭu/	Initial(e)	/ haŋe/	/ baɭe/	/ ʃi:ppu/
/kuɖi/	/ guɖisu /	Medial(a)	/ ʈeɳu/	/ doŋɳe/	/ soɭɭe/	Initial(u)
/kuri/	/ gu:ɖu/	/ gadɖa/	/ ʈe:pu/	/ maŋe/	/ maɭe/	/ ʃukki/
/ku:dalu/	/ gu:ɭi/	/ guɖɖa/	/ ʈe:bal/			/ ʃu:ru/
/ku:gu/	/gu:be/	/ garuɖa/	Initial(o)			Initial(e)

/ku:ɖu/	Initial (e)	Medial(i)	/ ʈoma:ʈo/			/ ʃeɳɖu/
Initial(e)	/ gere/	/ mandɪ/	/ ʈo:pi/			/ ʃe:ru/
/kempu/	/gedʒdʒe/	/ angaɖi/	Medial(a)			Medial(a)
/kenne/	/ ge:ʈu/	/ karaɖi/	/ paʈa/			/ mantʃa/
/kere/	Initial (o)	Medial(u)	/ kiʈaki/			/ kavaʃa/
/ke:sari/	/ gombe/	/ la:ɖu/	/ baʈʈalu/			Medial(i)
/ke:ku/	/ gobbara/	/ ka:ɖu/	/ paʈa:ki/			/ joʃʃisu/
Initial(o)	/ go:li/	/ huɖuga/	/ baʈaɳi/			/gubbaʃʃi/
/koʌalu/	/ go:ɖe/	Medial(e)	Medial(i)			/ kurtʃi/
/kokkare/	/go:ɖambi/	/ pagaɖe/	/ ʈuʈi/			/ kartʃifu/
/ko:ti/	Medial(a)	/ go:ɖe/	/ buʈʈi/			Medial(u)
/ko:pa/	/ haggə/	/ buruɖe/	/ roʈʈi/			/ kaʃʃu/
/ko:ʎi/	/ manga/		Medial(u)			/ bentʃu/
Medial(a)	/ langa/		/ raʈʈu/			/ hentʃu/
/ʃaraka/	/ banga:ra/		/ hiʈʈu/			/mantʃu:ri/
/pukka/	/ ʃaʎiga:la/		/ boʈʈu/			Medial(e)
/makkaʎu/	/baʎega:ra/		Medial(e)			/ paɳʃe/
/a:ka:ʃa/	Medial(i)		/ motte/			/ kaʃʰe:ri/
/ɖʒaʈaka/	/ ba:gilu/		/ ʈaʈte/			Medial(o)
Medial(i)	/ angi/		/ ʃiʈte/			/kaʃʃo:ri/
/akki/	/ maggi/		Medial(o)			
/hakki/	/ sangi:ta/		/ a:ʈo/			

/paʈa:ki/	Medial(u)		/toma:ʈo/			
/vaki:la/	/tengu/					
Medial(u)	/magu/					
/ʃa:ku/	/nagu/					
/bekku/	/dʒe:nugu:ɖu/					
/ʃakkuli/	Medial(e)					
Medial(e)	/ka:ge/					
/me:ke/	/oge/					
/rekke/	/hoge/					
/porake/	Medial(o)					
Medial(o)	/rango:li/					
/ʃakko:ta/						
/pako:ɖa/						

Wordlist

/dʒ/	/s/	/ʃ/	/r/
Initial (a)	Initial(a)	Initial(a)	Initial(a)
/dʒag/	/sara/	/ʃanka/	/rakṭa /
/dʒana/	/samo:sa/	/ʃari:ra/	/ratṭu/
/dʒaṭaka/	/sagaṇi/	/ʃartu/	/raṭṭa/
/dʒæ:keṭ/	/sa:gu/	/ʃa:mpu/	/ra:dʒa/

/ dʒa:tre/	/ sa:sive/	/ ʃa:lu/	/ ra:ŋi/
/ dʒa:ru/	/ sa:ru/	/ ʃa:le/	/ ra:k ^h i/
Initial(i)	Initial(i)	Initial(i)	Initial(i)
/ dʒirale/	/ simha/	/ ʃiva/	/ ripo:rʈu/
/ dʒi:rige/	/ sippe/	/ ʃikʃe/	/ rikʃa/
/ dʒinke/	/ siʈʈu/	/ ʃi:ta /	/ ribban/
/ dʒira:fe/	/ si:re/	/ ʃiʈ:u /	Initial(u)
/ dʒi:pu /	/ si:nu/		
Initial(u)		Initial(u)	/ rupa:ji/
/ dʒubba/	Initial(u)	/ ʃu:zu/	Initial(e)
/ dʒuʈʈu/	/ suŋŋa/	/ ʃu:ʈingu/	/ rekke/
/ dʒu:s/	/ suttu/	Medial(a)	/ rembe/
/ dʒu:ʈa:ʈa/	/ sustu/	/ puruʃa/	/ re:dijo/
Initial(e)	/ su:dʒi/	/ kaʃa:ja/	/ re:ʃme/
/ dʒe:bu/	/ su:rja/	Medial(i)	/ re:su/
/ dʒelli/	/ su:par/	/ k ^h uʃi/	Initial(o)
/ dʒeʈ/	Initial(e)	/ ruʃi/	/ roʈʈi/
/ dʒe:da/	/ seragu/	/ pakʃi/	/ ro:du/
/ dʒe:nu/	/ se:bu/		Medial(a)
	/ se:ru/		/ mara/
Initial(o)	/ se:tuve/		/ karaɖi/
/ dʒo:ʌa/	Initial(o)		/ ha:ra/
/ dʒo:kar/	/ soppu/		/ kara:ʈe/

/dʒo:ka:li/	/sonʈa/		/naʈara:dʒa/
/dʒollu/	/soʎle/		/aira:vata/
	/so:dʌ/		Medial(i)
Medial(a)	/so:pu/		/kuri/
/kaɖaɖʒa/	Medial(a)		/giri/
/ra:dʒa/	/kasa/		/hari/
/aɖʒa/	/mosaʎe/		/ʃari:ra/
/kaɖʒa:ja/	/kesaru/		/kiri:ʈa/
Medial(i)	/masa:le/		Medial(u)
/su:dʒi/	Medial(i)		/ʈaɡaru/
/gaɖʒi/	/hasiru/		/kesaru/
Medial(u)	/masi/		/iruve/
/ga:dʒu/	/sasi/		Medial(e)
/ka:dʒu/	/masi:di/		/gere/
/ɡoɖʒu/	/rasi:ti/		/si:re/
Medial(e)	Medial(u)		/ga:re/
/saɖʒe/	/hasu/		Medial(o)
/geɖʒe/	/halasu/		/saro:vara/
/heɖʒe/	/bassu/		/paro:ʈa/
	/kasu:ti/		

Developed vowel contextual based wordlist in Kannada

Wordlist

/k/	/g/	/q/	/t/	/ɳ/	/l/	/ʃ/
Initial (a)	Initial(a)	Initial(a)	Initial(a)	Medial(a)	Medial(a)	Initial(a)
ಕವೆ	ಗಂಟೆ	ಡಬ್ಬಿ	ಟಗರು	ಬಣ್ಣ	ಕಳ್ಳ	ಚಂದ್ರ
ಕಣ್ಣ	ಗಣೇಶ	ಥಮರು	ಟವಲ್	ಹಣ	ಕಳಶ	ಚಪಾತಿ
ಕಸ	ಗರಿ	ಡಸ್ಟಬಿನ್	ಟಯರ್	ನೊಣ	ಹಳದಿ	ಚಮಚ
ಕಾಲು	ಗಾಳಿ	ಡಾಕು	ಟಾಟಾ	Medial(i)	Medial(i)	ಚಾಕು
ಕಾರು	ಗಾಜು	Initial(i)	ಟಾಬ್ಲೆಟ್	ಮಣಿ	ಬಿಳಿ	ಚಾಪೆ
ಕಾಗೆ	ಗಾಡಿ	ಡಿಕ್ಕಿ	Initial(i)	ಎಣಿ	ಗಾಳಿಪಟ	ಚಾಮುಂಡಿ
Initial(i)	Initial(i)	Initial(u)	ಟಿಕೆಟ್	ರಾಣಿ	ಗಿಳಿ	Initial(i)
ಕಿವಿ	ಗಿಡ	ಡುಮ್ಮಿ	ಟಿಫಿನ್	Medial(u)	Medial(u)	ಚಿಟ್ಟೆ
ಕಿರೀಟ	ಗಿಳಿ	ಡುಮ್ಮಿ	ಟೀಚರ್	ಕಣ್ಣ	ಮುಳ್ಳು	ಚಿನ್ನ
ಕೀಲಿ	ಗೀಚು	Initial(o)	ಟೀ	ಹಣ್ಣ	ಮರಳು	ಚಿರತೆ
ಕೀಟ	Initial (u)	ಡೊಂಕು	Initial(u)	ಮಣ್ಣ	ಬೆರಳು	ಚೀಲ
ಕೀಬೋರ್ಡ್	ಗುಲಾಬಿ	ಫೋಲು	ಟು	Medial(e)	Medial(e)	ಚೀಟಿ
Initial (u)	ಗುಬ್ಬಿ	ಡೊಳ್ಳು	Initial(e)	ಹಣೆ	ಬಳೆ	ಚಿಪ್ಪು
ಕುಡಿ	ಗುಡಿಸು	Medial(a)	ಟೆಂಟು	ಡೊಣ್ಣೆ	ಸೊಳ್ಳೆ	Initial(u)

ಕುರಿ	ಗೂಡು	ಗಡ್ಡ	ಟೇಪು	ಮಣೆ	ಮಳೆ	ಚುಕ್ಕೆ
ಕೂದಲು	ಗೂಳಿ	ಗುಡ್ಡ	ಟೇಬಲ್			ಚೂರು
ಕೂಗು	ಗೂಬೆ	ಗರುಡ	Initial(o)			Initial(e)
ಕೂಡು	Initial (e)	Medial(i)	ಟೊಮಾಟೋ			ಬೆಂಡು
Initial(e)	ಗೆರೆ	ಮಂಡಿ	ಟೋಪಿ			ಬೇರು
ಕೆಂಪು	ಗೆಜ್ಜೆ	ಅಂಗಡಿ	Medial(a)			Medial(a)
ಕೆನ್ನೆ	ಗೇಟು	ಕರಡಿ	ಪಟ			ಮಂಚ
ಕೆರೆ	Initial (o)	Medial(u)	ಕಿಟಕಿ			ಕವಚ
ಕೇಸರಿ	ಗೊಂಬೆ	ಲಾಡು	ಬಟ್ಟಲು			Medial(i)
ಕೇಕು	ಗೊಬ್ಬರ	ಕಾಡು	ಪಟಾಕಿ			ಯೋಚಿಸು
Initial(o)	ಗೋಲಿ	ಹುಡುಗ	ಬಟಾಣಿ			ಗುಬ್ಬಚ್ಚಿ
ಕೊಳಲು	ಗೋಡೆ	Medial(e)	Medial(i)			ಕುರ್ಚಿ
ಕೊಕ್ಕರೆ	ಗೋಡಂಬಿ	ಪಗಡೆ	ತುಟಿ			ಕರ್ಚೀಪು
ಕೋತಿ	Medial(a)	ಗೋಡೆ	ಬುಟ್ಟಿ			Medial(u)
ಕೋಪ	ಹಗ್ಗ	ಬುರುಡೆ	ರೊಟ್ಟಿ			ಕಚ್ಚು
ಕೋಳಿ	ಮಂಗ		Medial(u)			ಬೆಂಚು
Medial(a)	ಲಂಗ		ರಟ್ಟು			ಹೆಂಚು
ಚರಕ	ಬಂಗಾರ		ಹಿಟ್ಟು			ಮಂಚೂರಿ

ಪುಕ್ಕ:	ಚಳಿಗಾಲ		ಬೊಟ್ಟು			Medial(e)
ಮಕ್ಕಳು	ಬಳೆಗಾರ		Medial(e)			ಪಂಚೆ
ಆಕಾಶ	Medial(i)		ಮೊಟ್ಟೆ			ಕಛೇರಿ
ಜಟಕಾ	ಬಾಗಿಲು		ತಟ್ಟೆ			Medial(o)
Medial(i)	ಅಂಗಿ		ಚಿಟ್ಟೆ			ಕಚೋರಿ
ಅಕ್ಕಿ	ಮಗ್ಗಿ		Medial(o)			
ಹಕ್ಕಿ	ಸಂಗೀತ		ಆಟೋ			
ಪಟಾಕಿ	Medial(u)		ಟೊಮಾಟೋ			
ವಕೀಲ	ತೆಂಗು					
Medial(u)	ಮಗು					
ಚಾಕು	ನಗು					
ಬೆಕ್ಕು	ಜೇನುಗೂಡು					
ಚಕ್ಕುಲಿ	Medial(e)					
Medial(e)	ಕಾಗೆ					
ಮೇಕೆ	ಒಗೆ					
ರೆಕ್ಕೆ	ಹೊಗೆ					
ಪೊರಕೆ	Medial(o)					
Medial(o)	ರಂಗೋಲಿ					

ಚಕ್ಕೋತ						
ಪಕ್ಕೋಡ						

Wordlist

/dz/	/s/	/ʃ/	/r/
Initial (a)	Initial(a)	Initial(a)	Initial(a)
ಜಗ್	ಸರ	ಶಂಖ	ರಕ್ತ
ಜನ	ಸಮೋಸಾ	ಶರೀರ	ರಟ್ಟು
ಜಟಕ	ಸಗಣೆ	ಶರ್ಫು	ರಥ
ಜಾಕೆಟ್	ಸಾಗು	ಶಾಂಪು	ರಾಜ
ಜಾತ್ರೆ	ಸಾಸಿವೆ	ಶಾಲು	ರಾಣಿ
ಜಾರು	ಸಾರು	ಶಾಲೆ	ರಾಖಿ
Initial(i)	Initial(i)	Initial(i)	Initial(i)
ಜಿರಳೆ	ಸಿಂಹ	ಶಿವ	ರಿಪೋರ್ಟು
ಜೀರಿಗೆ	ಸಿಪ್ಪೆ	ಶಿಕ್ಷೆ	ರಿಕ್ಷಾ
ಜಿಂಕೆ	ಸಿಟ್ಟು	ಶೀತ	ರಿಬ್ಬನ್
ಜಿರಾಫೆ	ಸೀರೆ	ಶೀಟು	
ಜೀಪು	ಸೀನು		Initial(u)
Initial(u)	Initial(u)	Initial(u)	ರೂಪಾಯಿ
ಜುಬ್ಬಾ		ಶೂಜು	Initial(e)

ಜುಟ್ಟು	ಸುಣ್ಣ	ಶೂಟಿಂಗು	ರೆಕ್ಕೆ
ಜ್ಯೂಸು	ಸುತ್ತ	Medial(a)	ರೆಂಬೆ
ಜೂಟಾಟ	ಸುಸ್ತು	ಪುರುಷ	ರೇಡಿಯೋ
Initial(e)	ಸೂಜಿ	ಕಷಾಯ	ರೇಷ್ಮೆ
	ಸೂರ್ಯ	Medial(i)	ರೇಸು
ಜೆಲ್ಲಿ	ಸೂಪರ್	ಖುಷಿ	Initial(o)
ಜೆಟ್	Initial(e)	ಖುಷಿ	ರೊಟ್ಟಿ
ಜೇಡ	ಸೆರಗು	ಪಕ್ಷಿ	ರೋಡು
ಜೇನು	ಸೇಬು		Medial(a)
ಜೇಬು	ಸೇರು		ಮರ
Initial(o)	ಸೇತುವೆ		ಕರಡಿ
ಜೋಳ	Initial(o)		ಹಾರ
ಜೋಕರ್	ಸೊಪ್ಪು		ಕರಾಟೆ
ಜೋಕಾಲಿ	ಸೊಂಟ		ನಟರಾಜ
ಜೊಲ್ಲ	ಸೊಳ್ಳೆ		ಐರಾವತ
Medial(a)	ಸೋಡಾ		Medial(i)
	ಸೋಪು		ಕುರಿ
ಕಡಜ	Medial(a)		ಗಿರಿ

ರಾಜ	ಕಸ		ಹರಿ
ಅಜ್ಜ	ಮೊಸಳೆ		ಶರೀರ
ಕಜ್ಜಾಯ	ಕೆಸರು		ಕಿರೀಟ
Medial(i)	ಮಸಾಲೆ		Medial(u)
ಸೂಜಿ	Medial(i)		ಟಗರು
ಗಂಜಿ	ಹಸಿರು		ಕೆಸರು
Medial(u)	ಮಸಿ		ಇರುವೆ
ಗಾಜು	ಸಸಿ		Medial(e)
ಕಾಜು	ಮಸೀದಿ		ಗೆರೆ
ಗೊಜ್ಜು	ರಸೀತಿ		ಸೀರೆ
Medial(e)	Medial(u)		ಗಾರೆ
ಸಜ್ಜೆ	ಹಸು		Medial(o)
ಗೆಜ್ಜೆ	ಹಲಸು		ಸರೋವರ
ಹೆಜ್ಜೆ	ಬಸ್ಸು		ಪರೋಟ
	ಕಸೂತಿ		

APPENDIX 5

Developed picture for the selected wordlist

Contextual-based Picturable Wordlist in Kannada

Target Sound /k/

Initial position

1) /kappe/

ಕಪ್ಪೆ



2) /kaŋɲu/

ကံ့
ဏ္ဍ



3) /kasa/

કાસ



4) /ka:lu/

ಕಾಲ



5) /ka:ru/

ಕಾರು



6) /ka:ge/

ಕಾಗೆ



7) /kivi/

ಕಿವಿ



8) /kiri:ʈa/

ಕಿರೀಟ



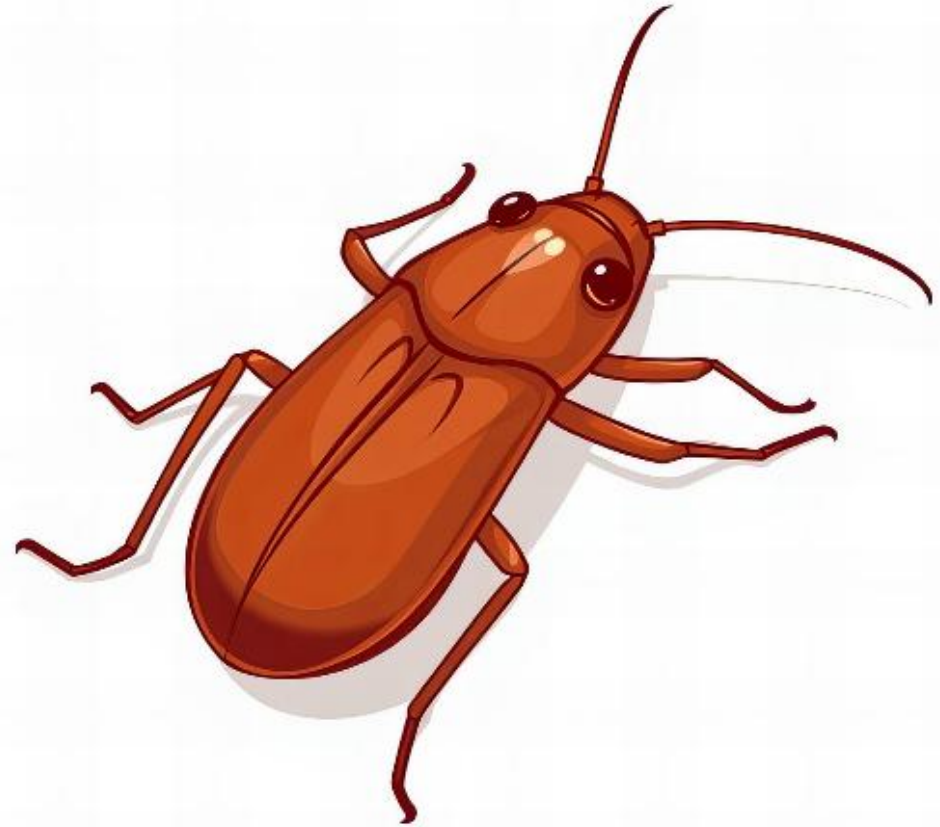
9) /ki:li/

கீலி



10) /ki:ʈa/

ჭეჭ



11) /ki:bo:rd/

ಕೀಬೋರ್ಡ್



12) /kud̪i/

ಕುಡಿ



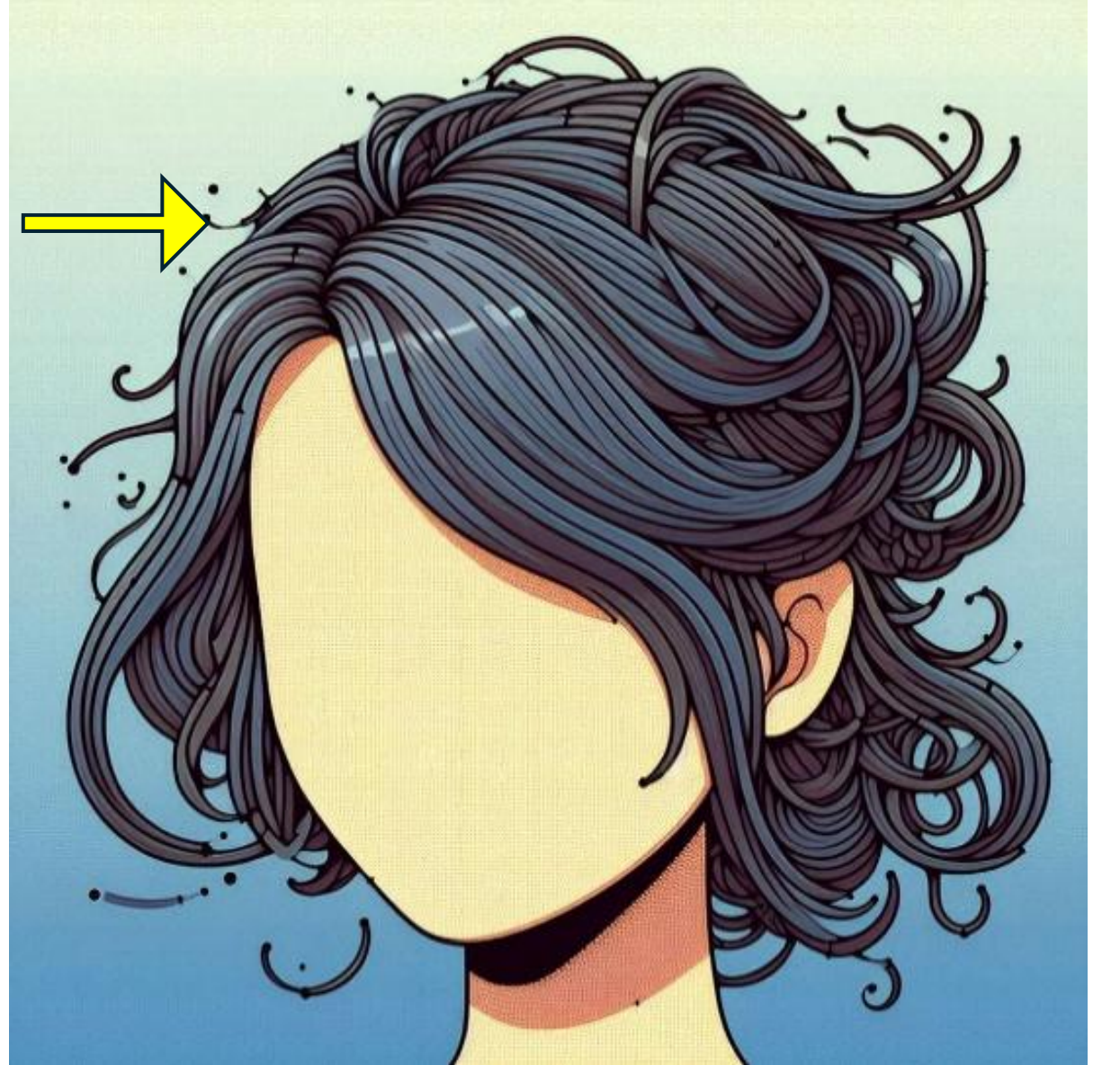
13) /kuri/

ಕುರಿ



14)/ku:dalu/

ಕೂದಲು



15) /ku:gu/

ಕೂಗು



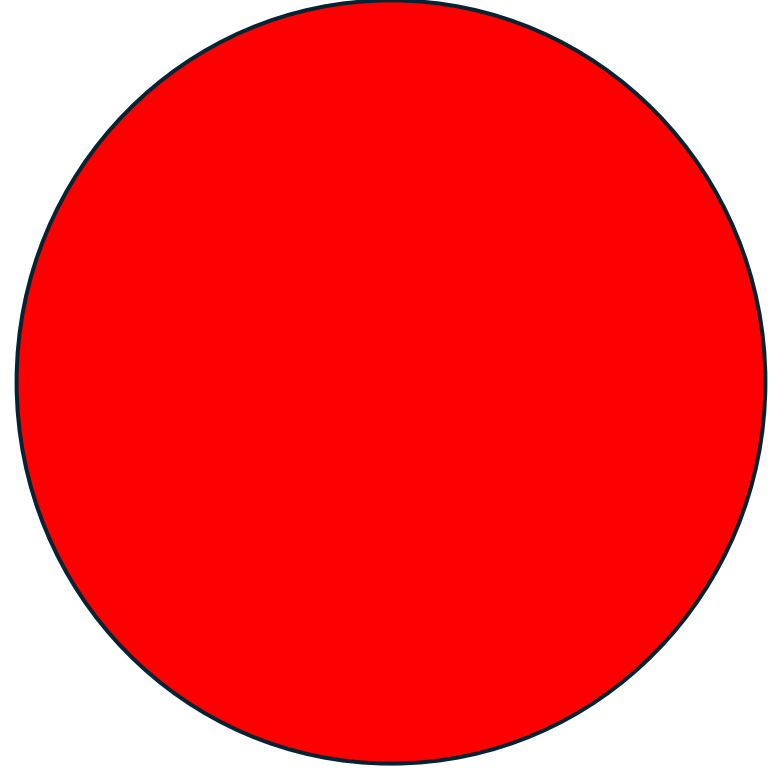
16)/ku:du/

ಕೂಡು



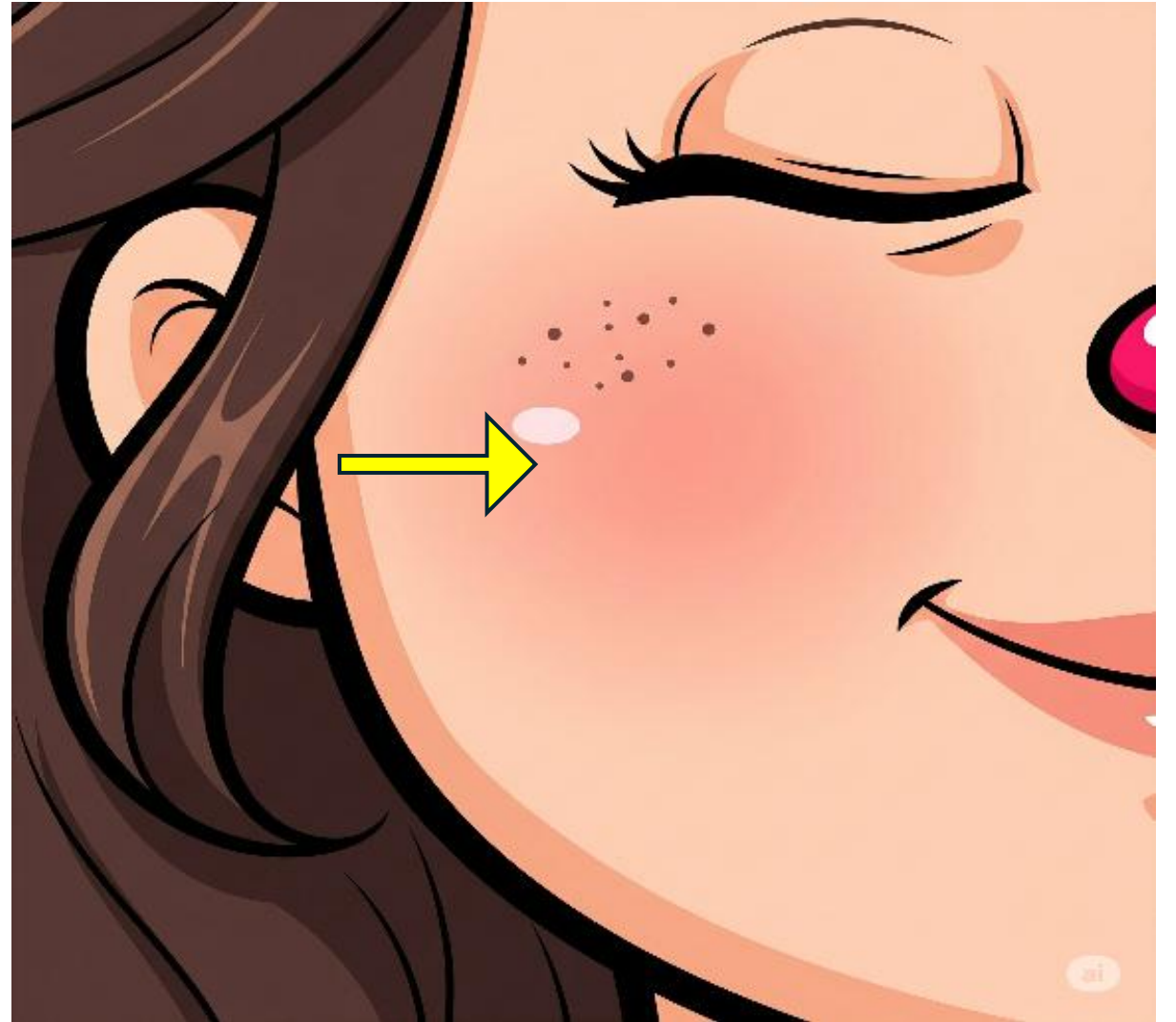
17) /kempu/

ಕೆಂಪು



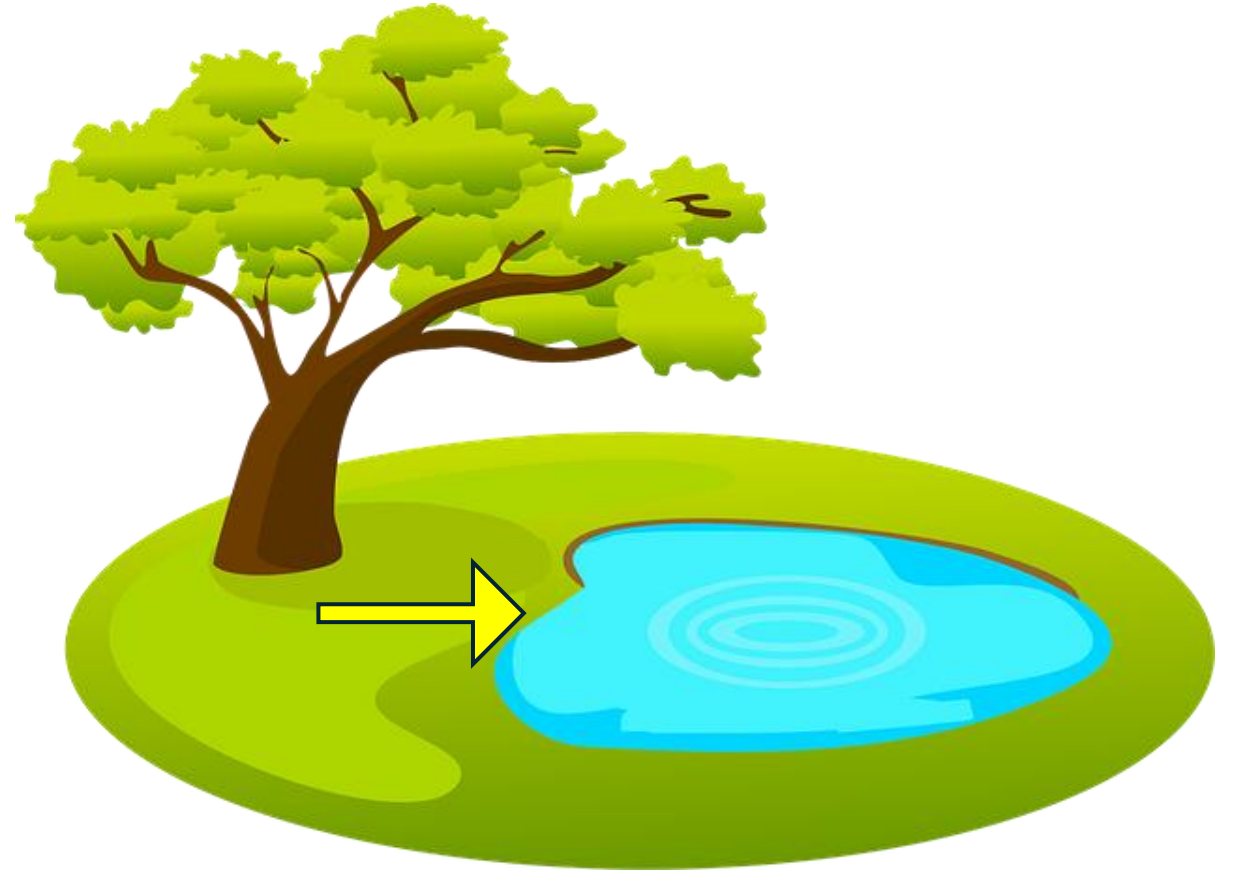
18) /kenne/

ಕೆನ್ನೆ



19) /kere/

કેરું



20) /ke:sari/

ಕೇಸರಿ



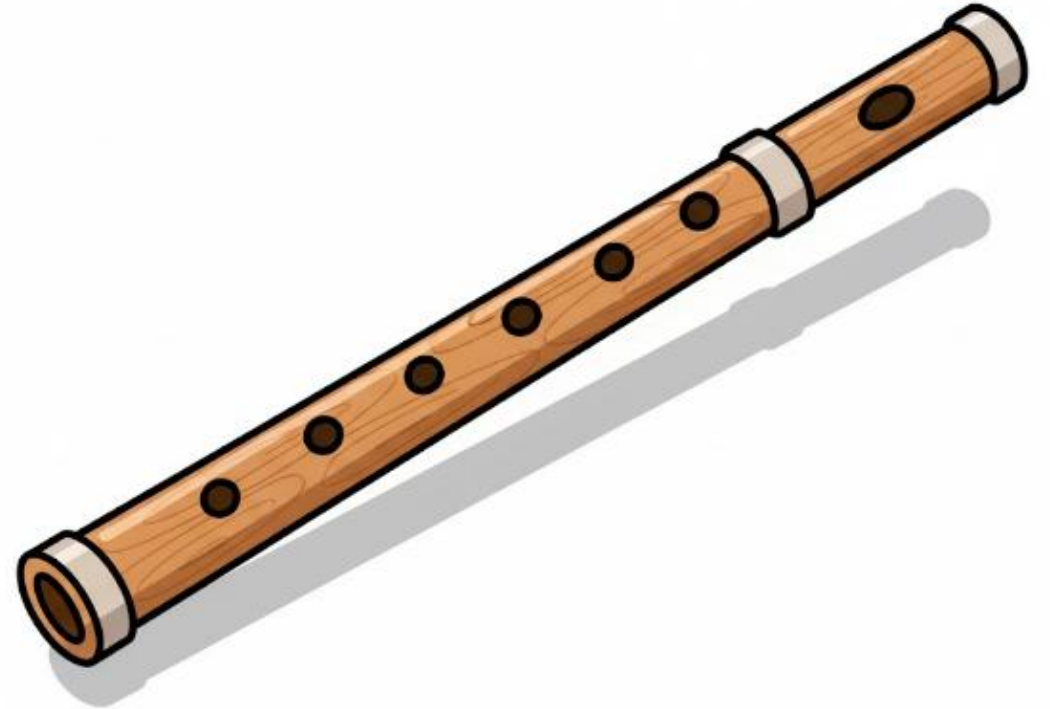
21) /ke:ku/

ಕೆಕು



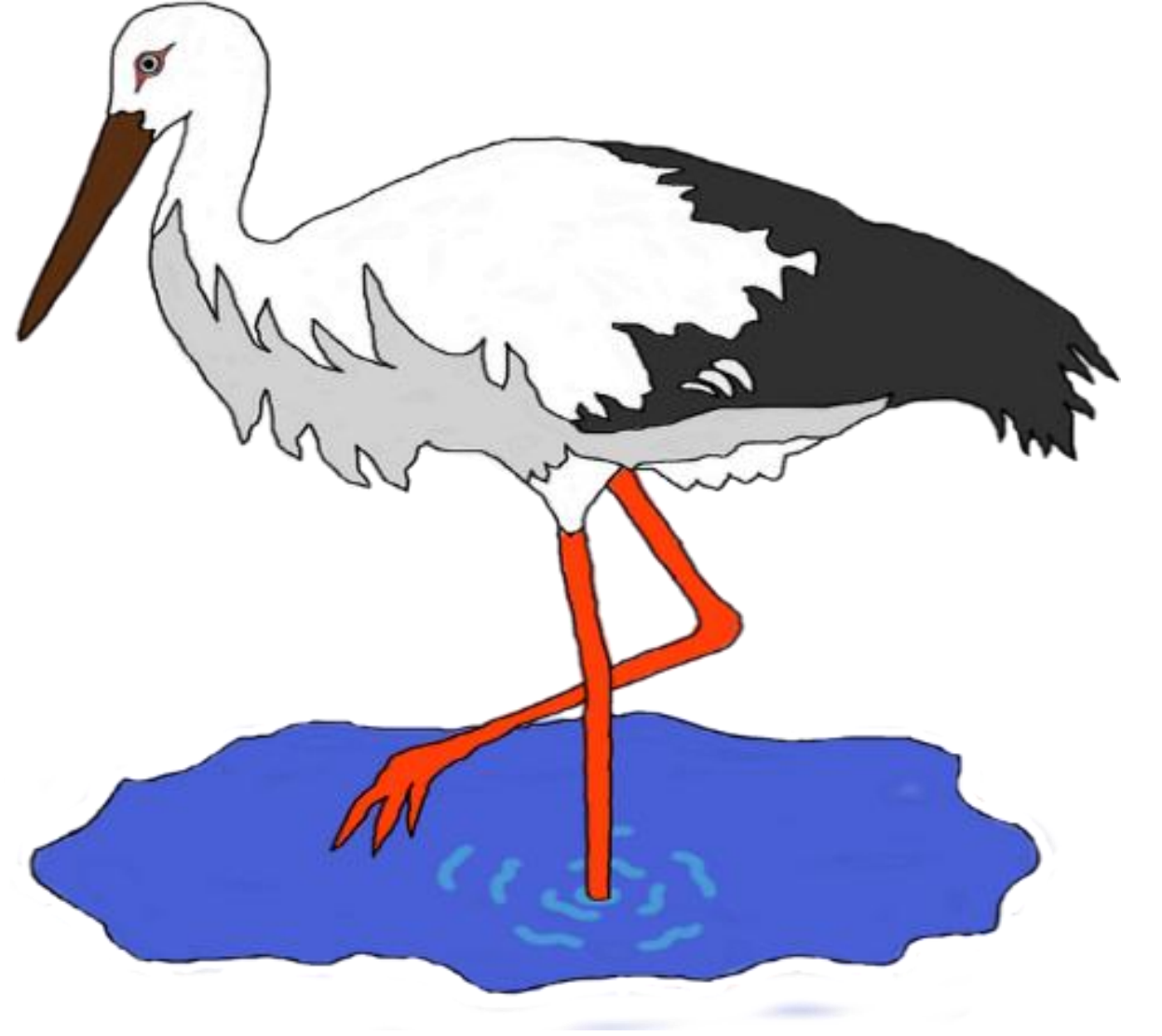
22) /ko|alu/

ಕೊಳಲು



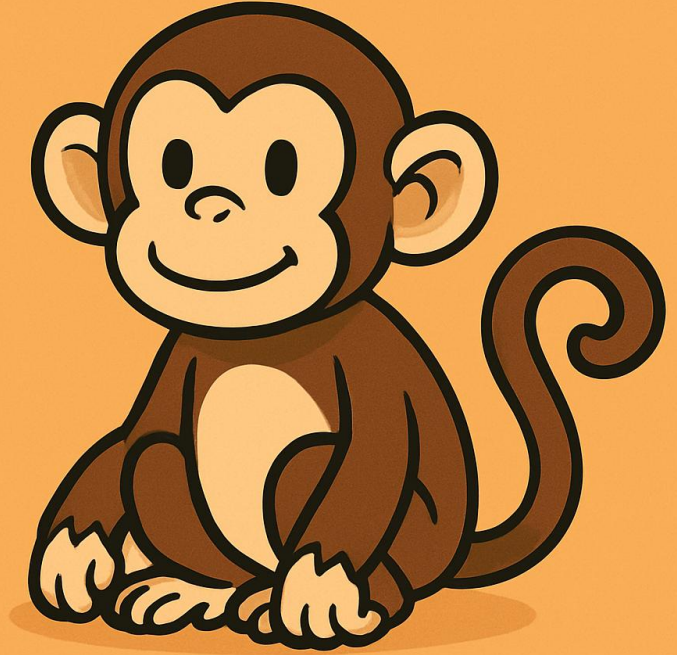
23) /kokkare/

ಕೊಕ್ಕರೆ



24) /ko:ti/

ಕೋತಿ



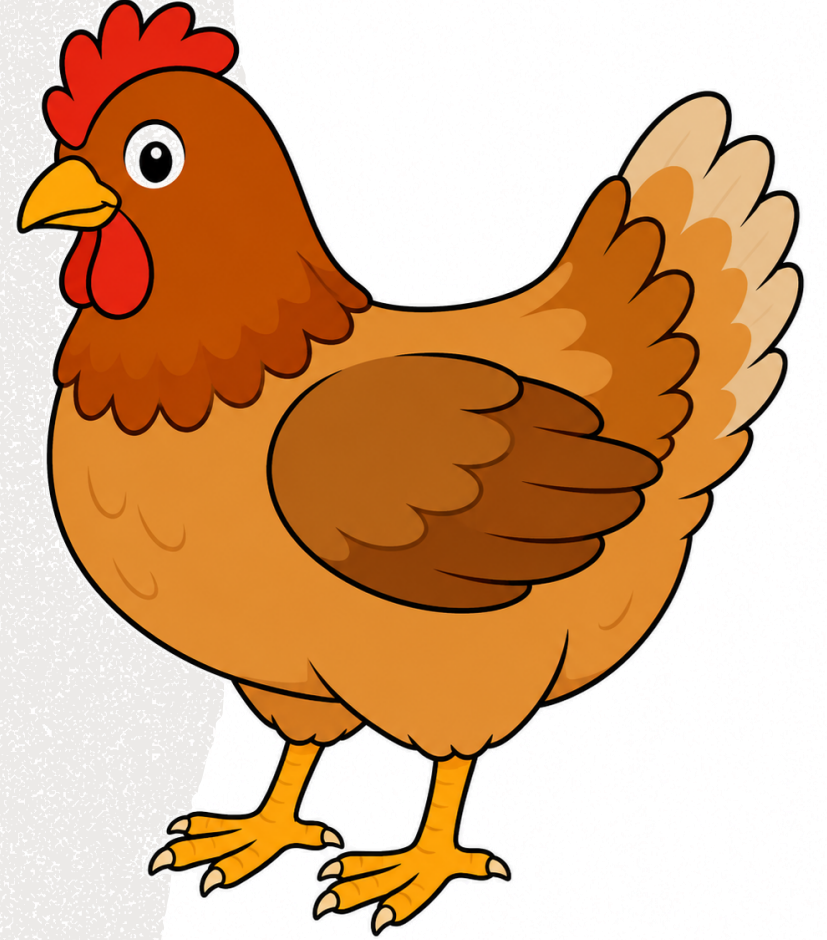
25) /ko:pa/

ಕೋಪ



26) /ko:li/

કોલી

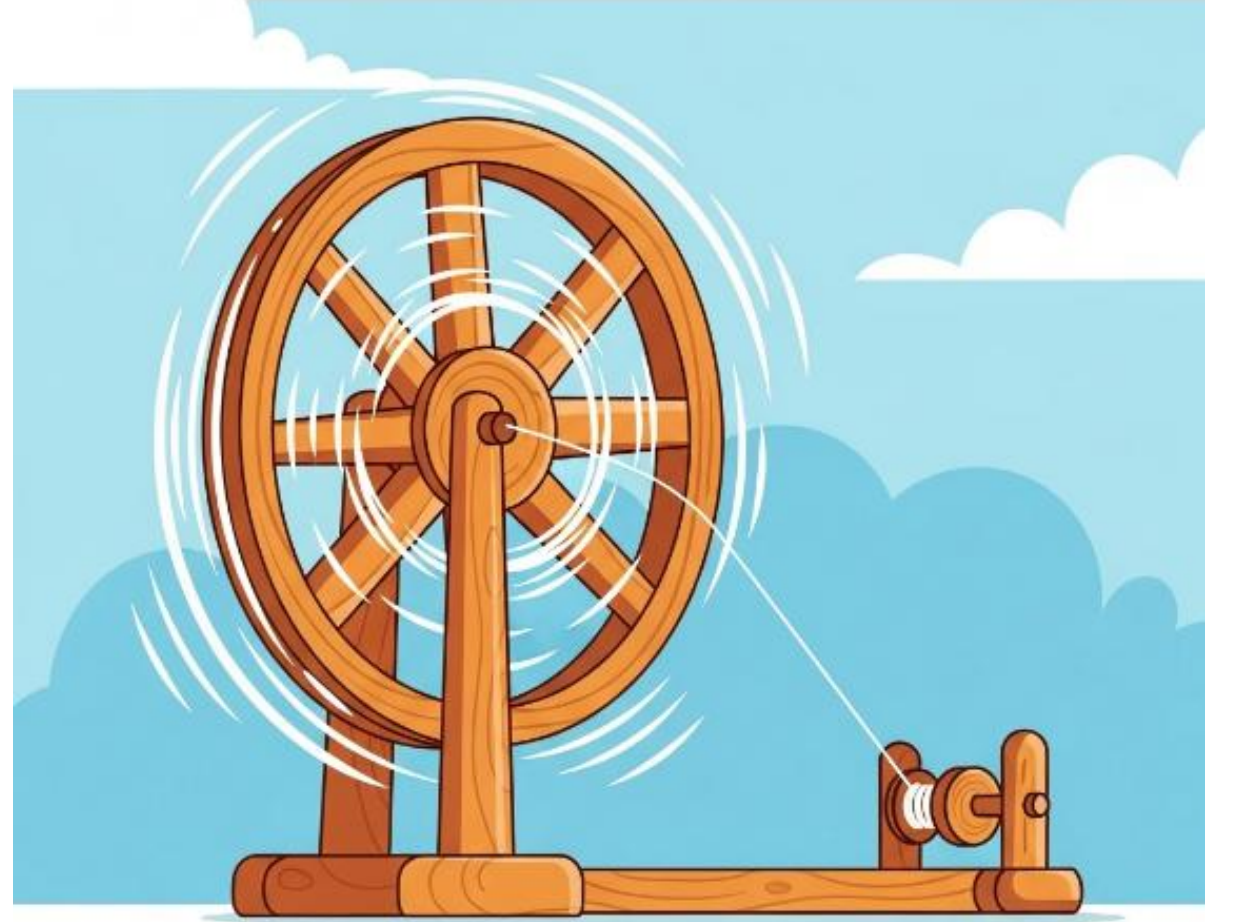


Target Sound /k/

Medial position

27) /ʈaraka/

ಚರಕ



28) /pukka/

ಫುಕಾ



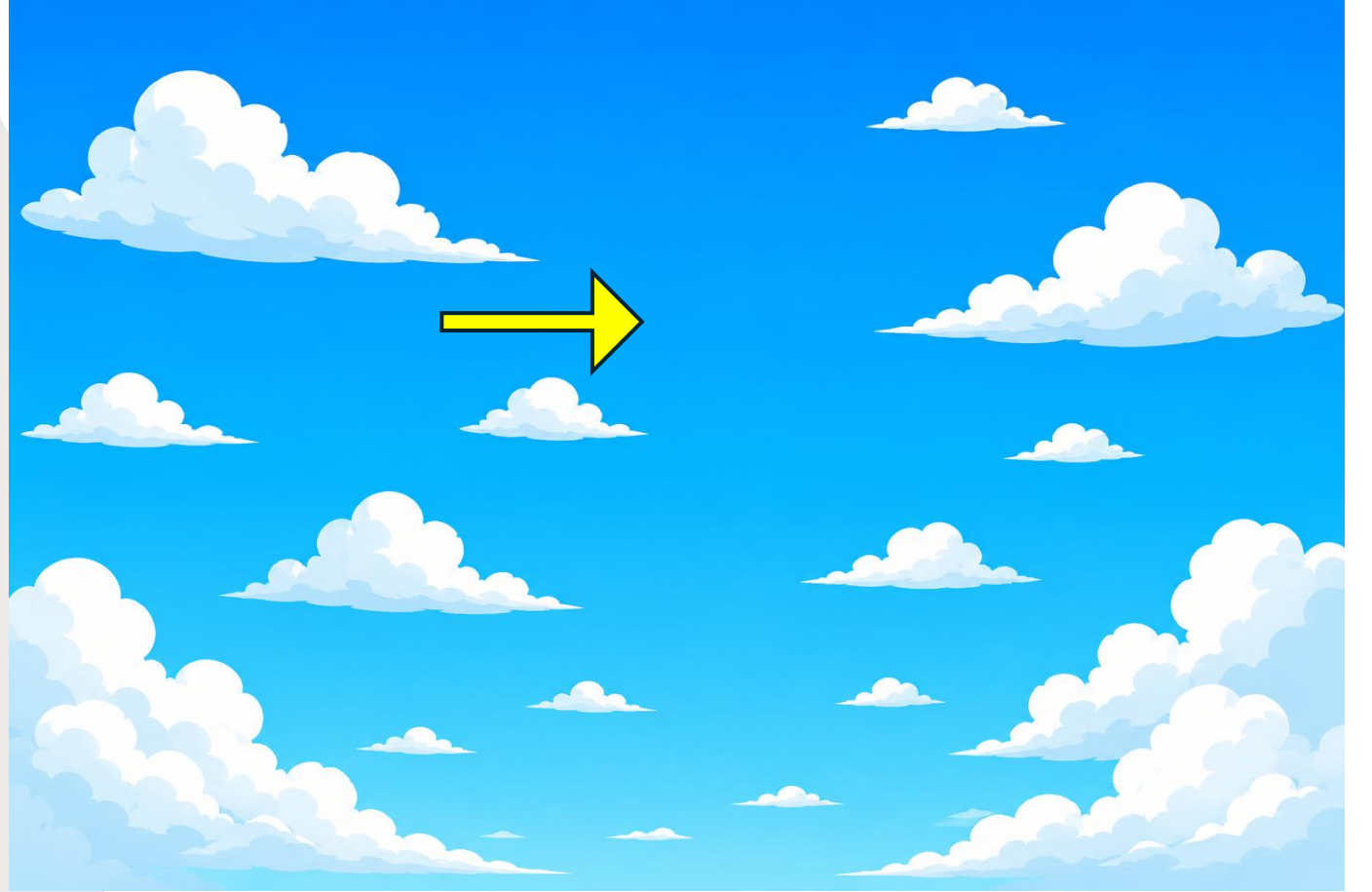
29) /makka[u/

ಮಕ್ಕಳು



30) /a:ka:ʃa/

ಆಕಾಶ



31) /ɖʒaʈaka/

ઝઘઠા



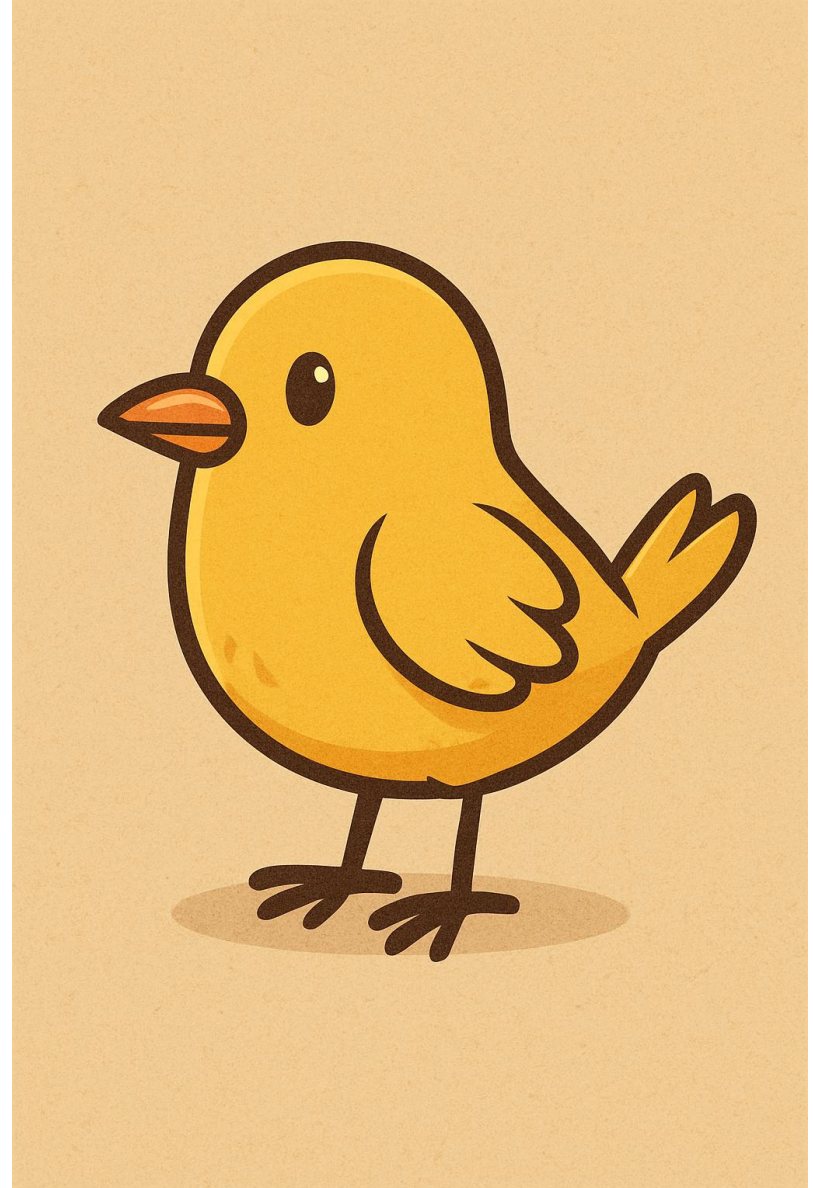
32) /akki/

ಅಕ್ಕಿ



33) /hakki/

ಹಕ್ಕಿ



34) /paʈa:ki/

ಪಟಾಕಿ



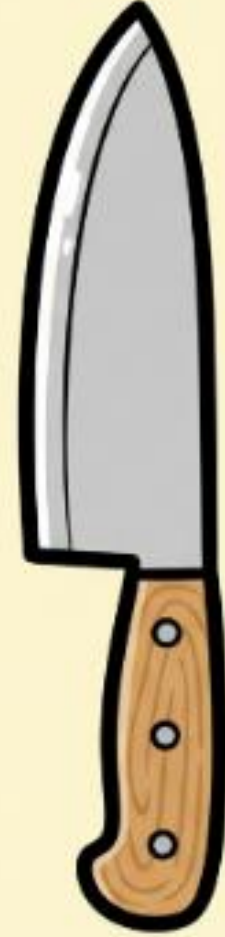
35) /vaki:la/

ವಕೀಲ



36) /tʃa:ku/

ಚಾಕು



37) /bekku/

ಬೆಕ್ಕು



38) /ʈakkuli/

ಚಕ್ಕಲಿ



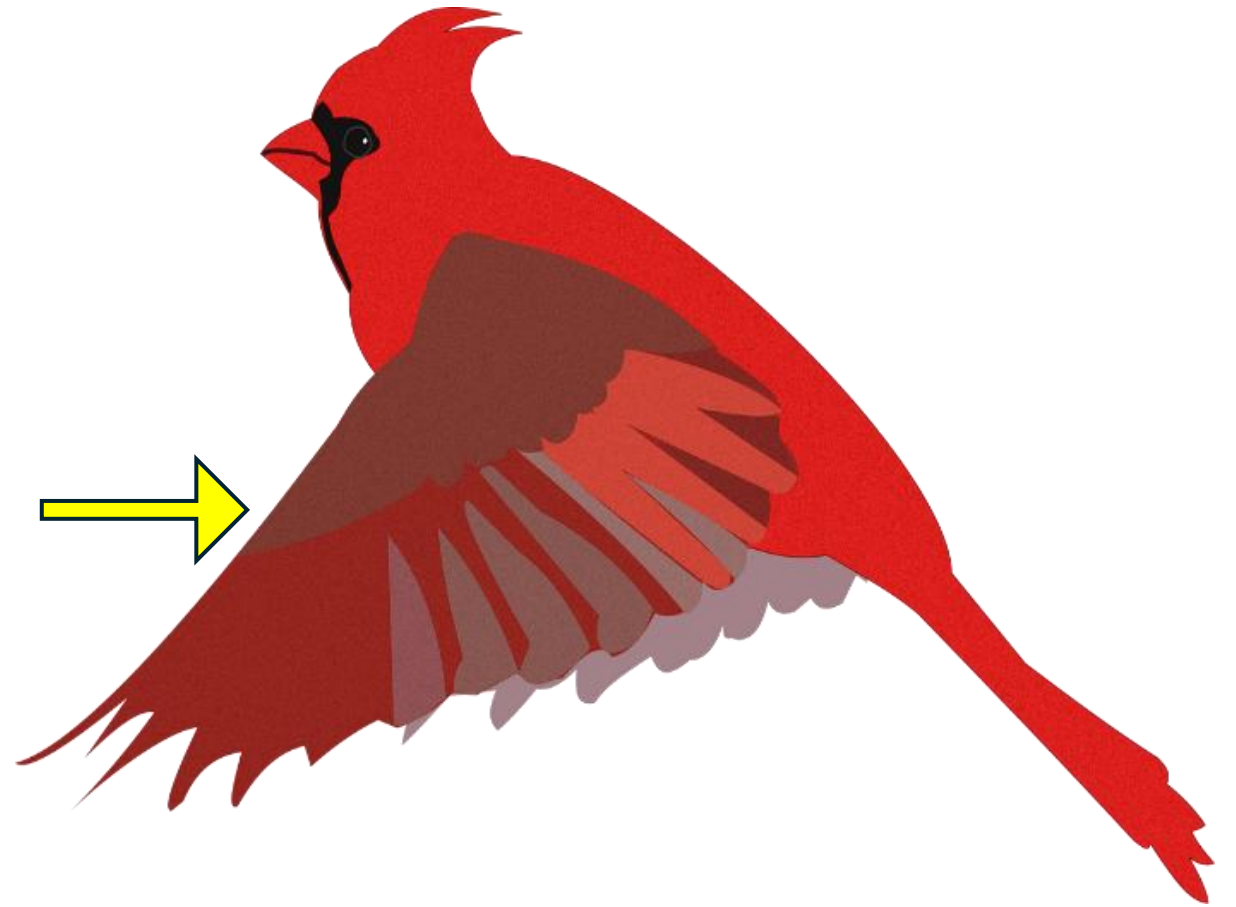
39) /me:ke/

ಮೇಕೆ



40) /rekke/

ರೈಕೆ



41) /porake/

ಪೊರಕೆ



42) /ʈakko:ta/

ಚಕ್ಕೋತ



43) /pako:da/

ಪಕೋಡ



Target Sound /g/

Initial position

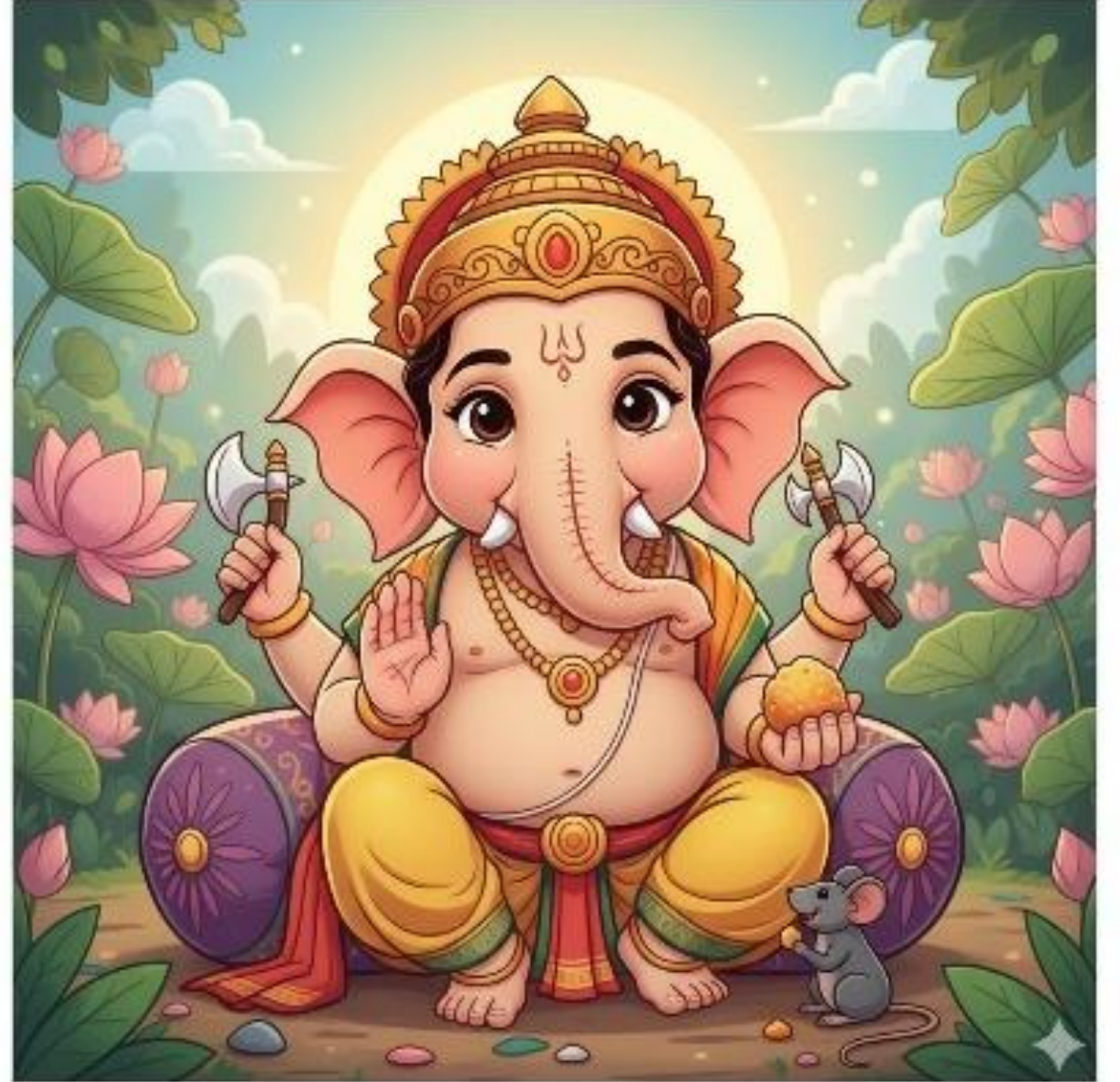
1) /ganɕe/

ဂံဇံ



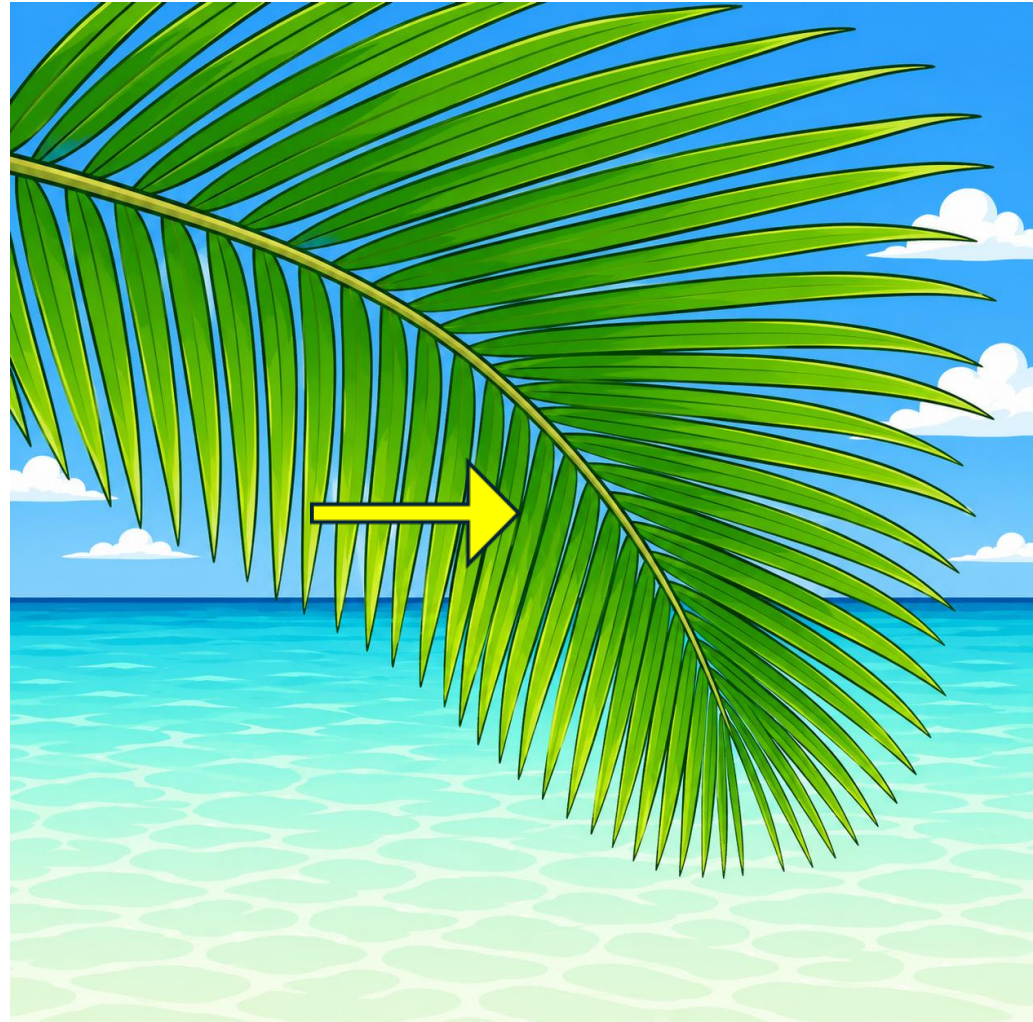
2) /gane:ʃə/

ಗಣೇಶ



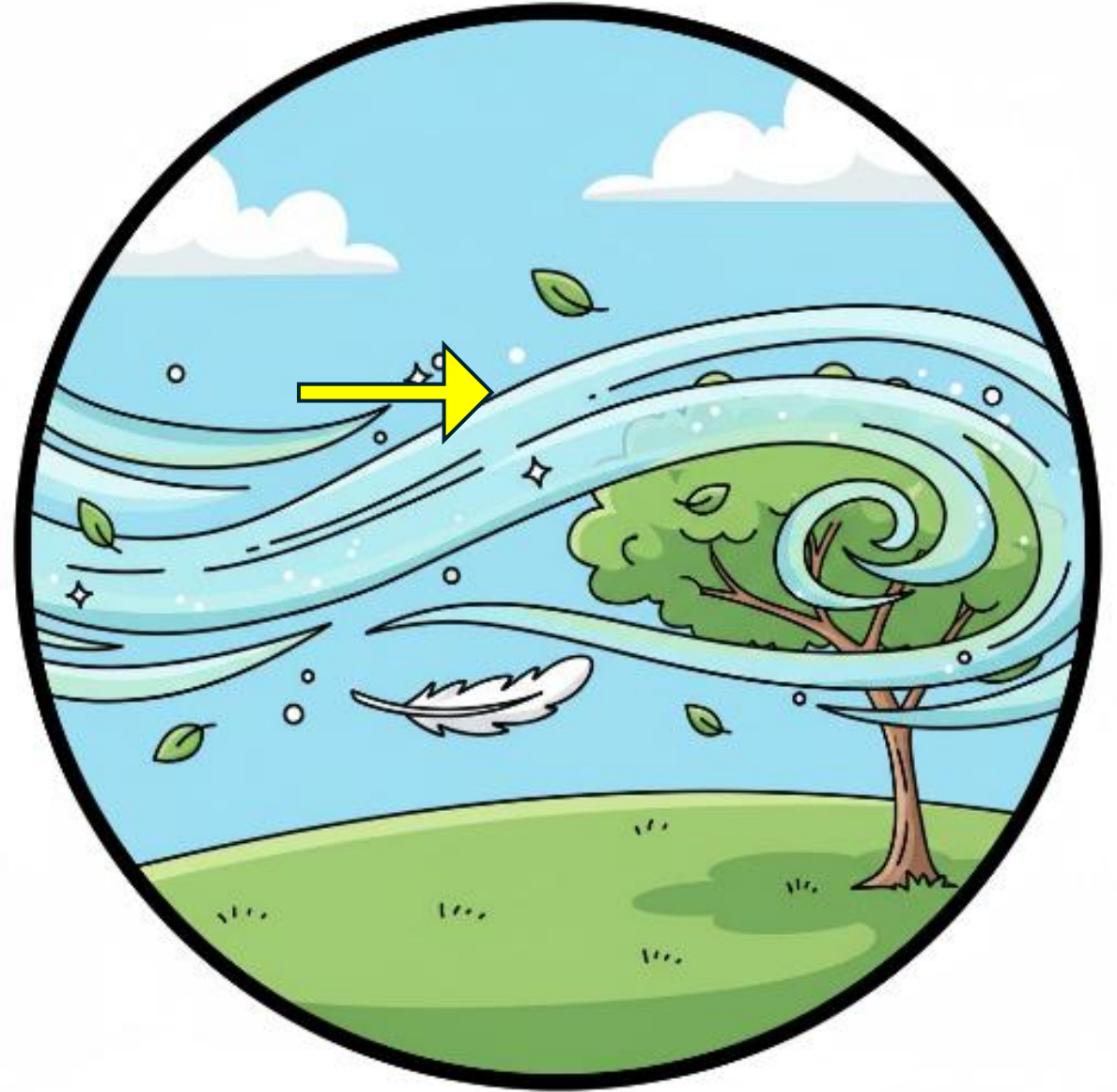
3) /gari/

ဂဓ



4) /ga:li/

గాలి



5) /ga:ɖʊ/

ಗಾಜು



6) /ga:di/

ಗಾಡಿ



7) /gidɑ/

ಗಿಡ



8) /gili/

ກິລີ



9) /gi:tfu/

ಗೀಚು



10) /gula:bi/

ಗುಲಾಬಿ



11) /gubbi/

ಗುಬ್ಬಿ



12) /gudisu/

ಗುಡಿಸು



13) /gu:du/

ಗೂಡು



14) /gu:li/

గూళి



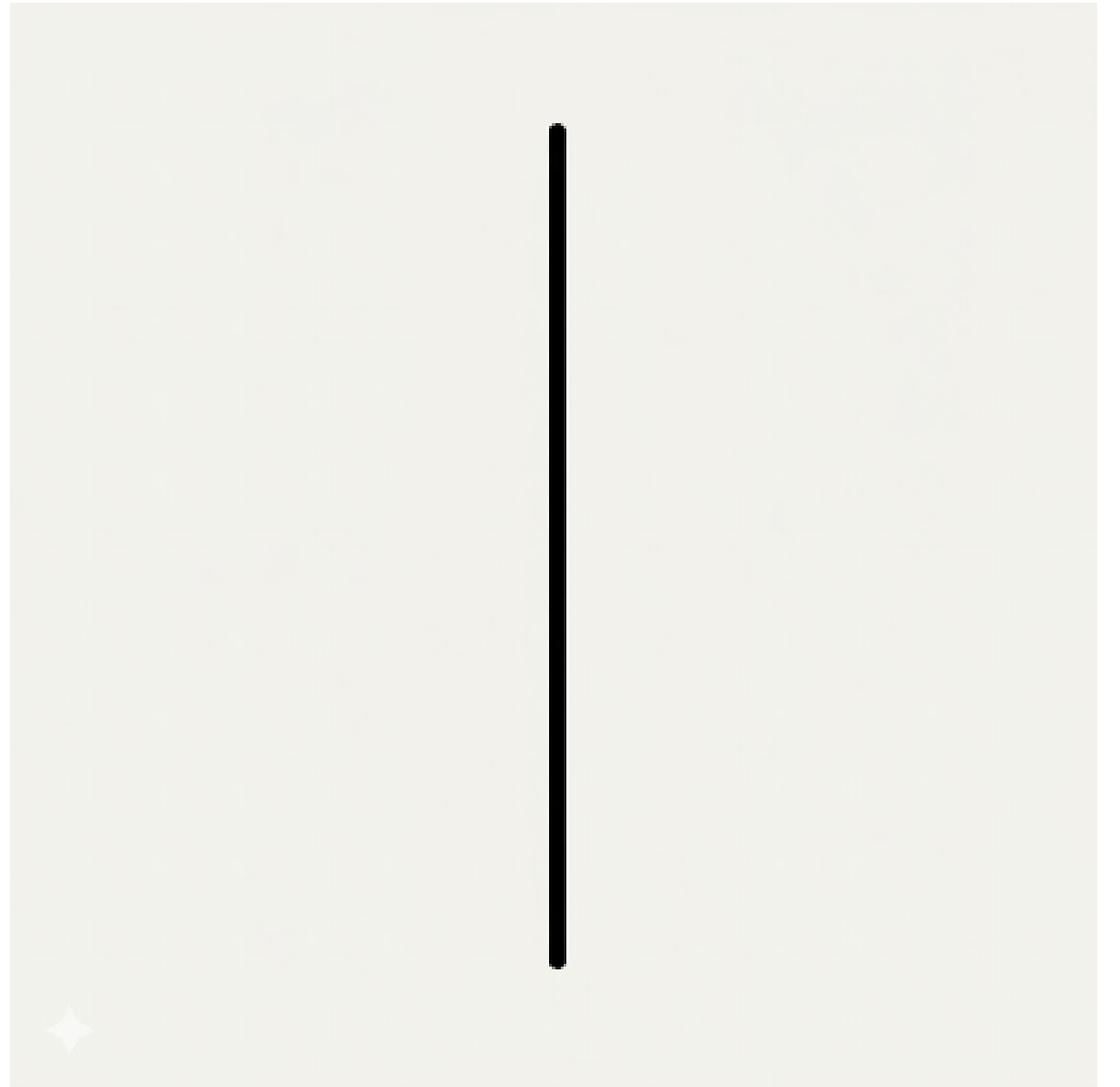
15) /gu:be/

ಗೂಬೆ



16) /gere/

ဂံဝံ



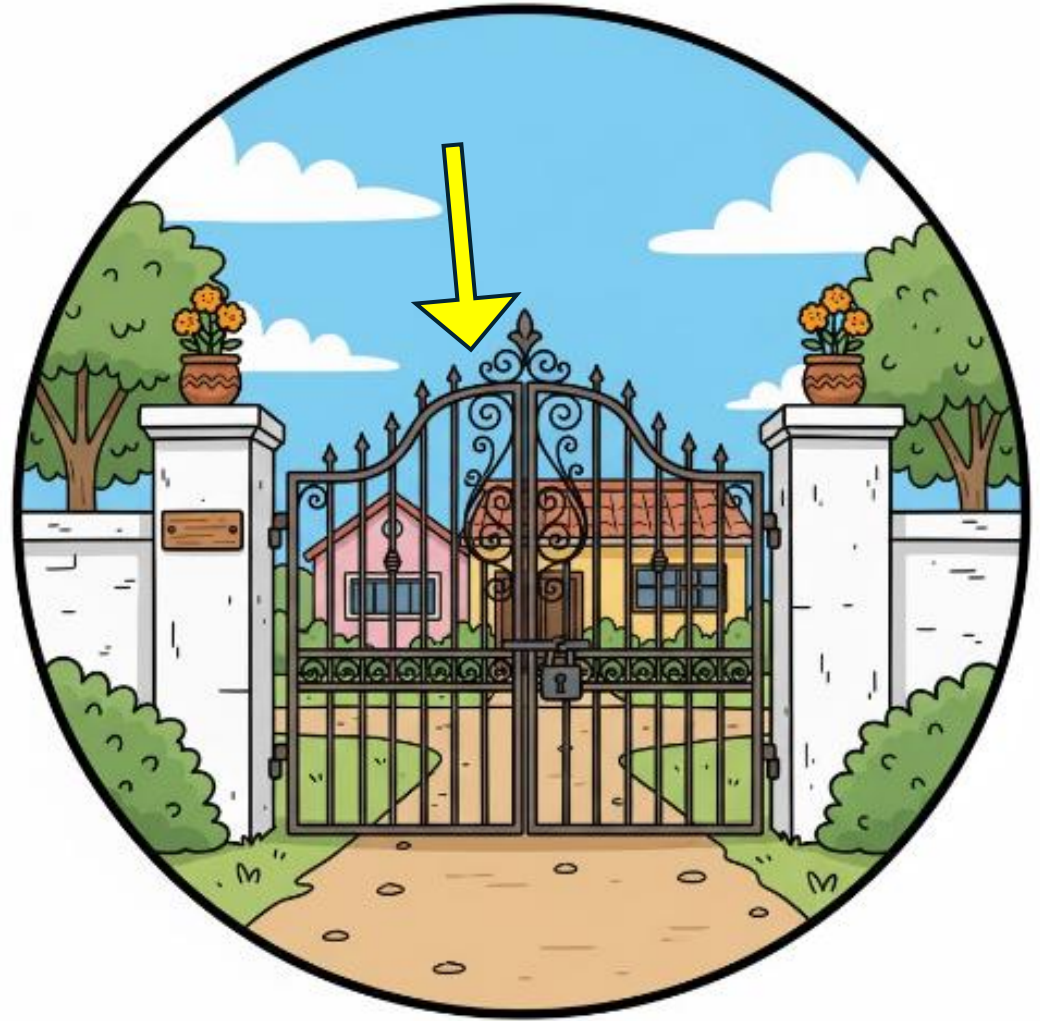
17) /gedʒdʒe/

ಗೆಜ್ಜೆ



18) /ge:tu/

ဂဲယ



19) /gombe/

ગોમ્બે



20) /gobbara/

ಗೊಬ್ಬರ



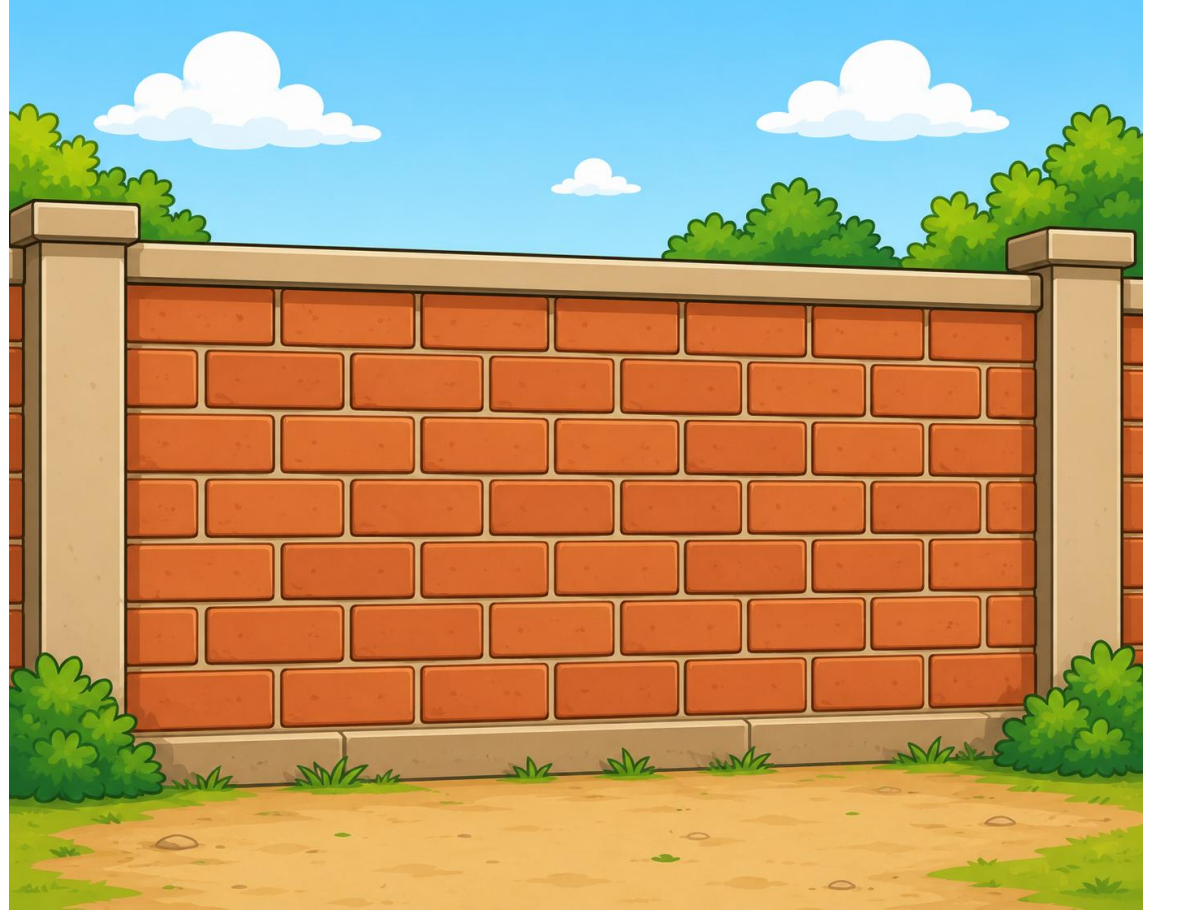
21) /go:li/

ಗೋಲಿ



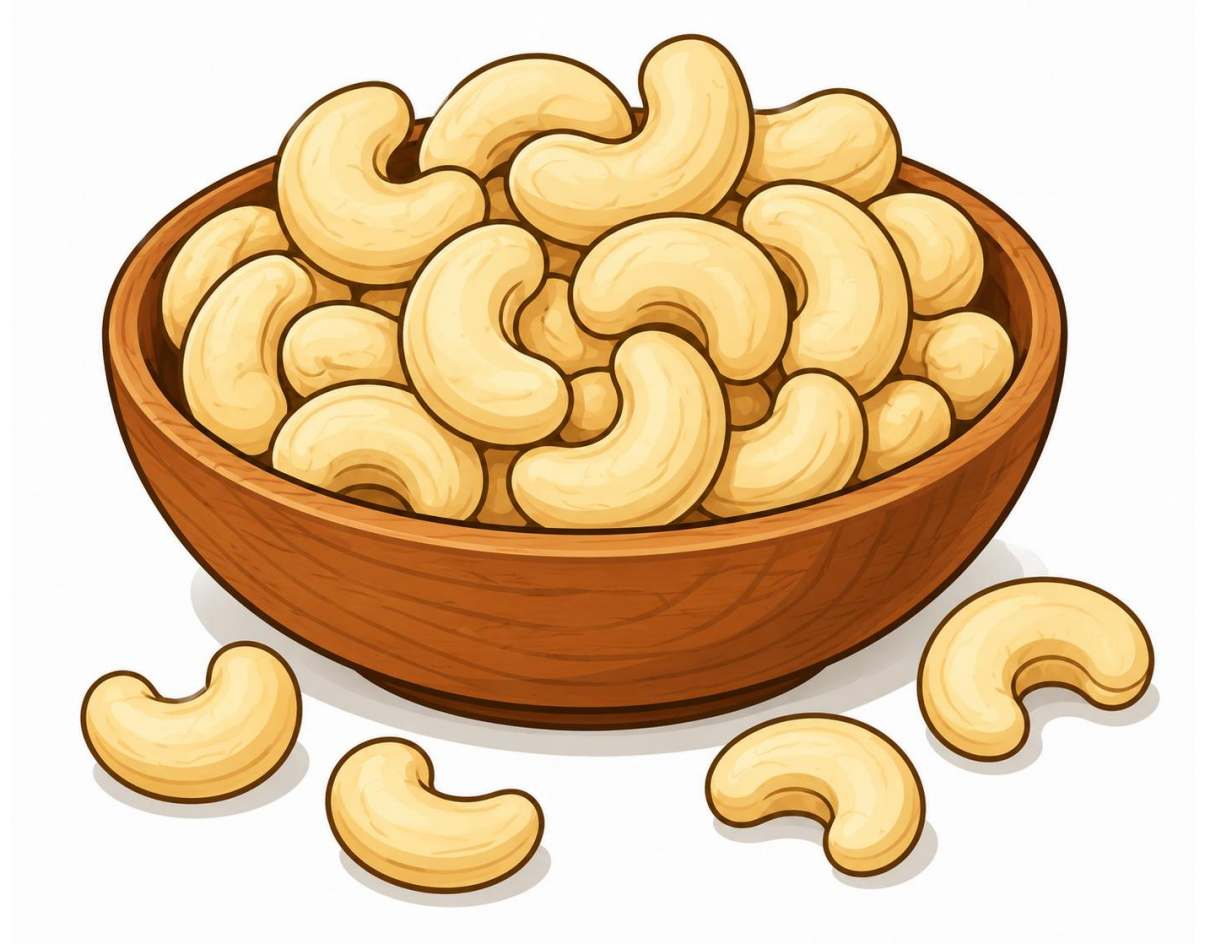
22) /go:de/

ಗೋಡೆ



23) /go:ɖambi/

ಗೋಡಂಬಿ

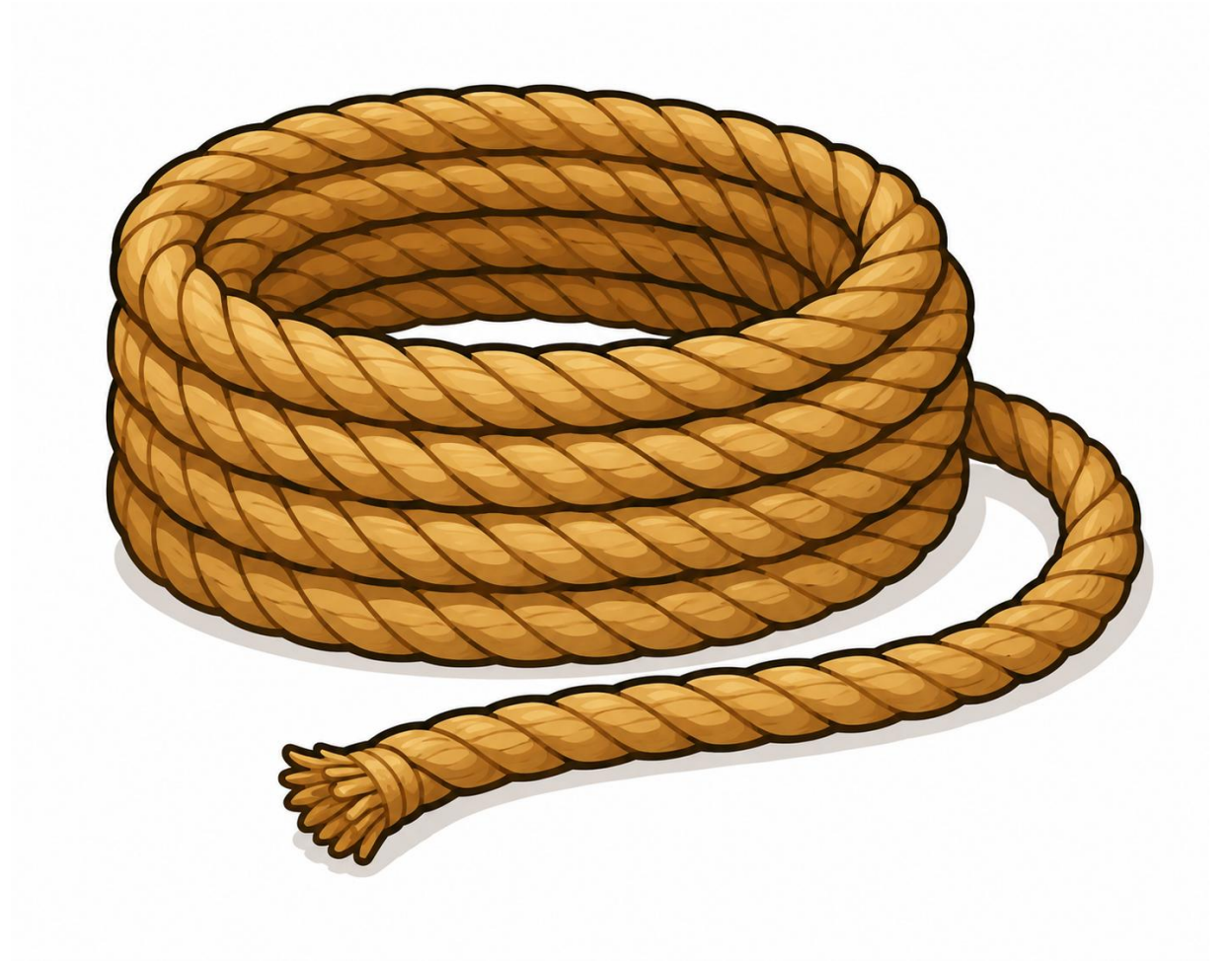


Target Sound /g/

Medial position

24) /hagga/

ಹಗ್ಗ



25) /manga/

ಮಂಗೆ



26) /laga/

ಲಂಗ



27) /banga:ra/

ಬಂಗಾರ



28) /ʈaɭiga:la/

ಚಳಿಗಾಲ



29) /baɭega:ra/

ಬಳೆಗಾರ



30) /ba:gilu/

ಬಾಗಿಲು



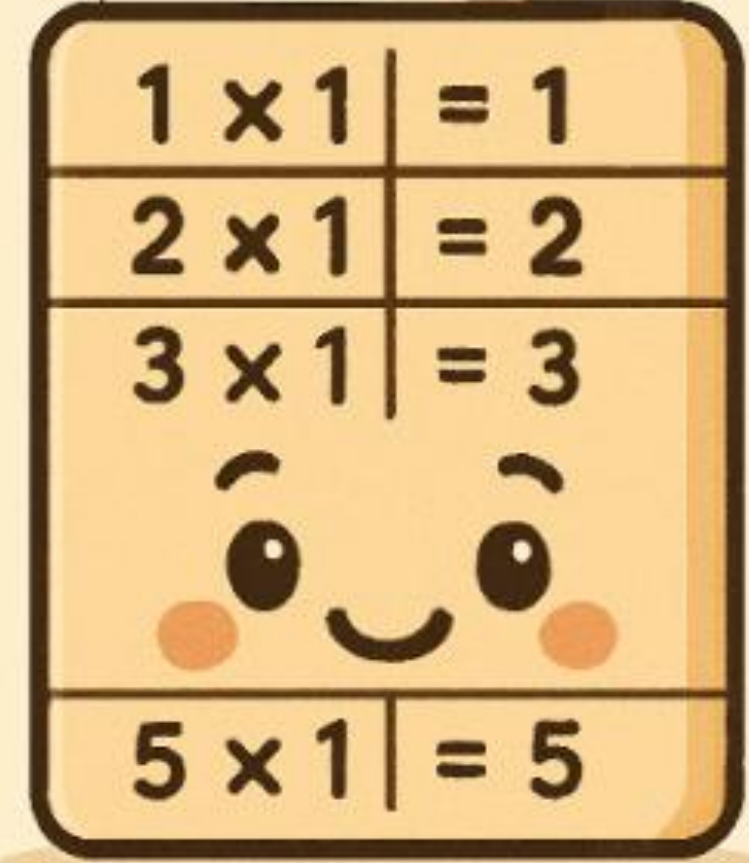
31) /angi/

အဝဲ



32) /maggi/

ಮಗ್ಗಿ



33) /sangi:ta/

ಸಂಗೀತ



34) /tengu/

ತೆಂಗು



35) /magu/

ಮಗು



36) /nagu/

ನಗು



37) /ɖɛ:nugu:ɖu/

ಜೇನುಗೂಡು



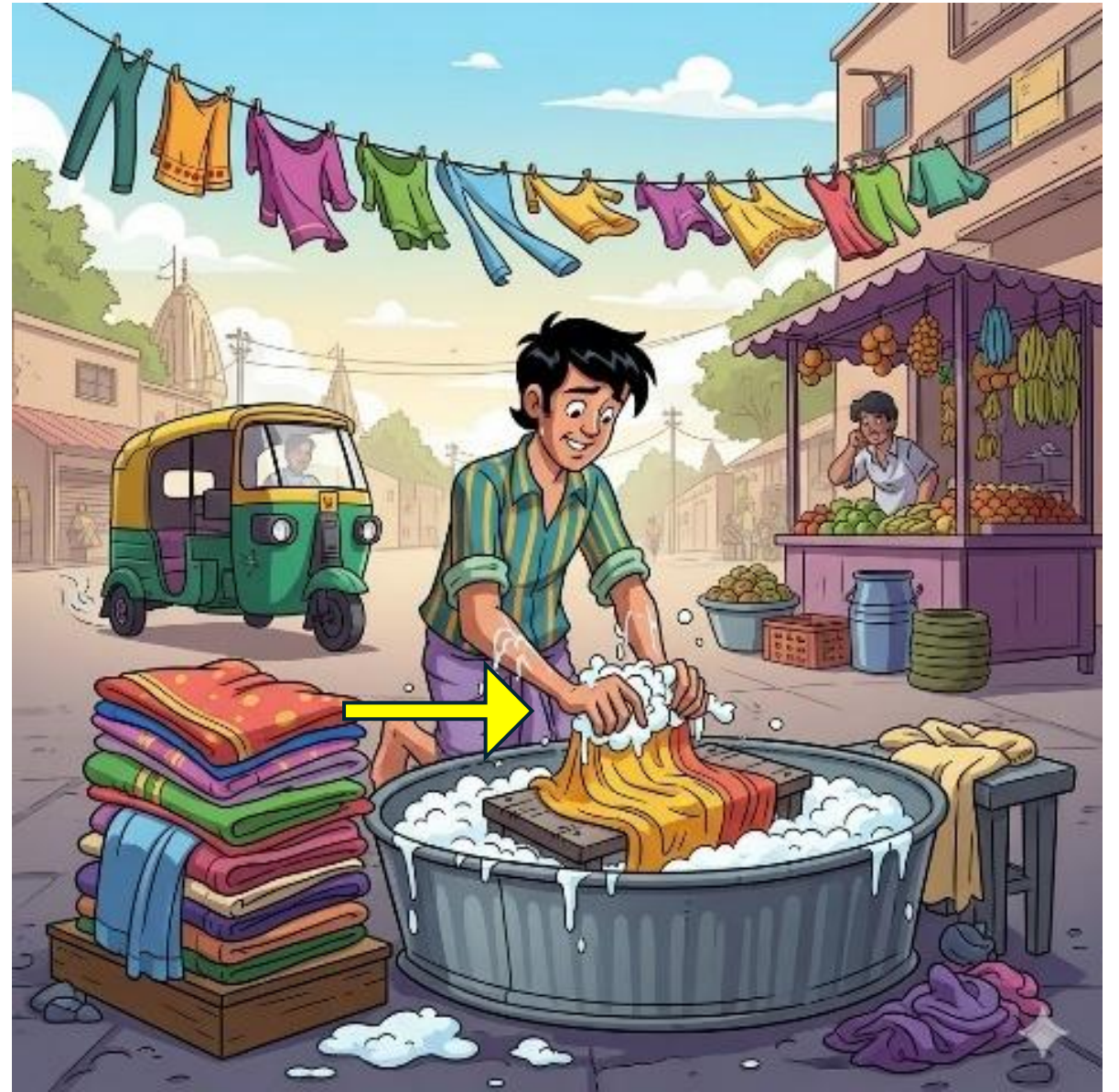
38) /ka:ge/

ಕಾಗೆ



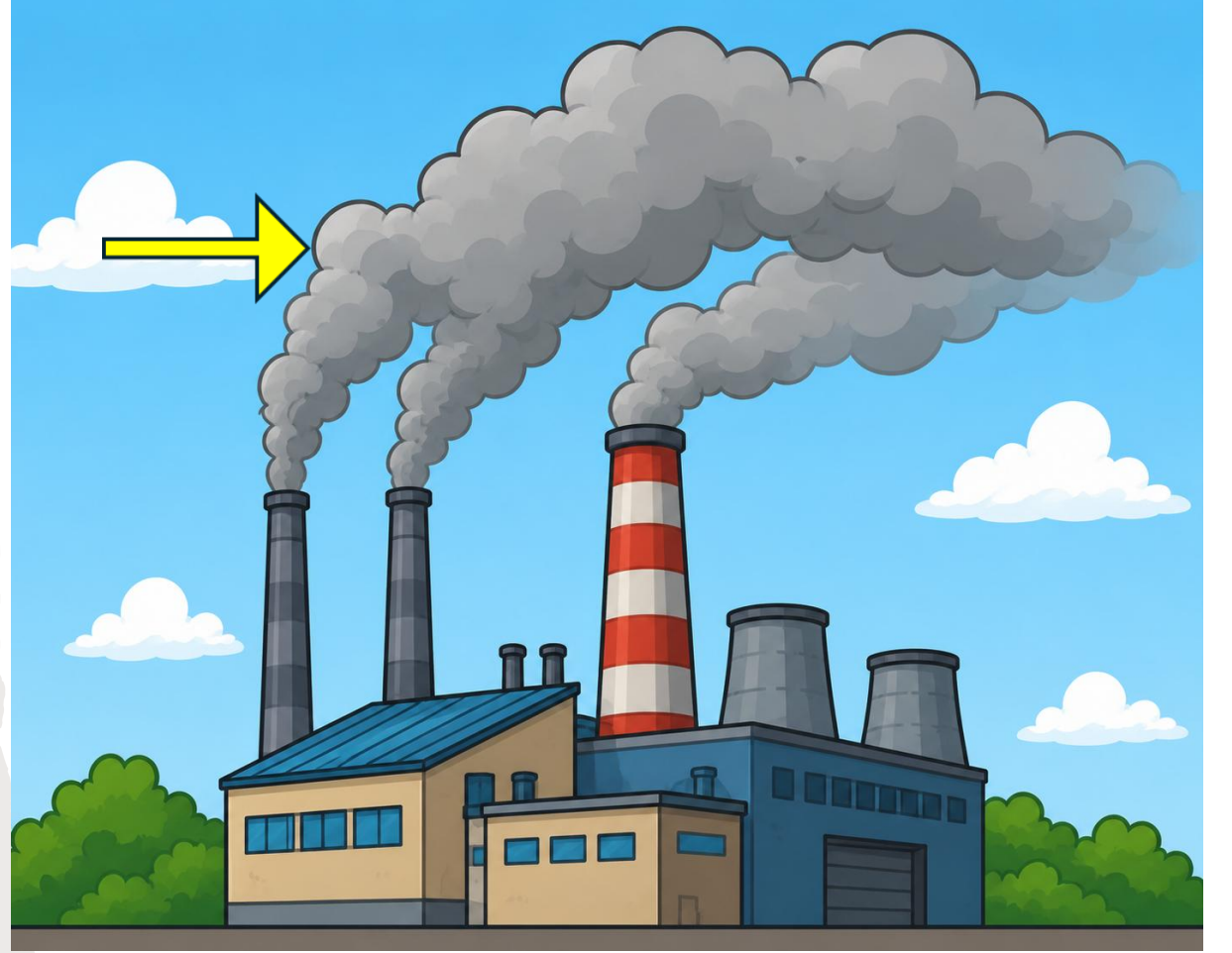
39) /oge/

ఒగ్గే



40) /hoge/

ಹೊಗೆ



41) /rango:li/

ರಂಗೋಲಿ



Target Sound /t/

Initial position

1) /tagaru/

ಟಗರು



2) /taval/

ಟವಲ್



3) /ɽajar/

ಟಯರ್



4) /ta:ta/

ಟାಟಾ



5) /təˈbleʃ/

ಟಾಬ್ಲೆಟ್



6) /tɪket/

ಟಿಕೆಟ್



7) /tiffin/

ಟಿಫಿನ್



8) /ti:tʃər/

ಟೀಚರ್



9) /ti:/

ဒီး



10) /tu/

ε3)

2

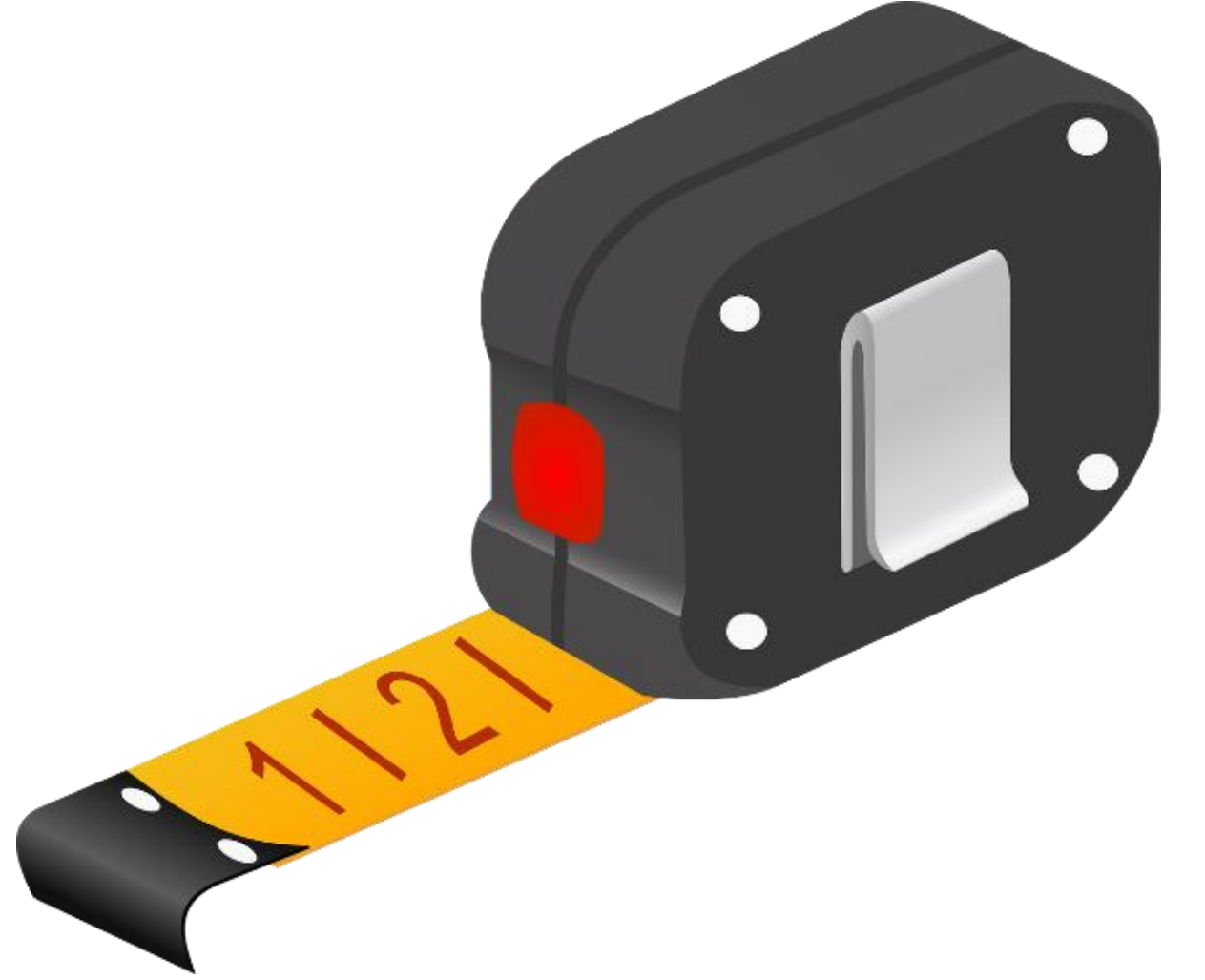
11) /tentu/

တဲဏ္ဍ



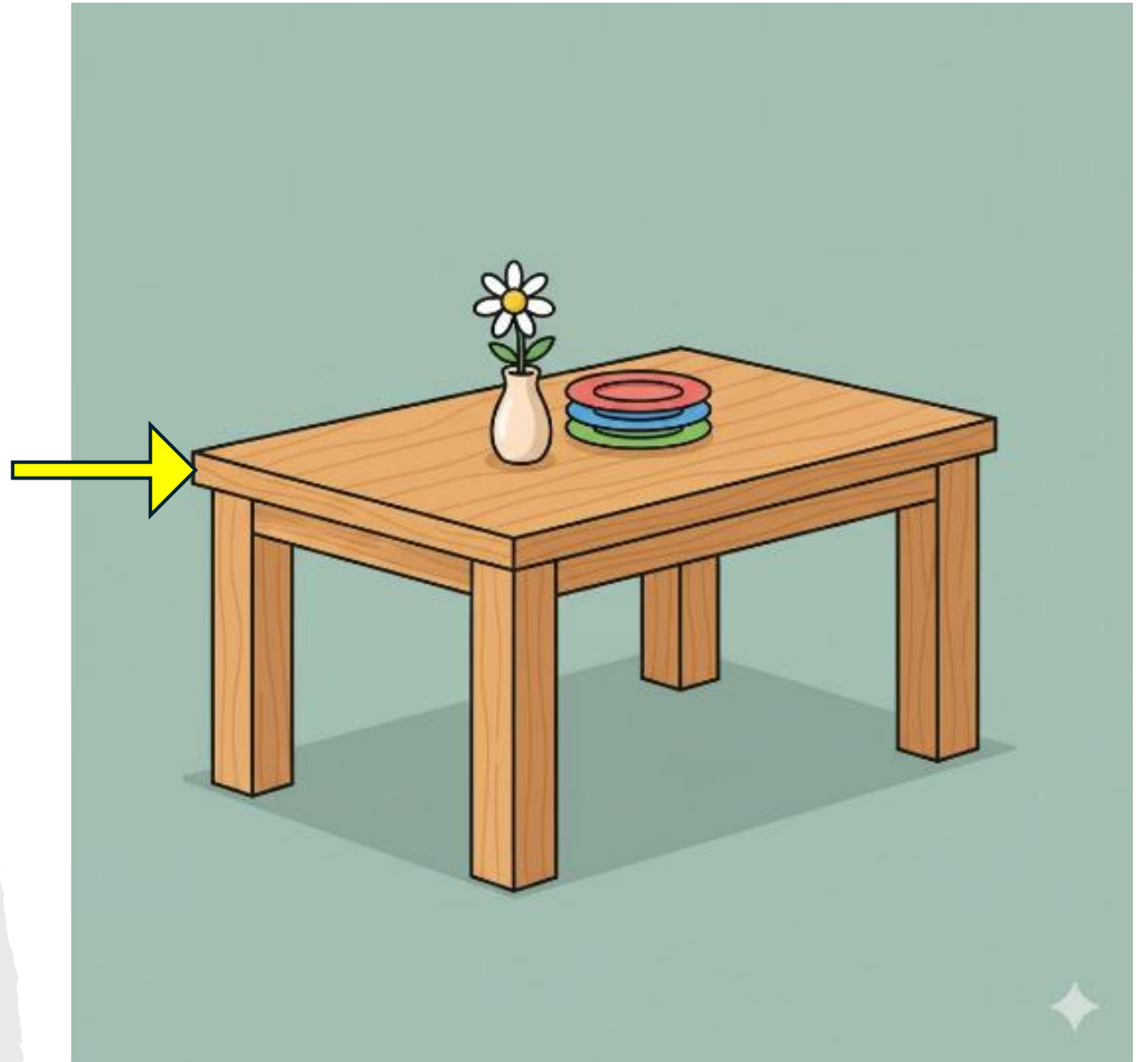
12) /te:pu/

ಟೇಪು



13) /tɛ:bal/

ಟೇಬಲ್



14) /toma:to/

ಟೂಮಾಟೋ



15) /to:pi/

ಟೋಪಿ

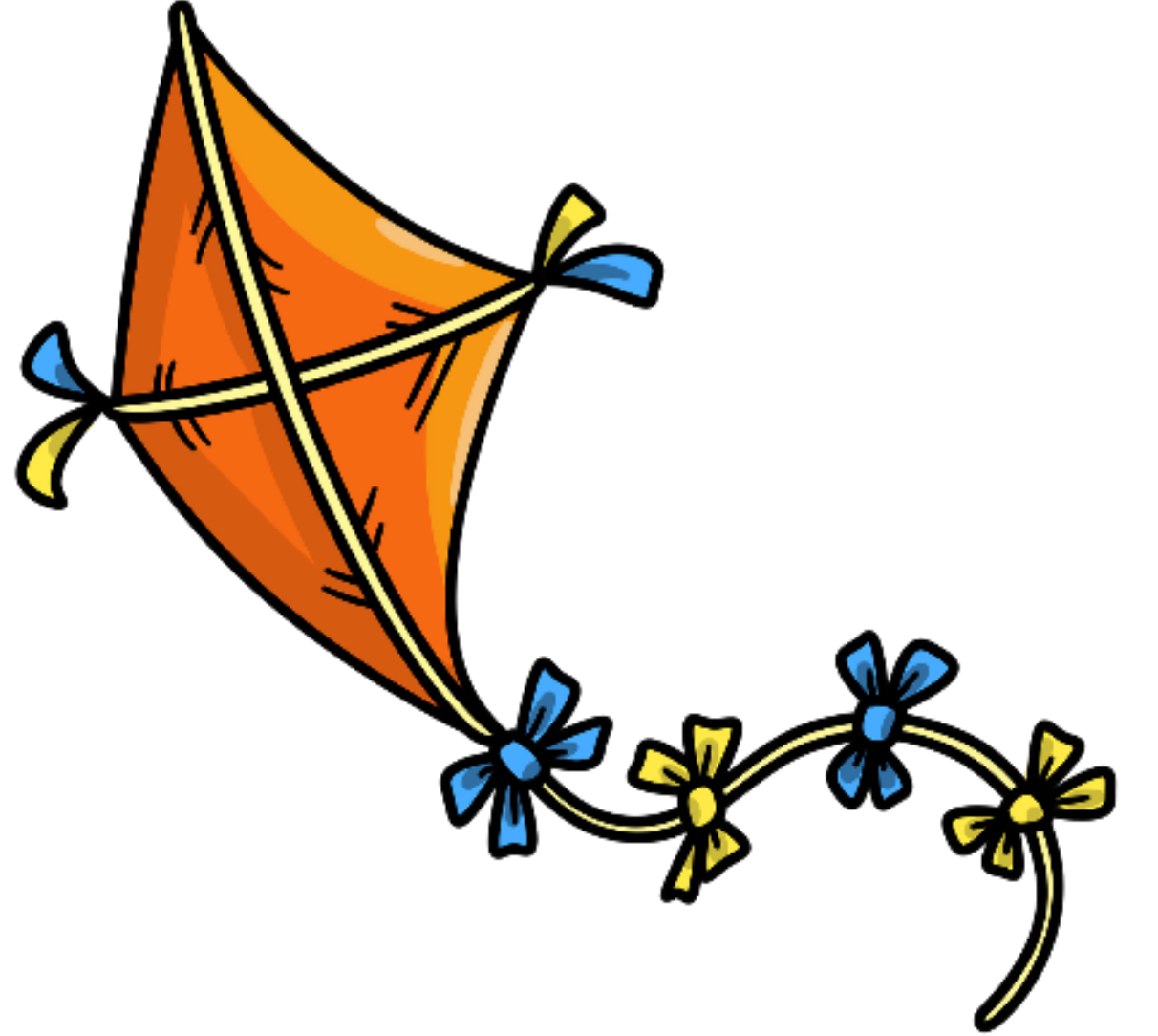


Target Sound /t/

Medial position

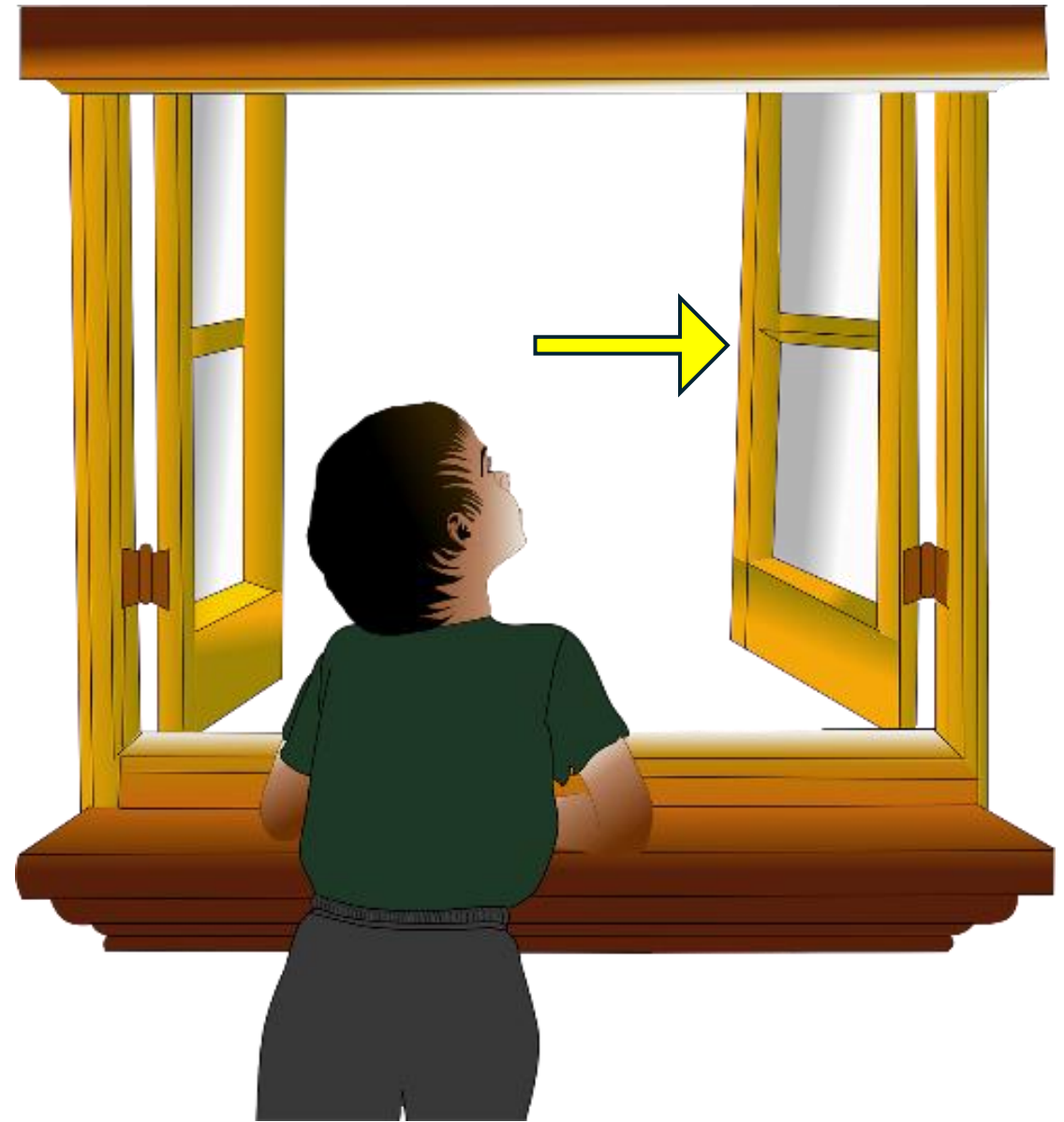
16) /paṭa/

ಪಟ



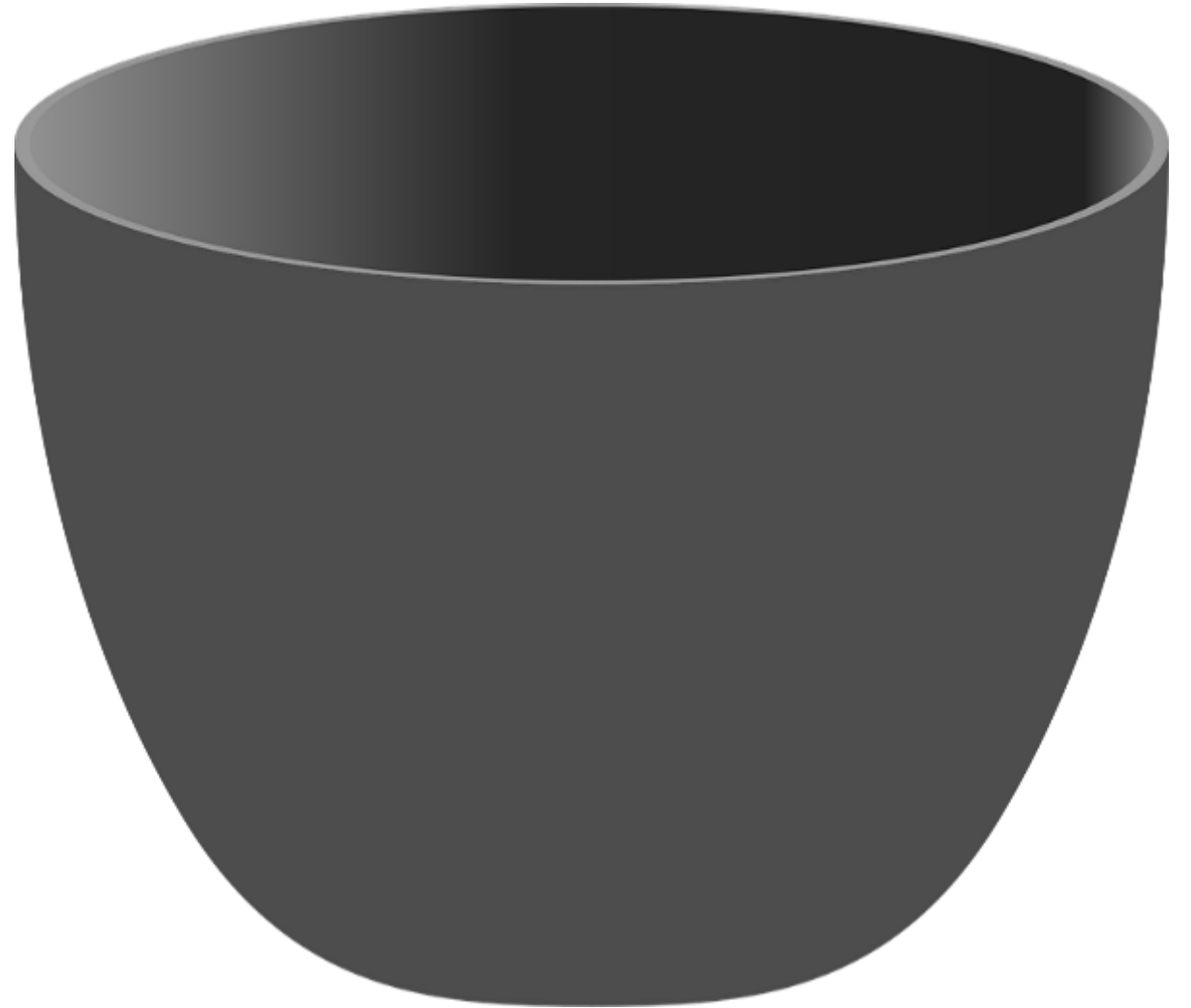
17) /kiṭaki/

ಕಿಟಕಿ



18) /battalu/

ಬಟ್ಟಲು



19) /paʈa:ki/

ಪಟಾಕಿ



20) /baʈaɳi/

ಬಟಾಣಿ



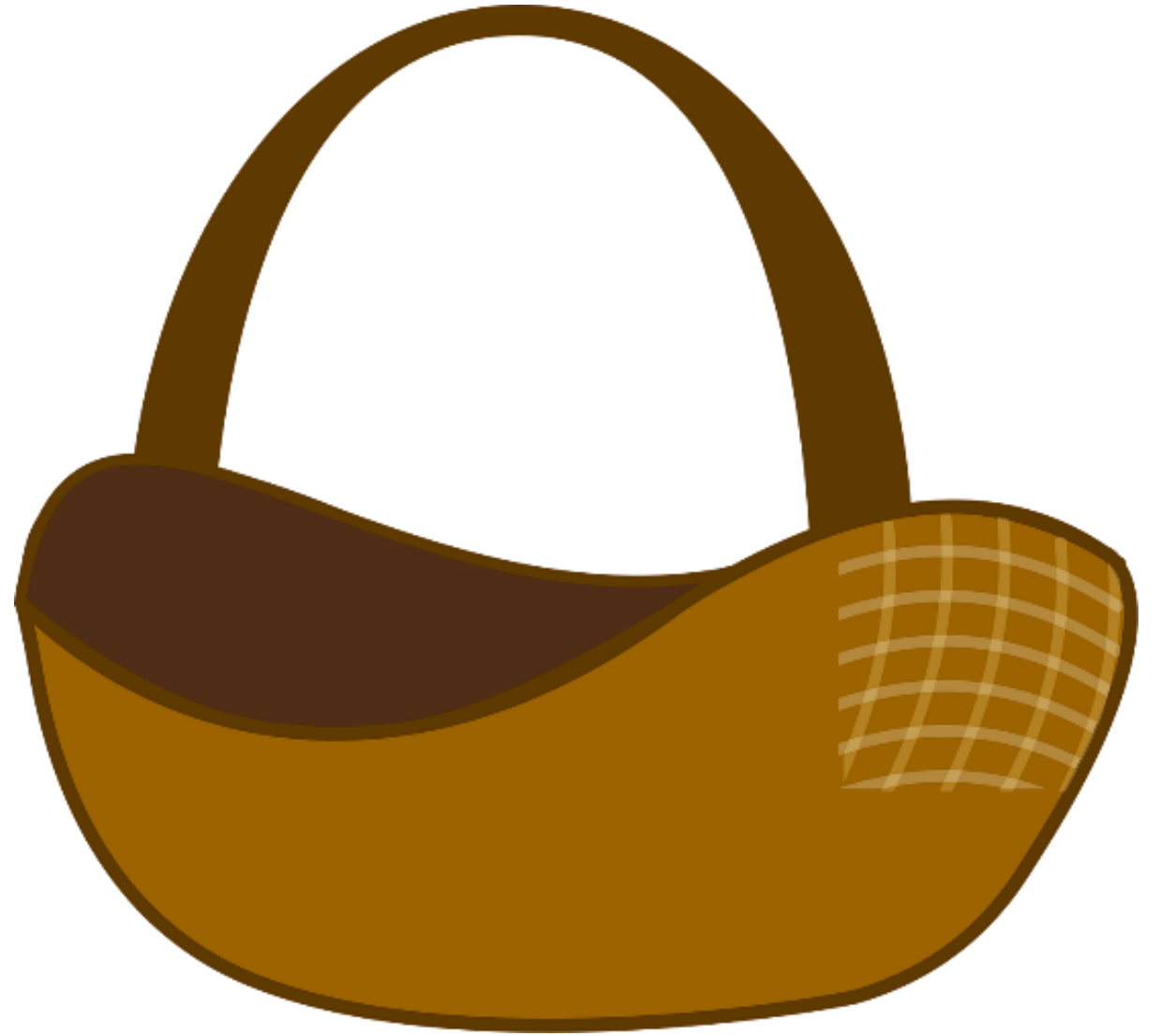
21) /tuʈi/

ತುಟಿ



22) /butti/

ಬುಟ್ಟಿ



23) /rotti/

ರೊಟ್ಟಿ



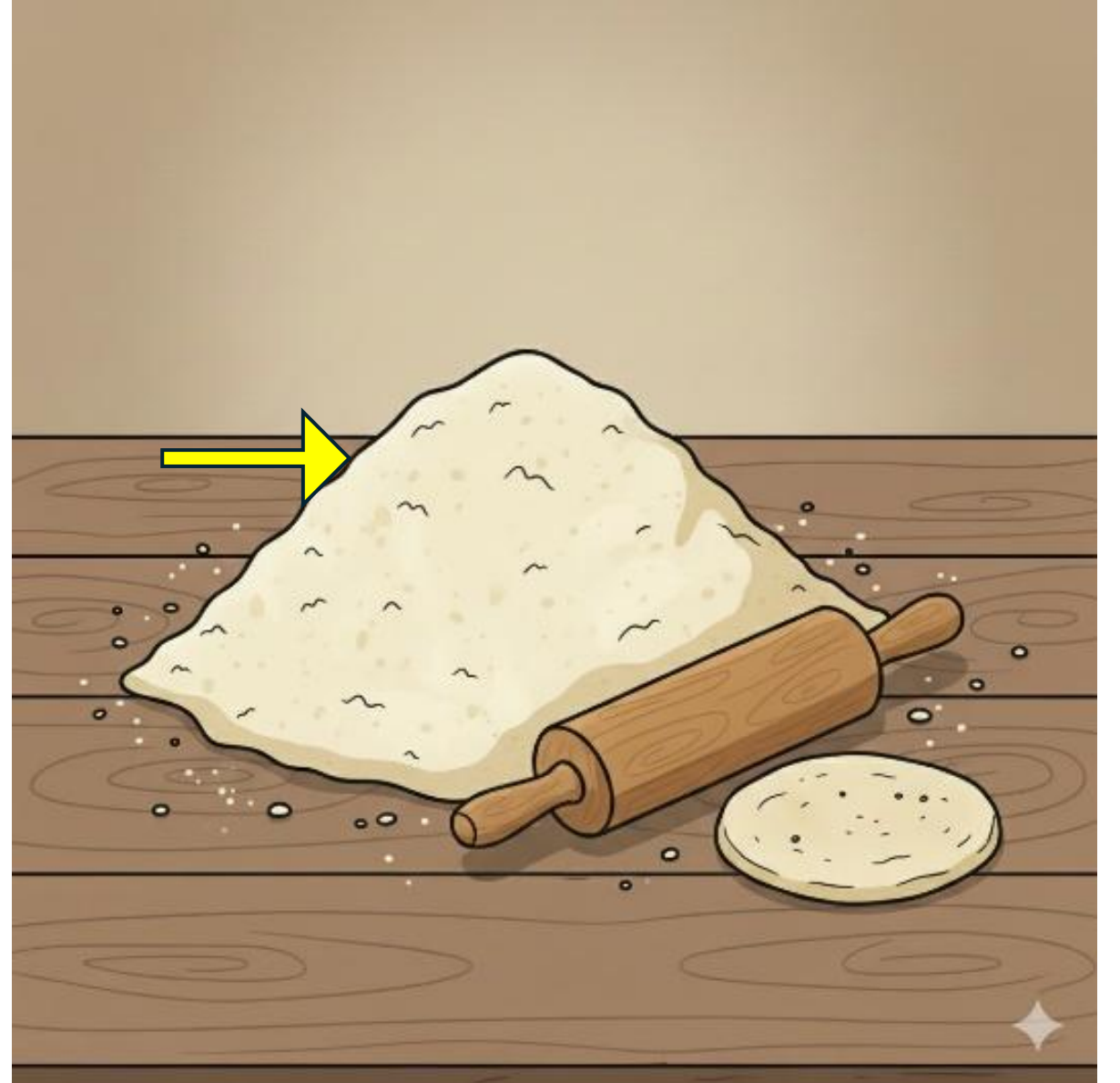
24) /rattu/

ರಟ್ಟು



25) /hittu/

ಹಿಟ್ಟು



26) /bottu/

ಬೊಟ್ಟು



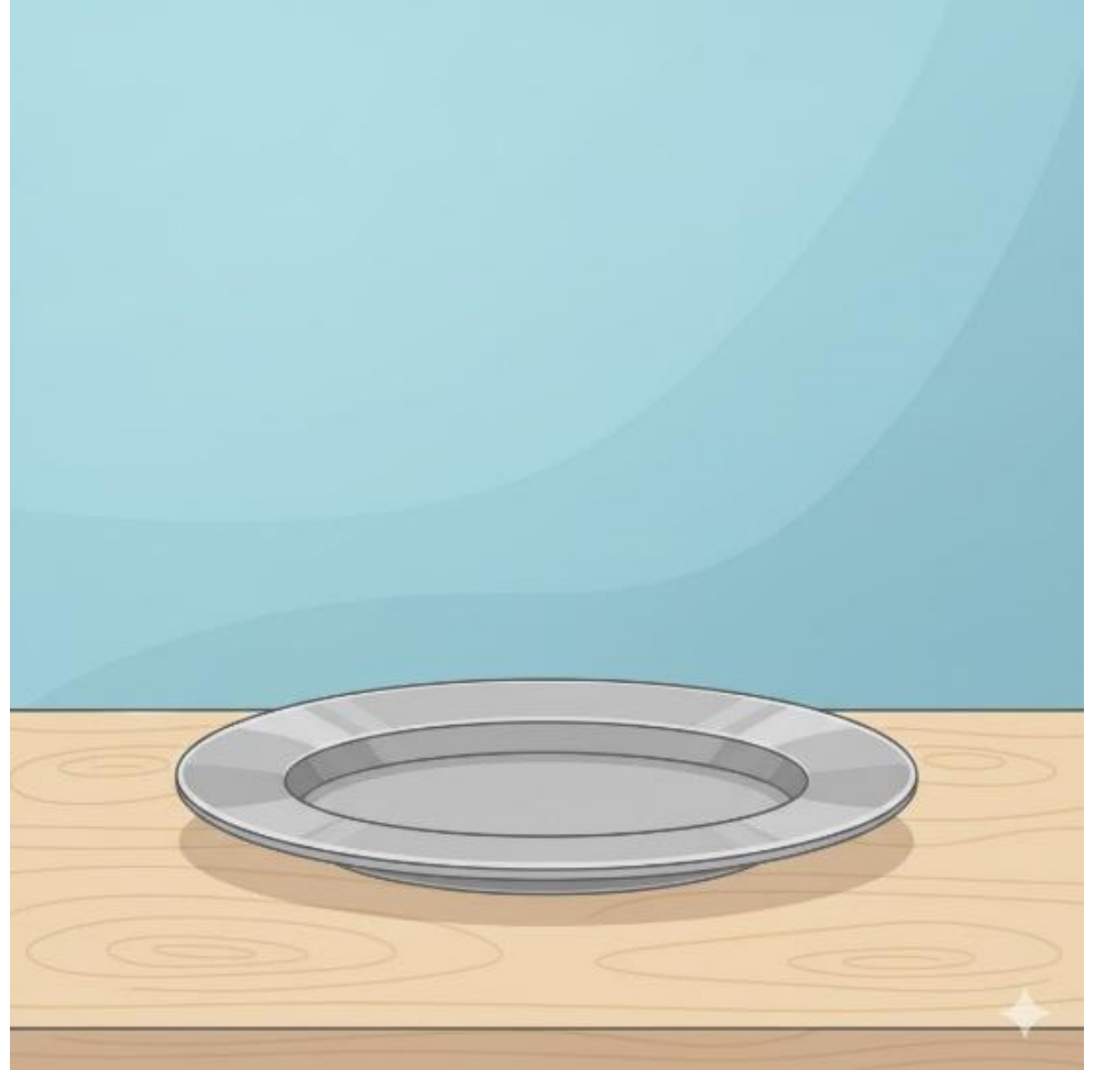
27) /mottle/

ಮೊಟ್ಟೆ



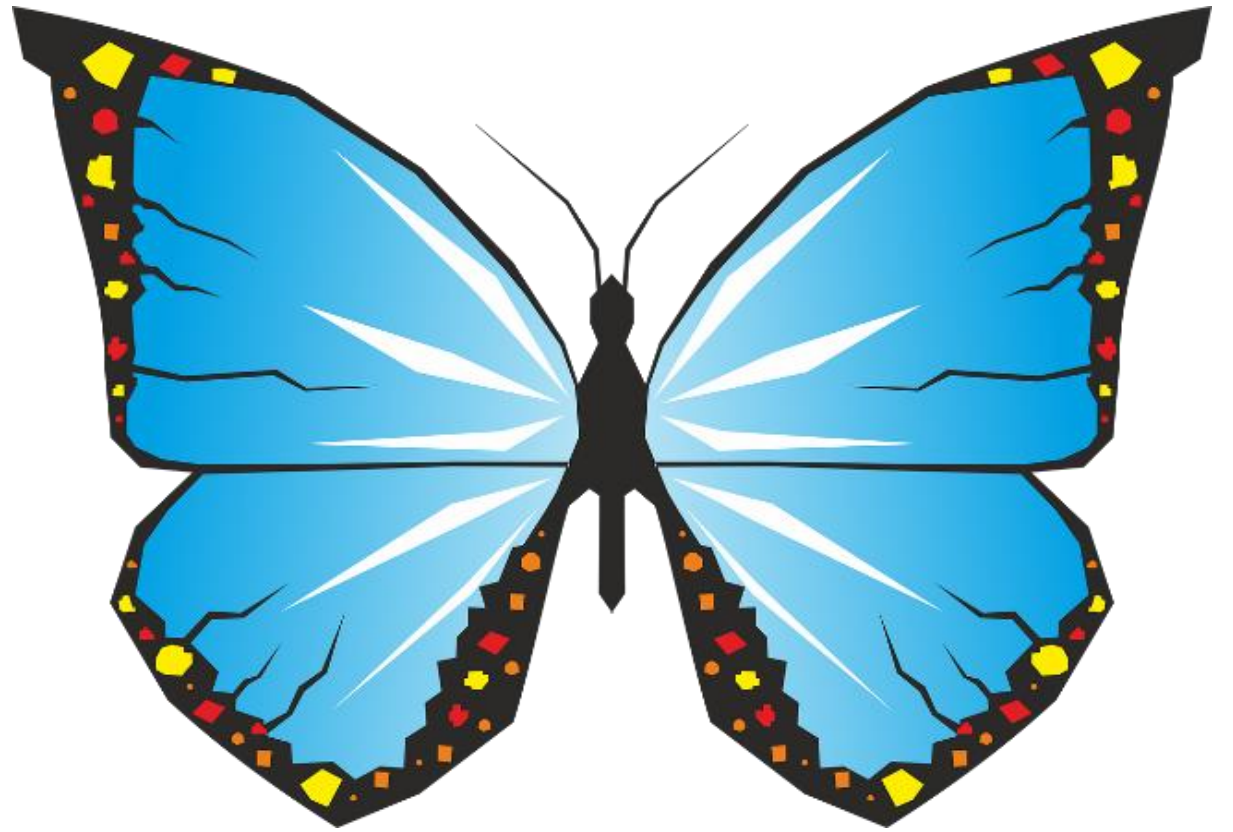
28) /tatte/

ತಟ್ಟೆ



29) /tʃitte/

ಚಿಟ್ಟೆ



30) /a:to/

ఆడోల



31) /toma:to/

ಟೋಮಾಟೋ



Target Sound /d/

Initial position

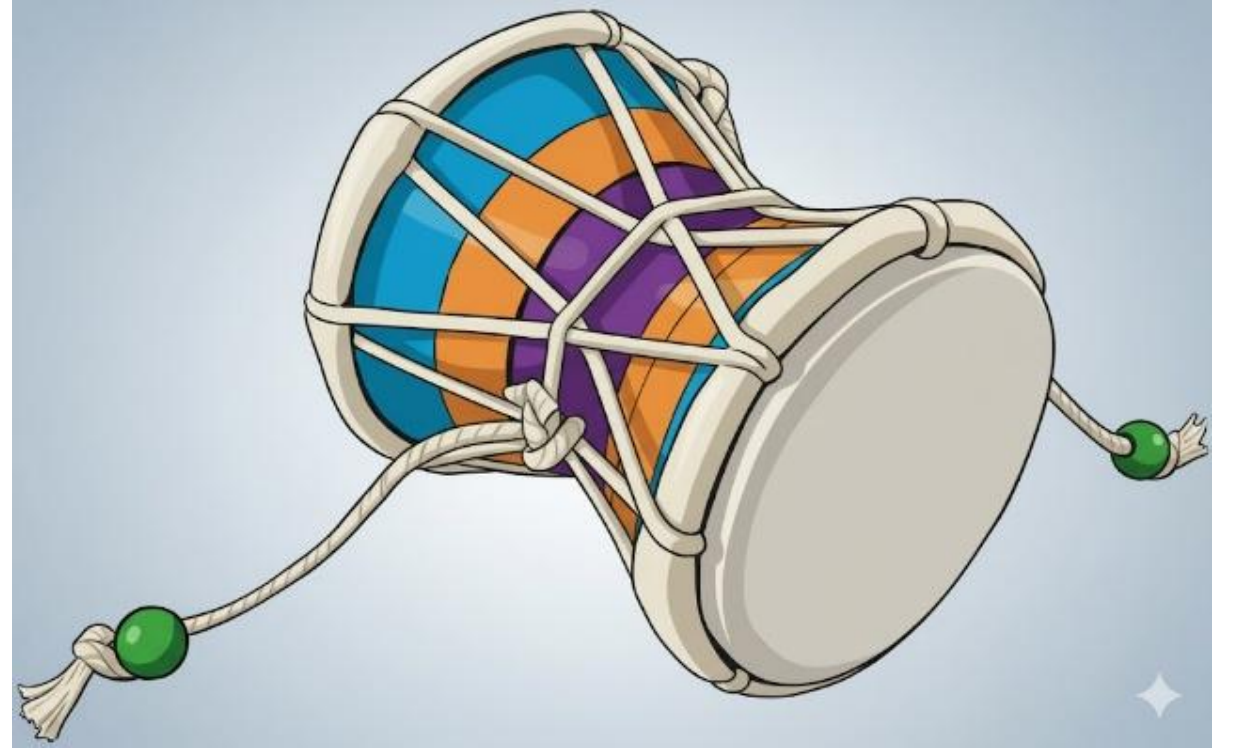
1) /ɖabbi/

ಡಬ್ಬಿ



2) /d^hamaru/

ಡಮರು



3) /dastbin/

ಡಸ್ಟ್‌ಬಿನ್



4) /ɖa:ku/

ಡಾಕು



5) /dikki/

ಡಿಕ್ಕಿ



6) /dumma/

ಡುಮ್ಮ



7) /dummi/

ಡುಮ್ಮಿ



8) /ɖonku/

ಡೊಂಕು



9) /d^ho:lu/

ಢೋಲು



10) /dɒllu/

ಡೊಳ್ಳು



Target Sound /d/

Medial position

11) /gadḍa/

ಗಡ್ಡೆ



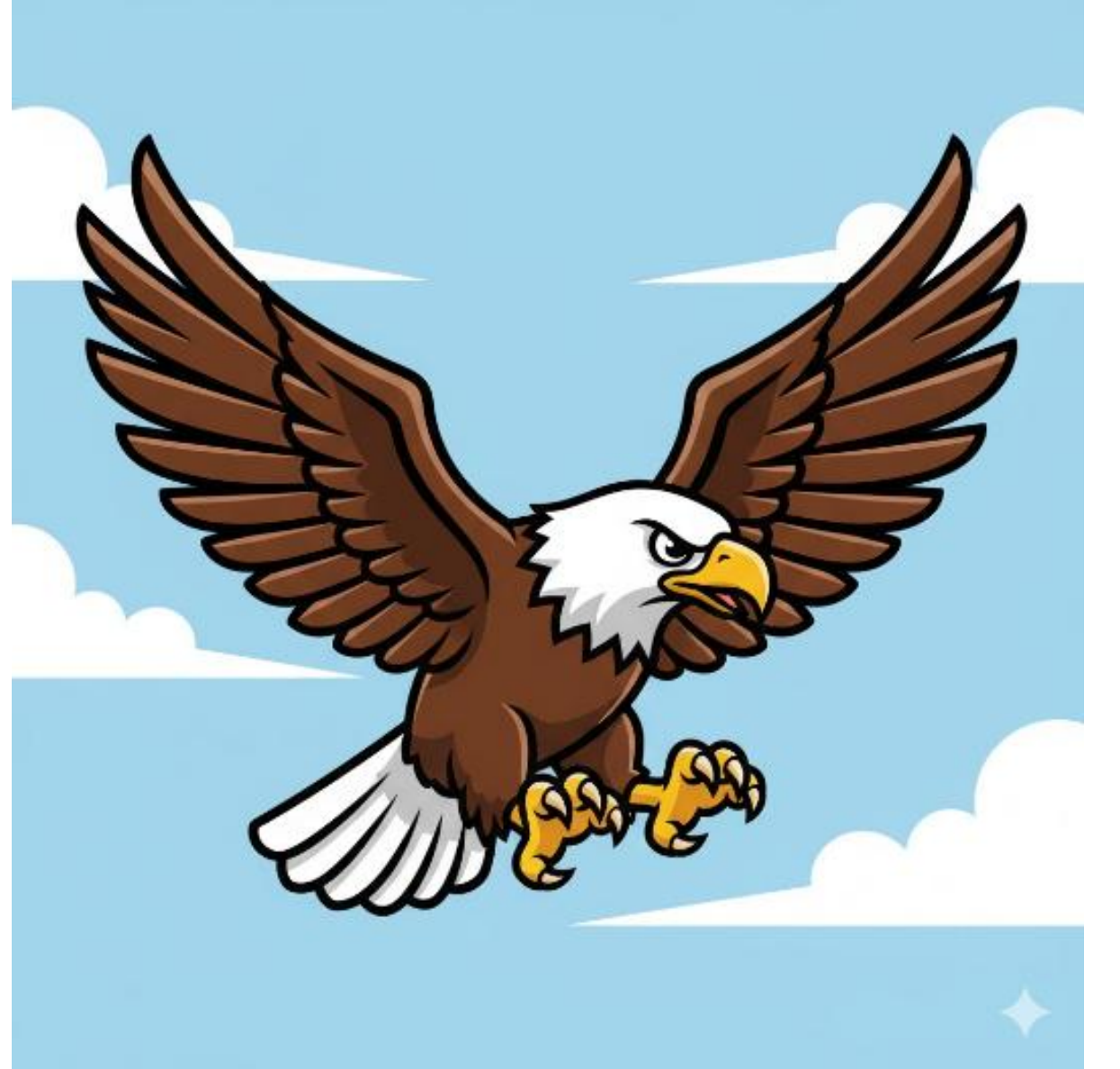
12) /gudda/

ಗುಡ್ಡ



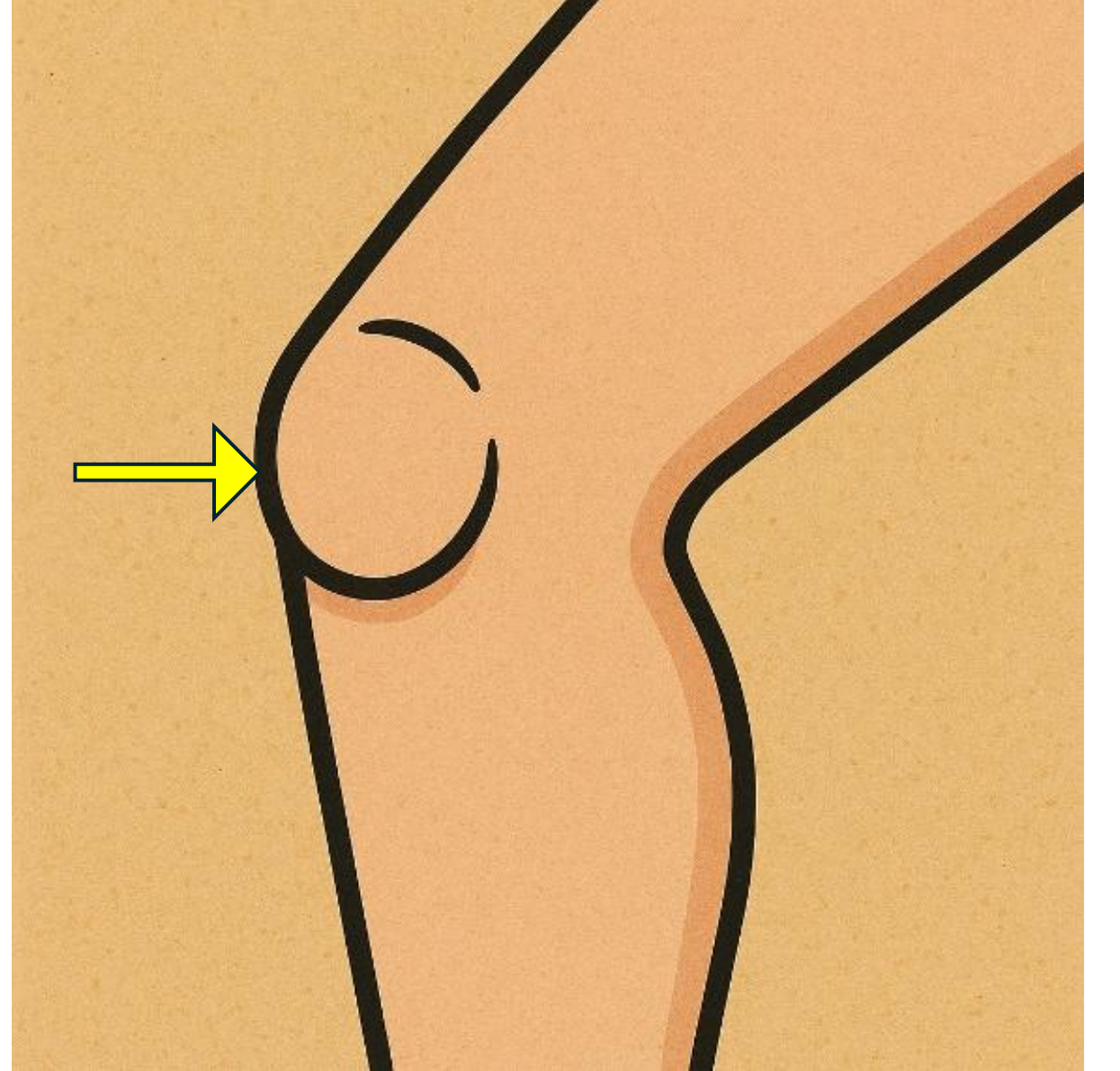
13) /garuḍa/

ಗರುಡ



14) /mandi/

ಮಂಡಿ



15) /angadi/

ಅಂಗಡಿ



16) /karadi/

કરડિ



17) /la:du/

ಲಾಡು



18) /ka:du/

ಕಾಡು



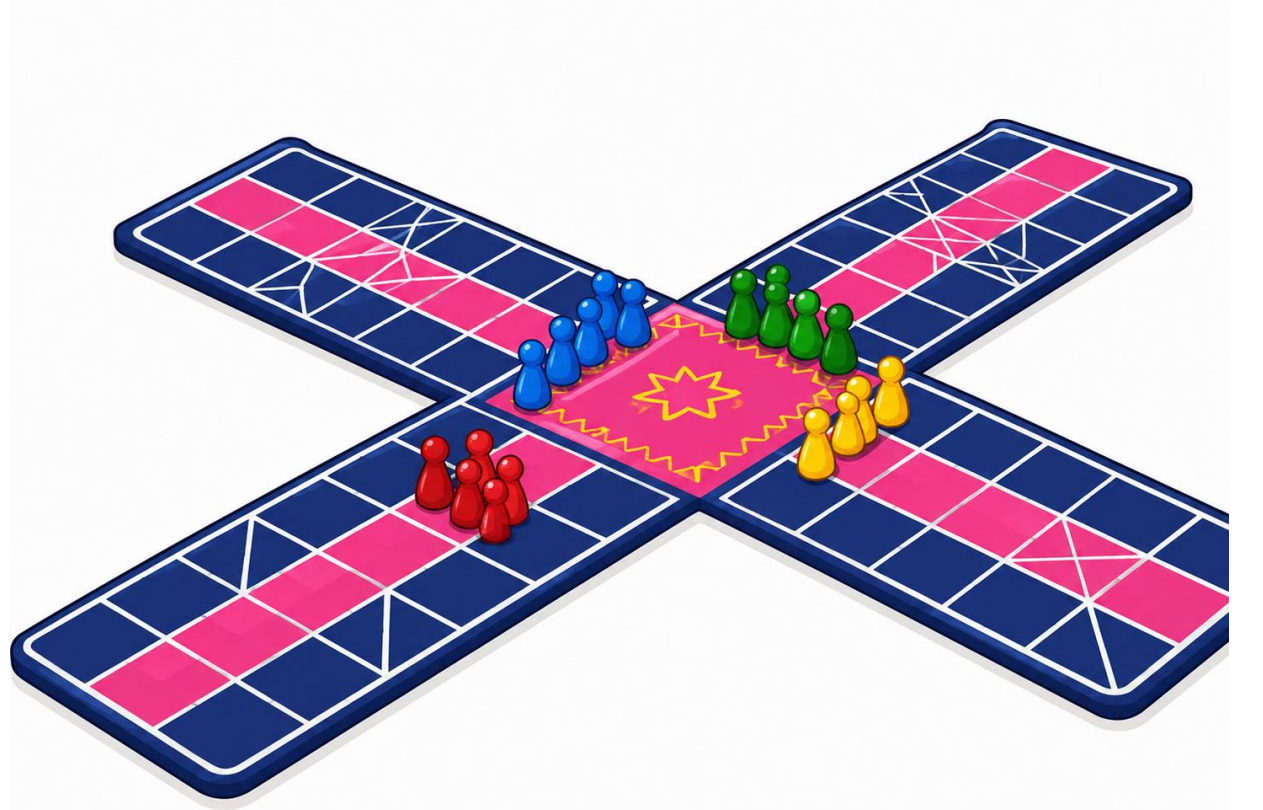
19) /huduga/

ಹುಡುಗ



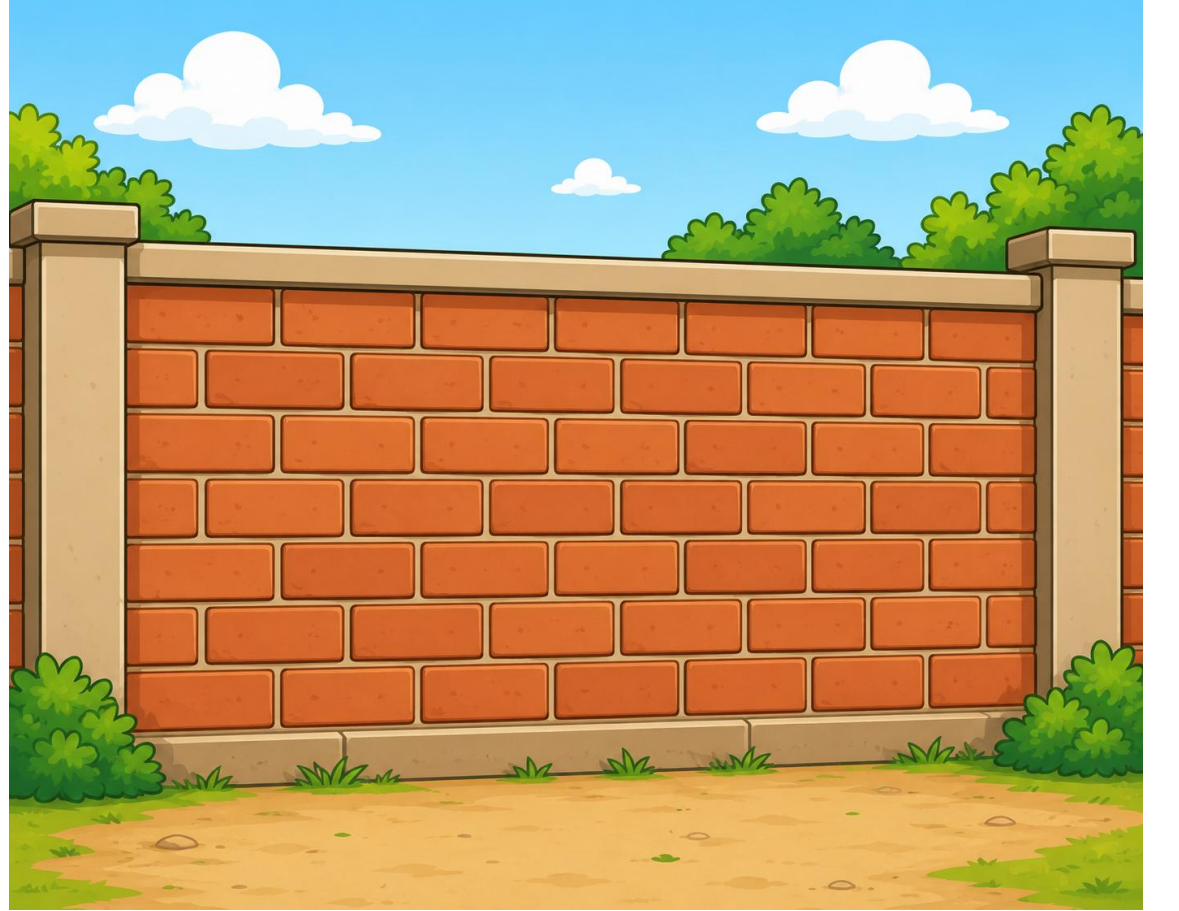
20) /pagade/

ಪಗಡೆ



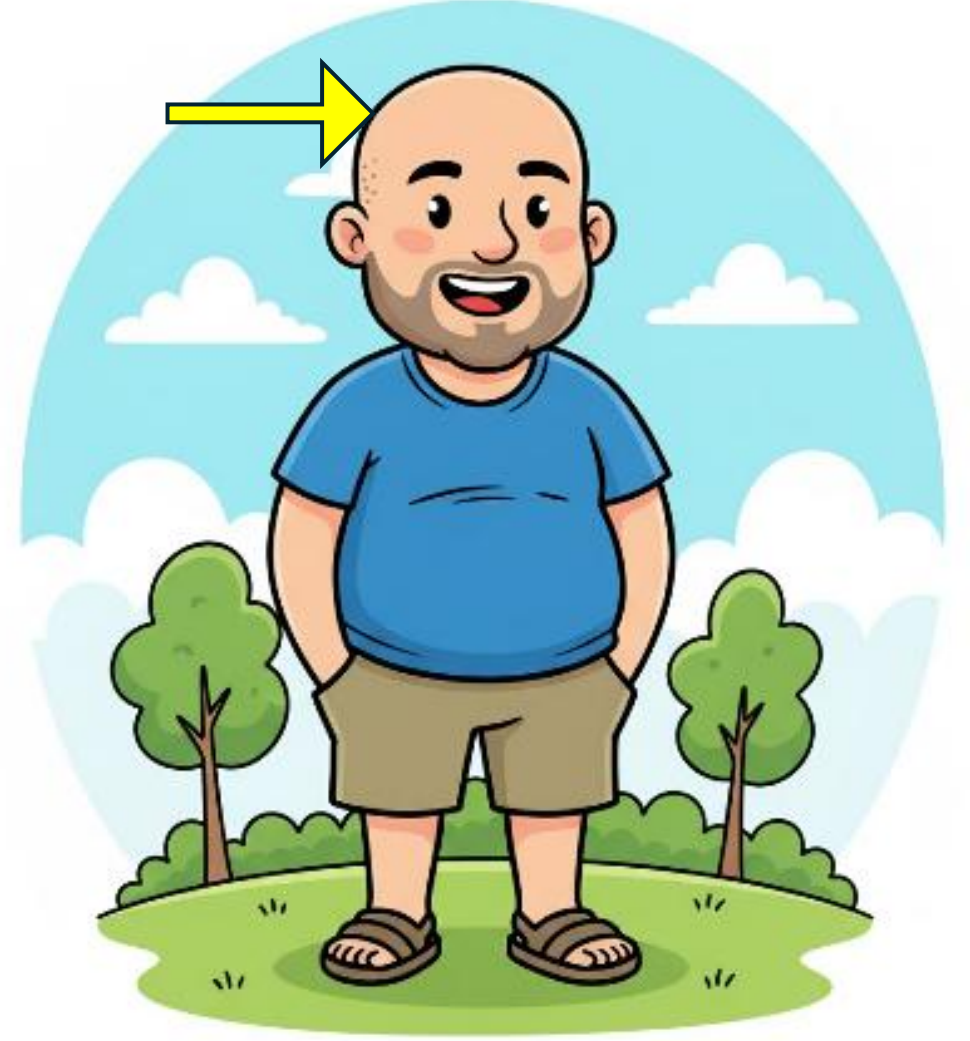
21) /go:de/

ಗೋಡೆ



22) /burudɛ/

ಬುರುಡೆ



Target Sound /ŋ/

Medial position

1) /baŋŋa/

သဏ္ဌ



2) /haŋa/

ಹಣ



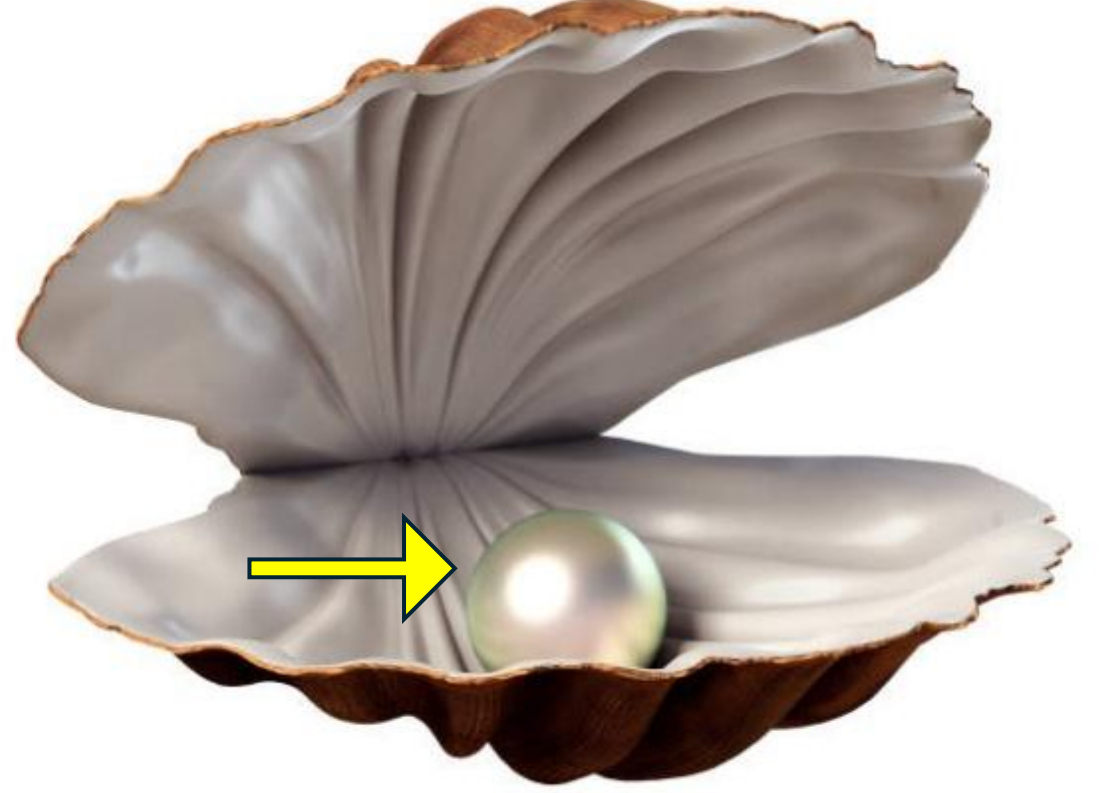
3) /noŋa/

ನೂಣ



4) /maɳi/

ಮಣಿ



5) /e:ηi/

ඩඞ්



6) /ra:ɳi/

ରାଣି



7) /kaŋɥu/

ကံ့
ဏ္ဍ



8) /haṇṇu/

ಹಣ್ಣು



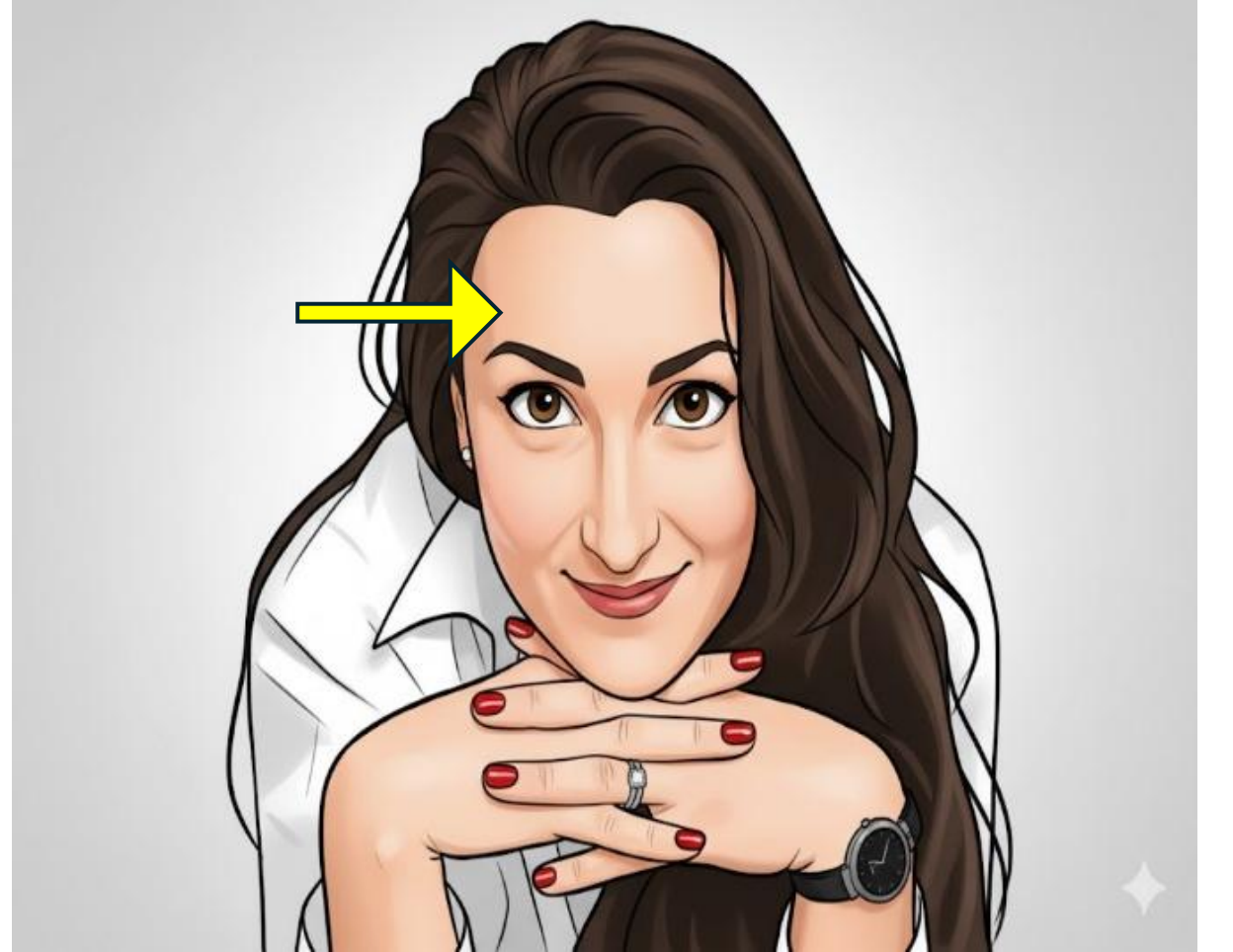
9) /maṇḍu/

ಮಣ್ಣು



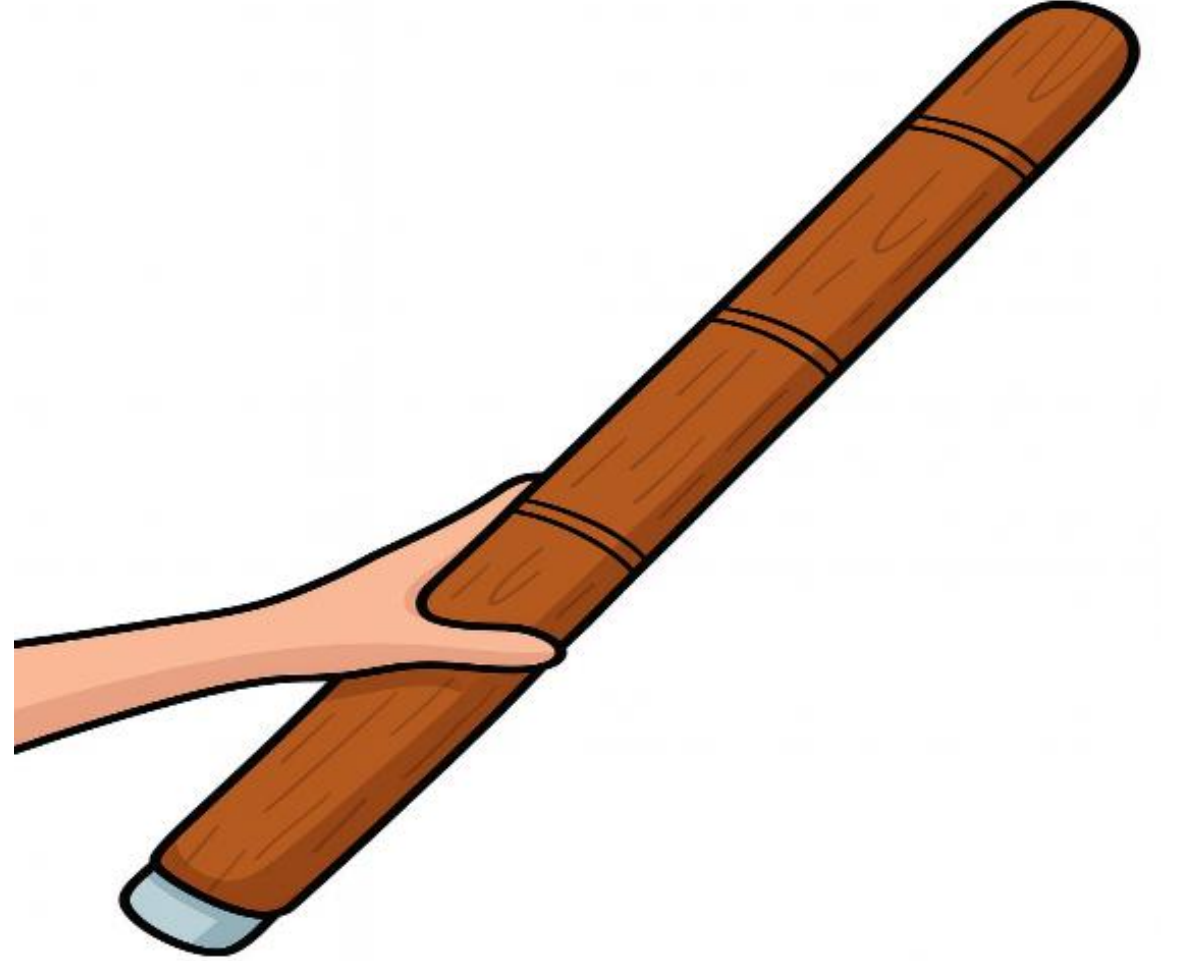
10) /haŋe/

ಹಣೆ



11) /donʎe/

ದೊಣ್ಣೆ



12) /maṇe/

ಮಣೆ



Target Sound /V/

Medial position

1) /kaḷḷa/

ಕಳ್ಳ



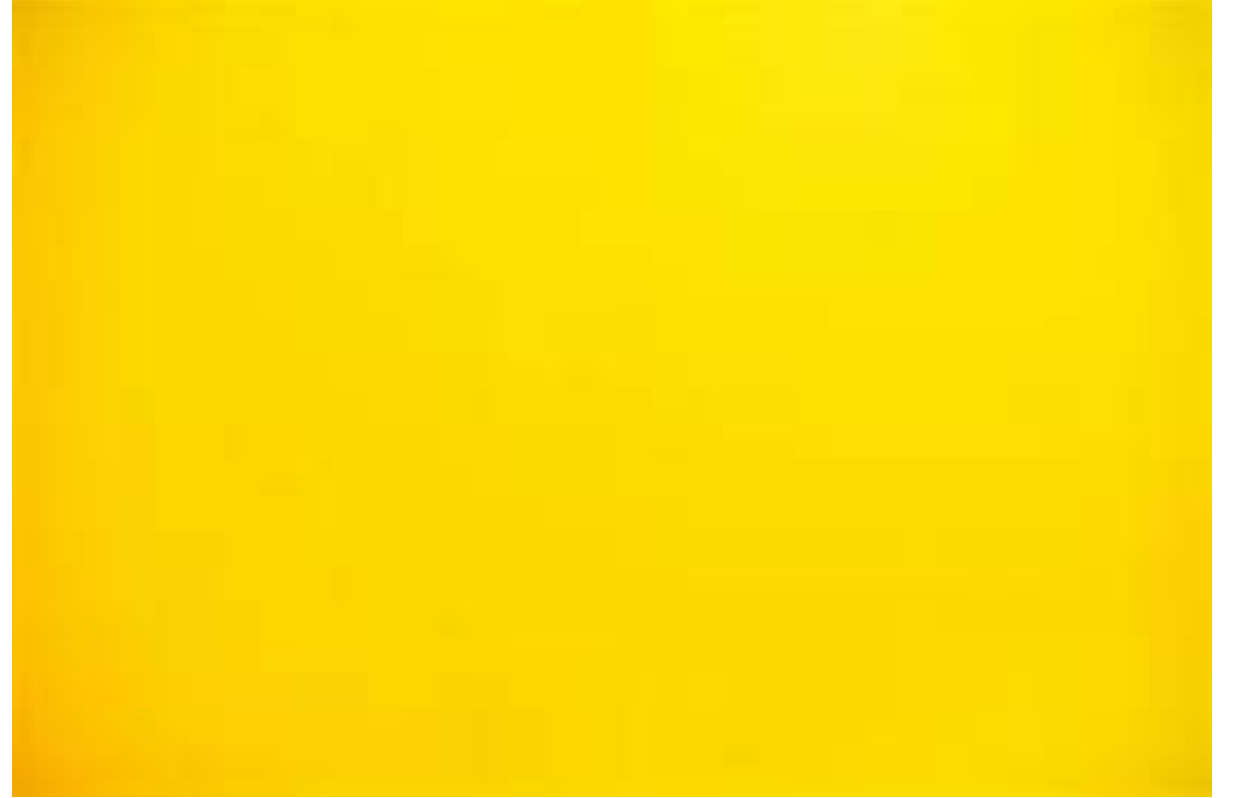
2) /kaɭaʃa/

ಕಳಶ



3) /haɭadi/

ಹಳದಿ



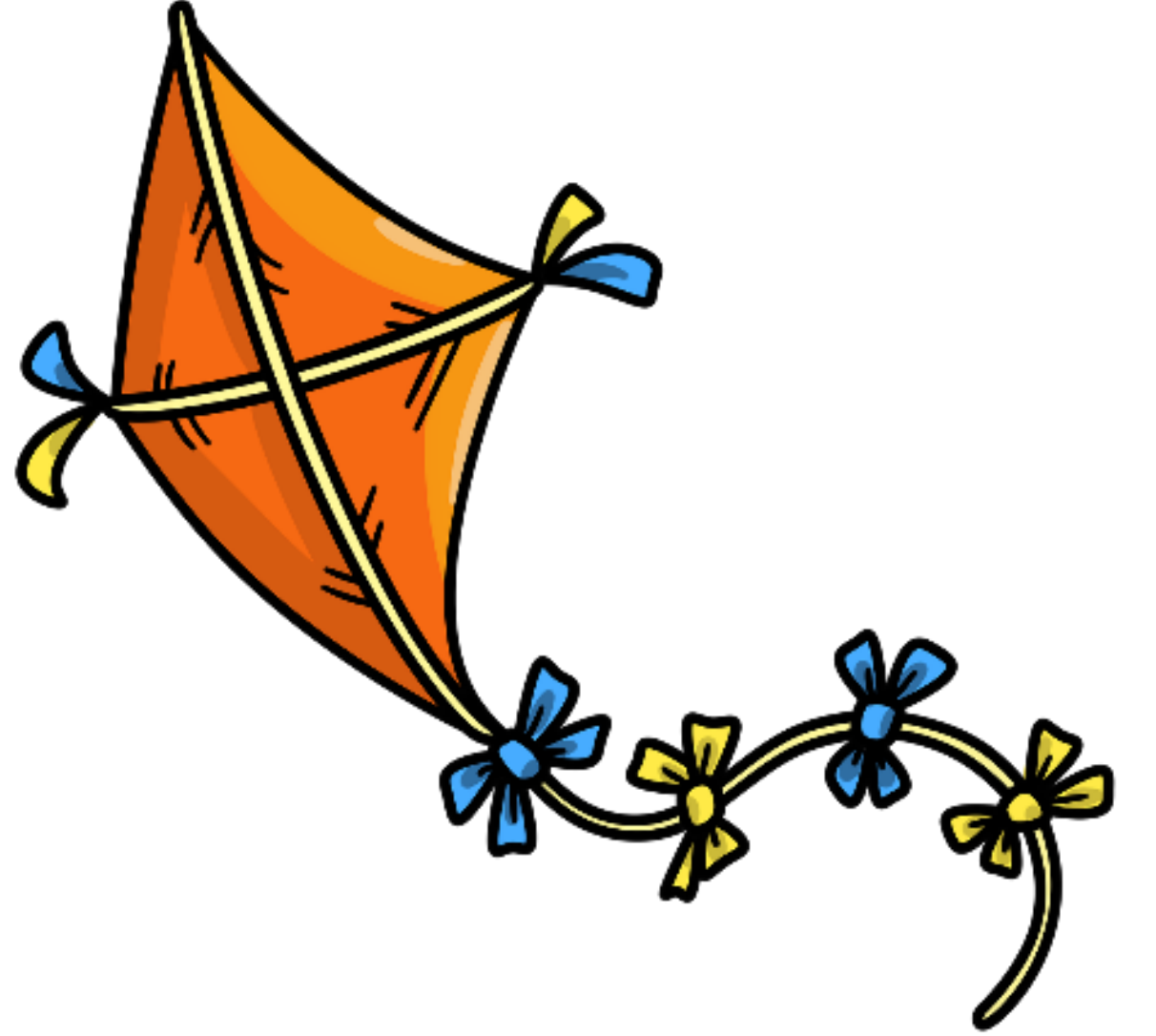
4) /biʎi/

ಬಿಳಿ



5) /ga:lipat̪a/

ಗಾಳಿಪಟ



6) /giḷi/

ဂိဗ္ဗ



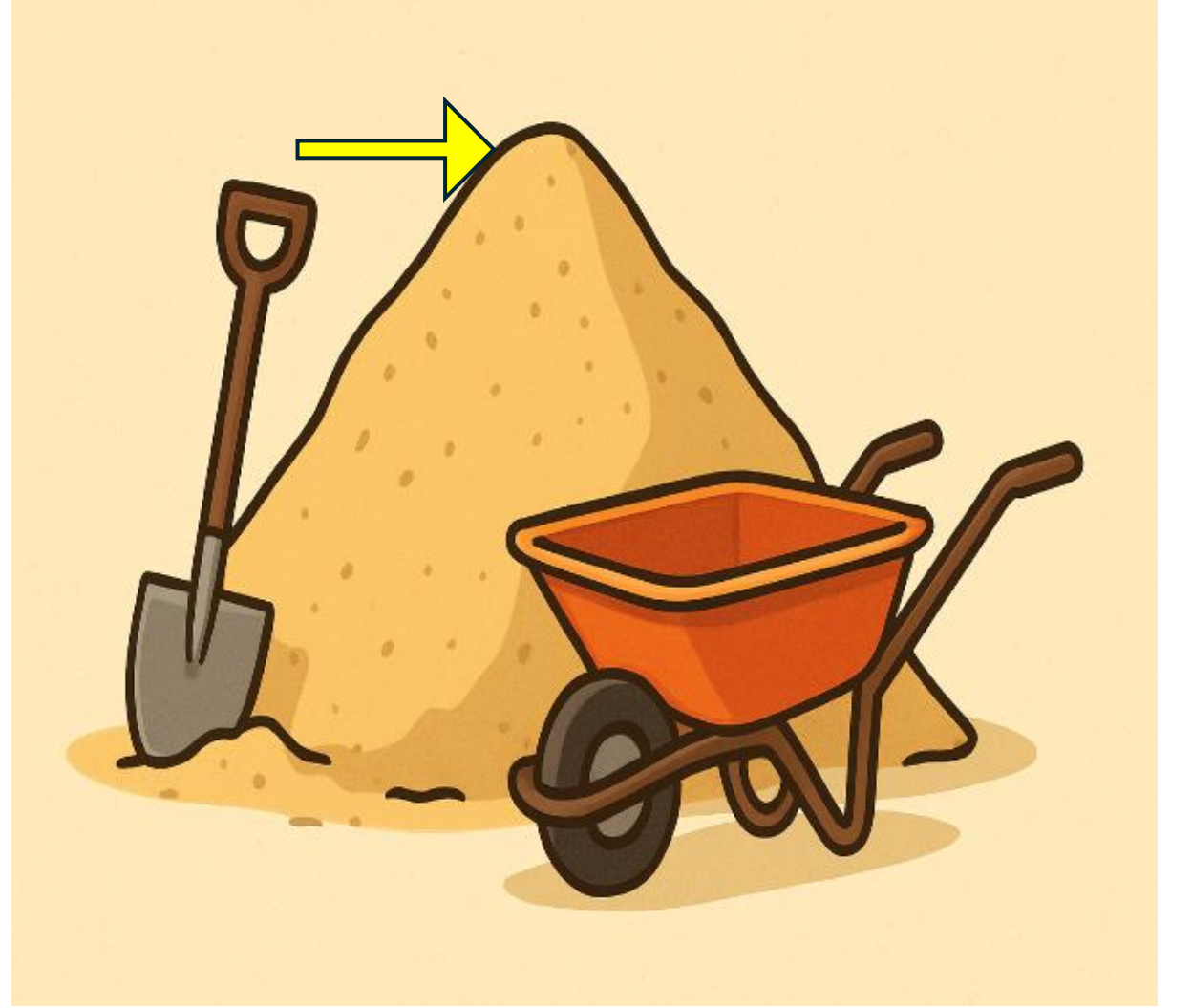
7) /muɭɭu/

ಮುಳ್ಳು



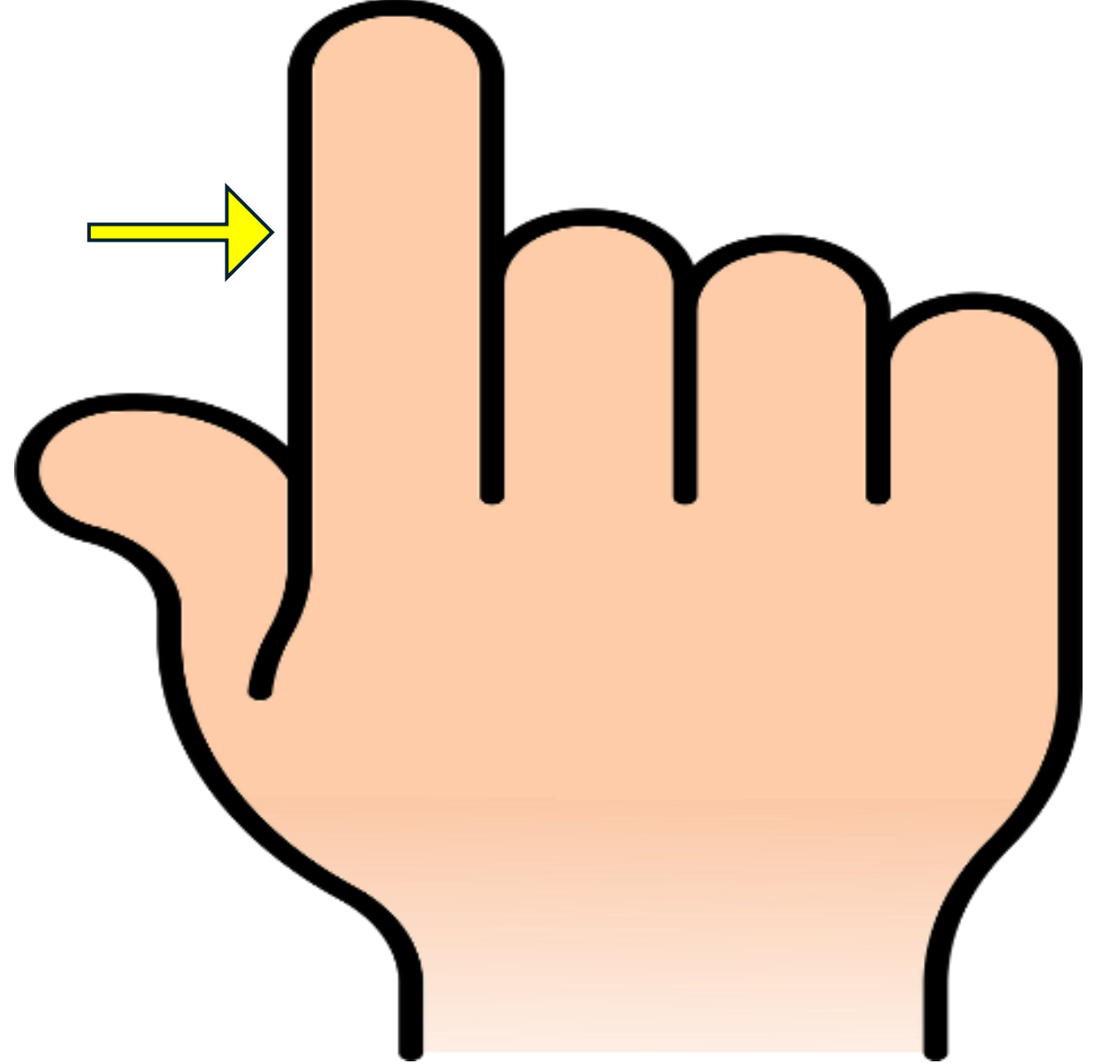
8) /mara[u/

ಮರಳು



9) /beralu/

ಬೆರಳು



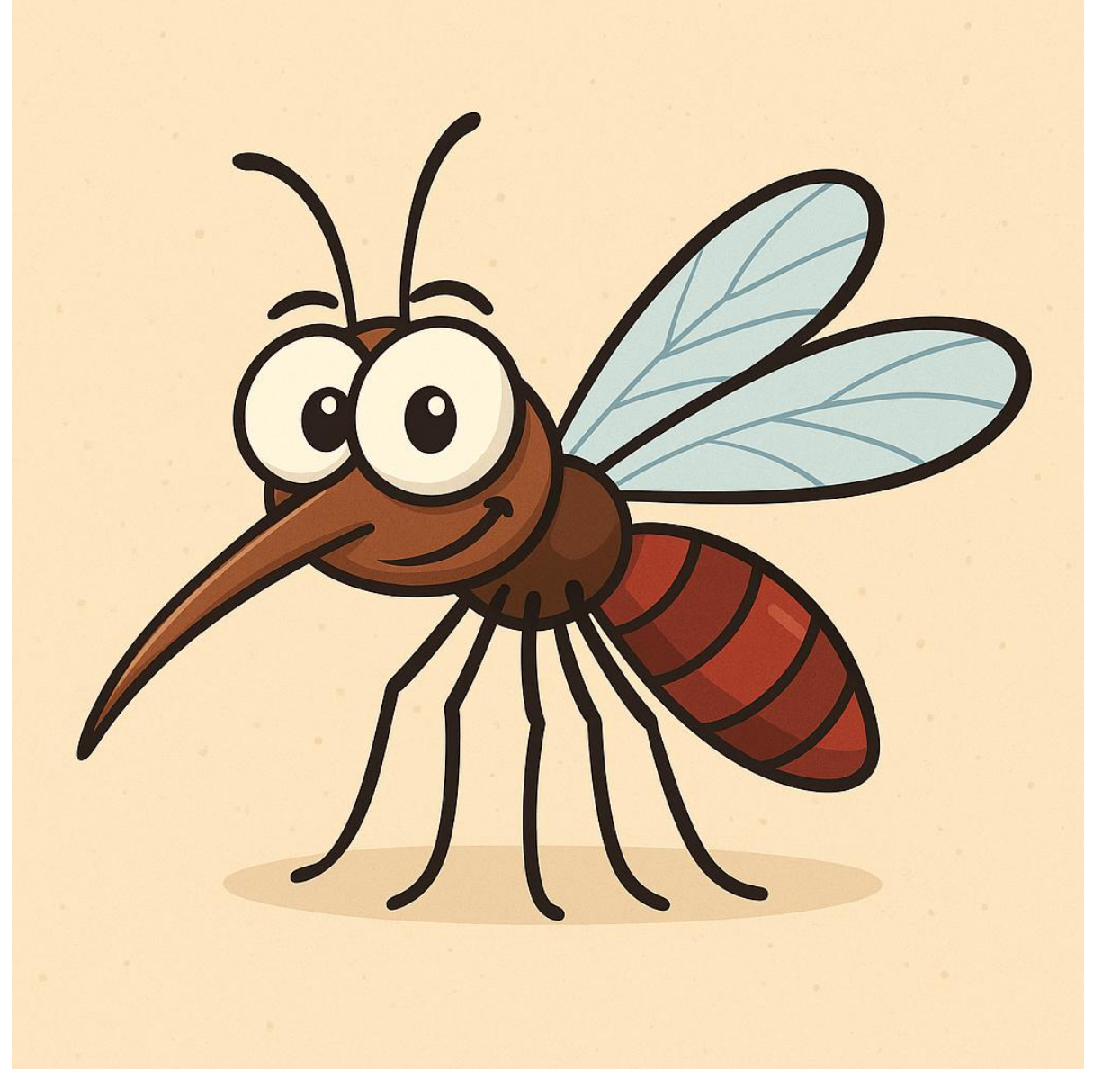
10) /ba|e/

બંધ



11) /solle/

ಸೊಳ್ಳೆ



12) /maɪe/

ಮಳೆ



Target Sound /tʃ/

Initial position

1) /ʈandra/

ಚಂದ್ರ



2) /ʔapa:ti/

ಚಪಾತಿ



3) /tʃamatʃa/

ಚಮಚ



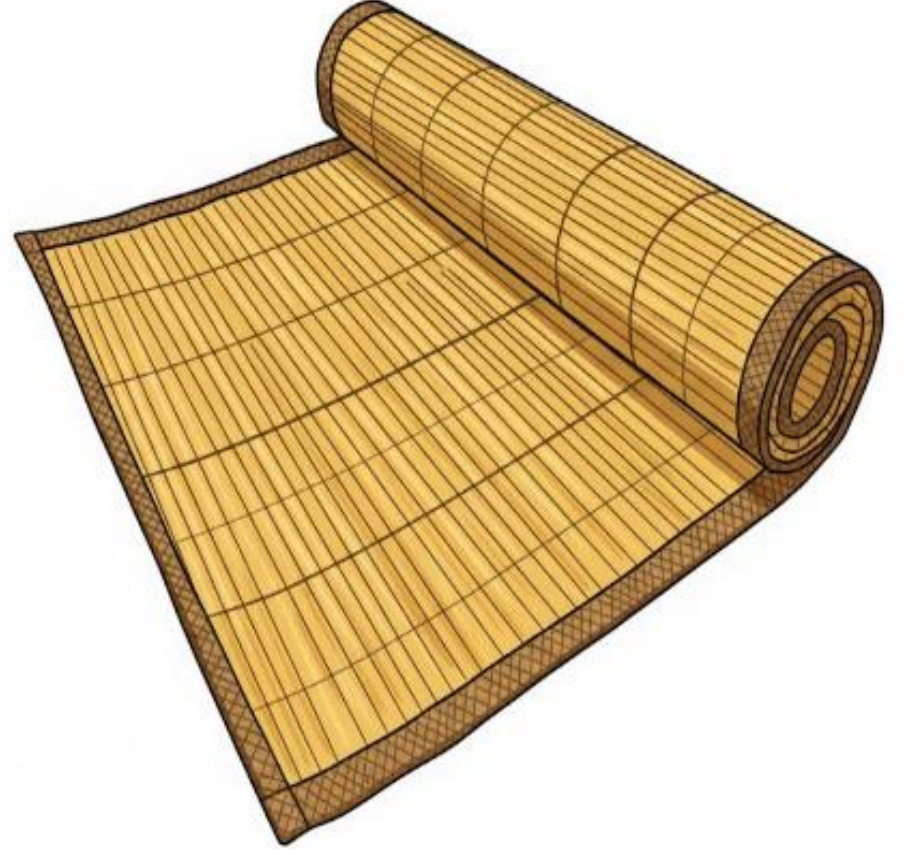
4) /ʈʌ:ku/

ಚಾಕು



5) /ʈʌ:pe/

ಚಾಪೆ



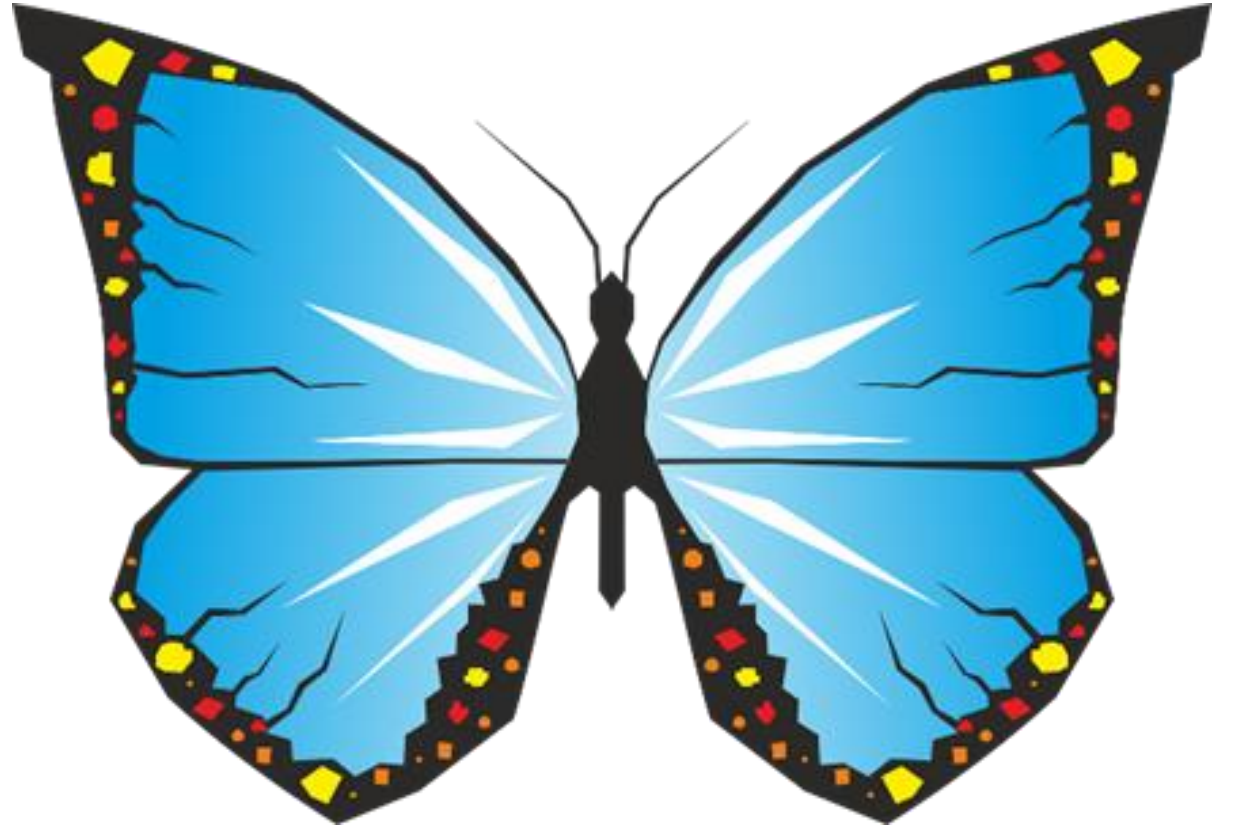
6) / ʃa:mundi/

ಚಾಮುಂಡಿ



7) / ʈitte/

ಚಿಟ್ಟೆ



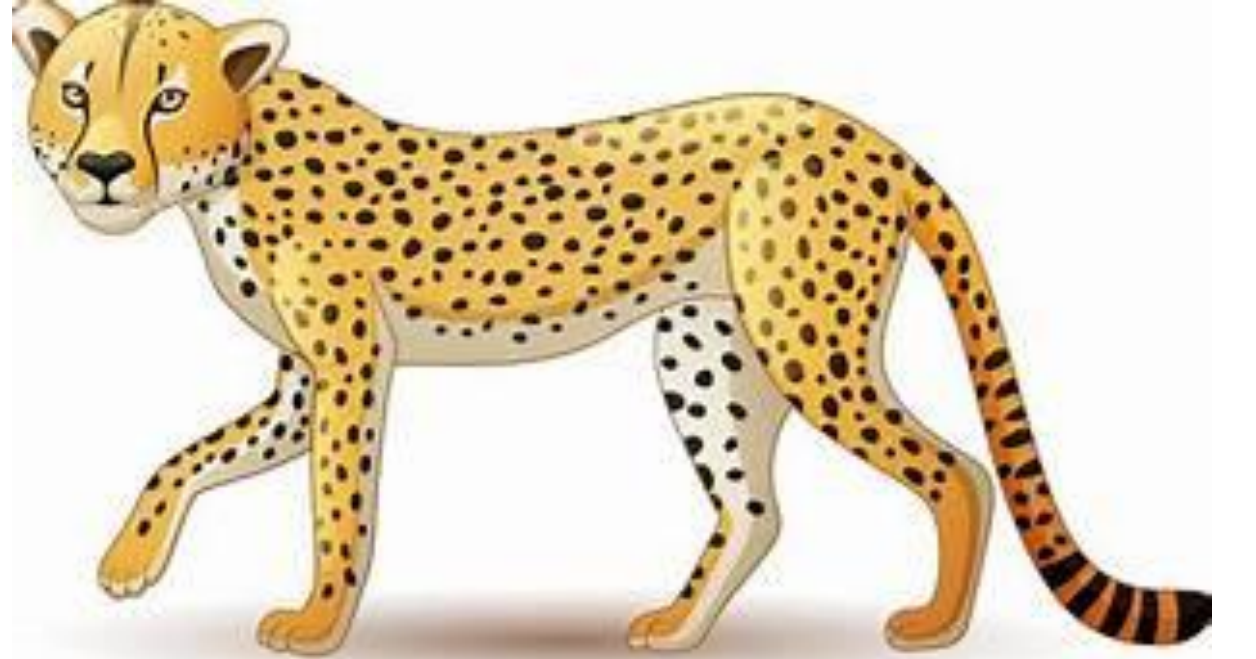
8) /ʈinna/

ಚಿನ್ನ



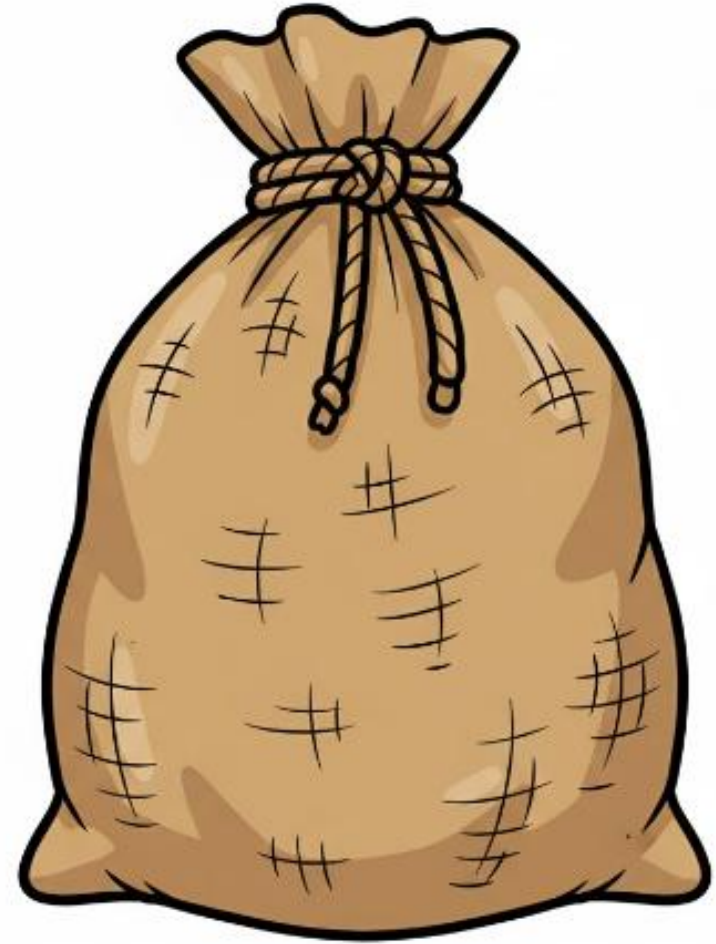
9) /ଫିରାଟେ/

ଝିରଡ଼ି



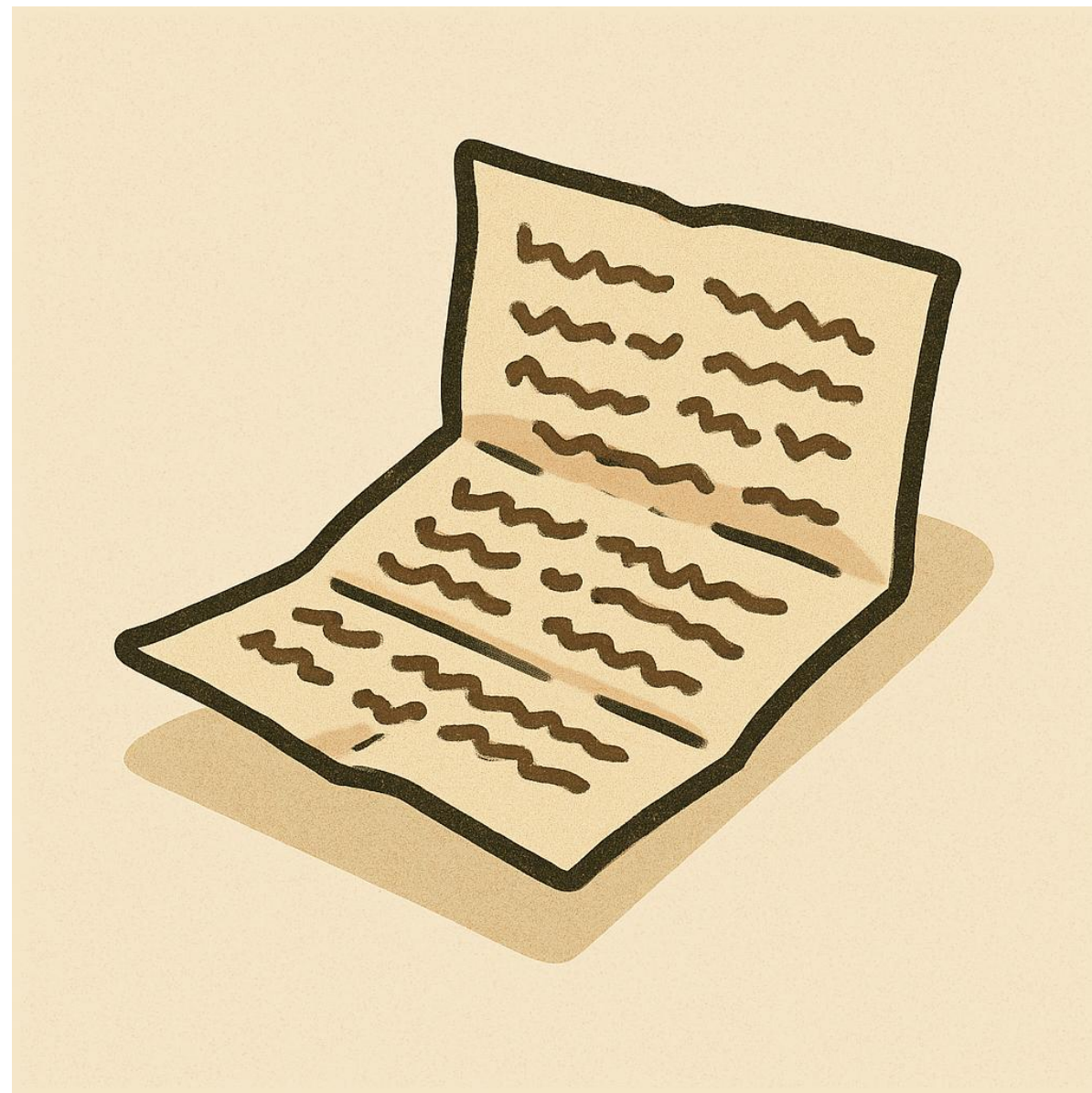
10) /tʃi:la/

ಚೀಲ



11) /tʃi:ti/

ಚೀಟಿ



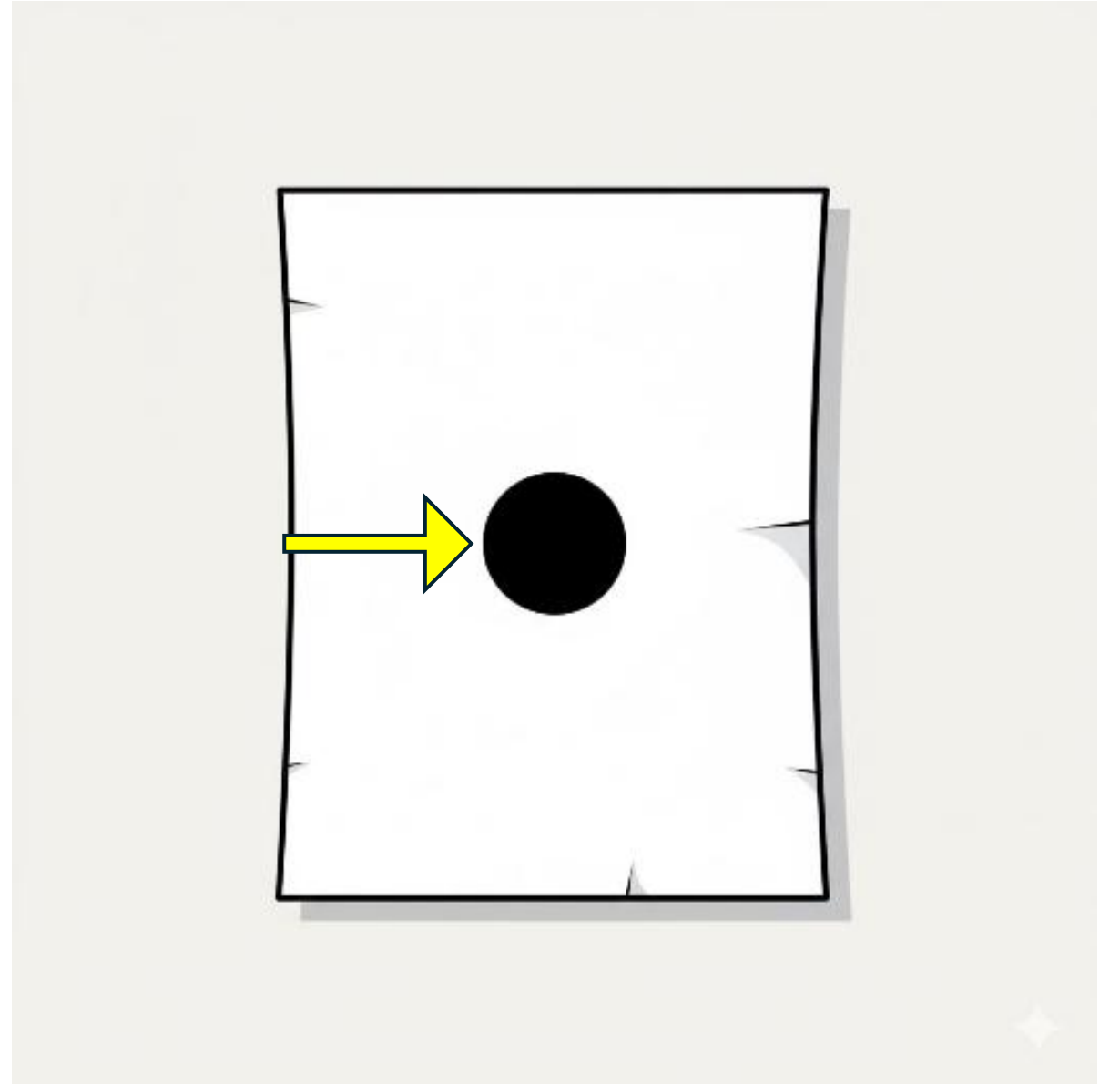
12) /tʃippu/

ಚಿಪ್ಪು



13) /ʈʊkki/

ಚುಕ್ಕಿ



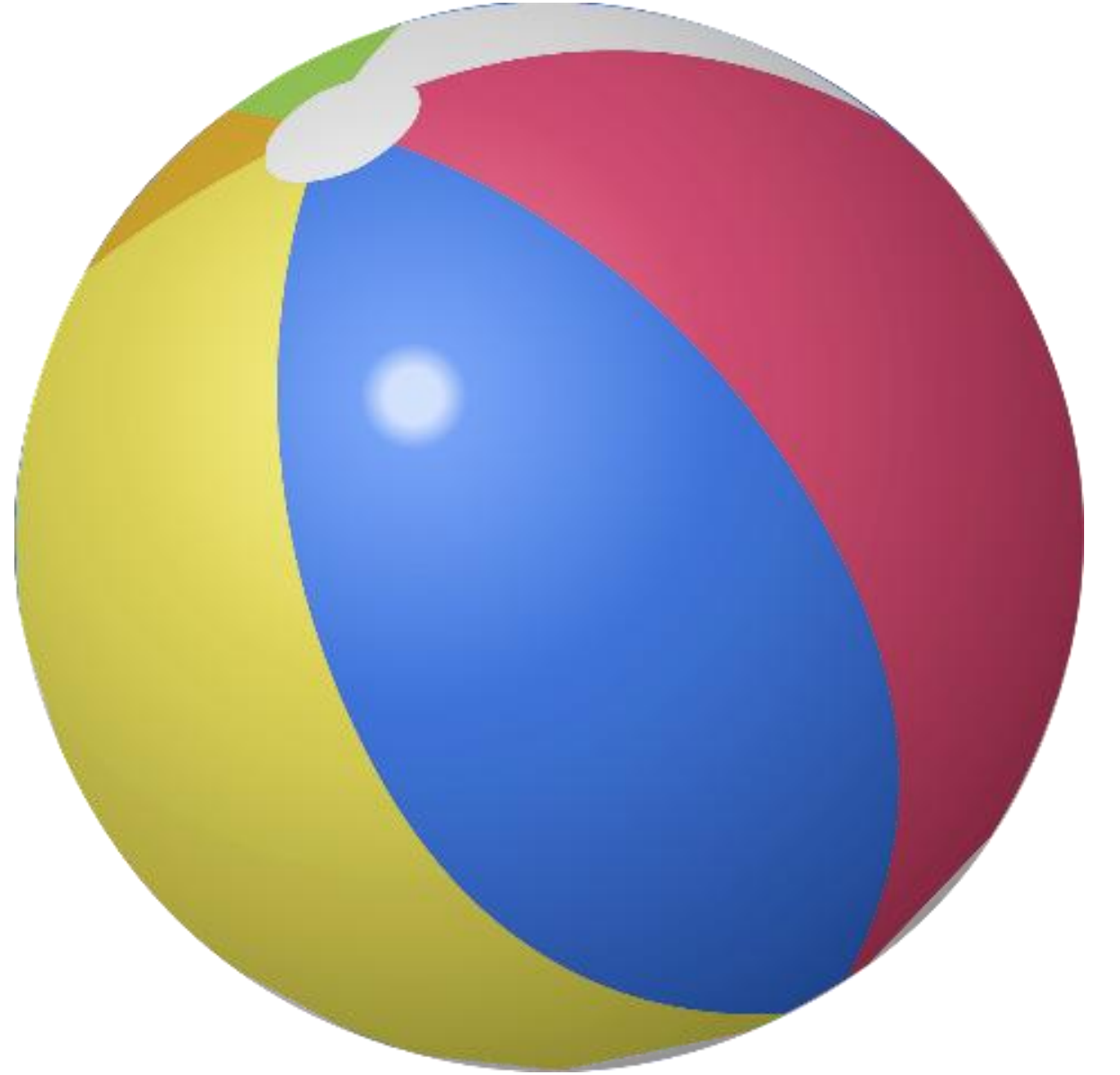
14) /ʈu:ru/

ಚೂರು



15) /ʈendu/

ಚೆಂಡು



16) /tʃe:ru/

ಚೇರು



Target Sound /tʃ/

Medial position

17) /mantʃa/

ಮಂಚ



18) /kavatʃa/

ಕವಚ



19) /joʈʃisu/

ಯೋಚಿಸು



20) /gubbatʃi/

ಗುಬ್ಬಚ್ಚಿ



21) /kurtʃi/

ಕುರ್ಚಿ



22) /kartʃifu/

ಕರ್ಚೀಫು



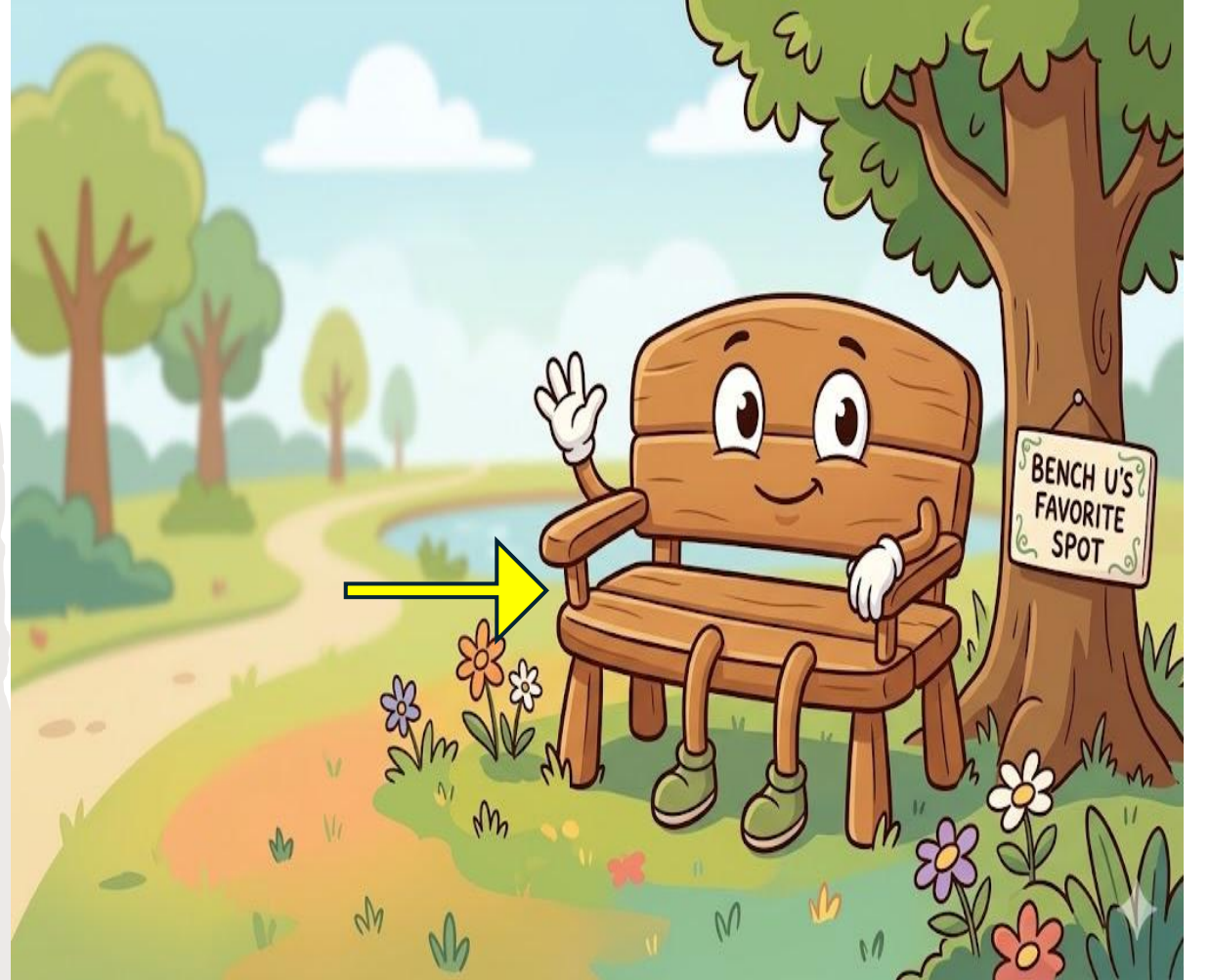
23) /katʃʃu/

ಕಚ್ಚು
ಚ



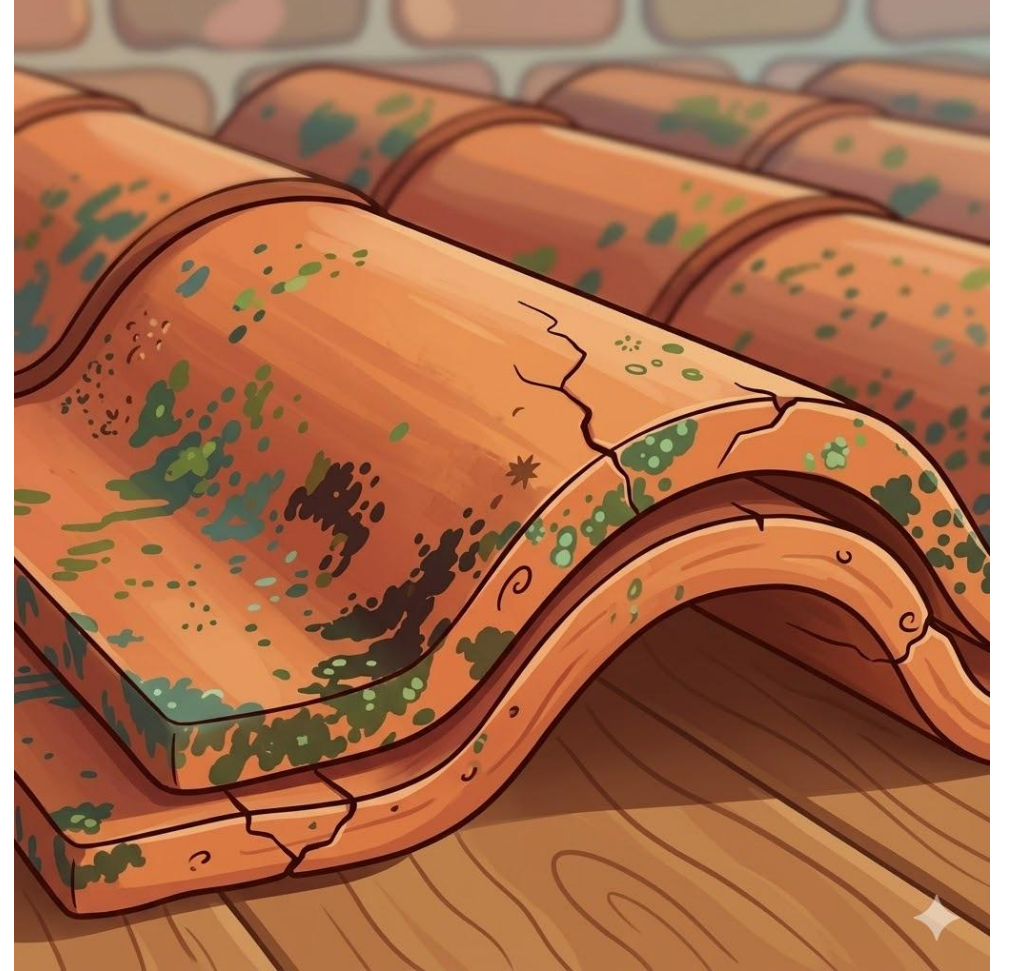
24) /bentʃu/

ಬೆಂಚು



25) /hentʃu/

ಹೆಂಚು



26) /mantfu:ri/

ಮಂಚೂರಿ



27) /pantfe/

ಪಂಚೆ



28) /kaʃe:ri/

કાફેરી



29) /katʃo:ri/

ಕಚೋರಿ



Target Sound /dʒ/

Initial position

1) /dʒag/

ಜಗ್



2) /dʒana/

ಜನ



3) /dʒaʈaka/

ઝઞક



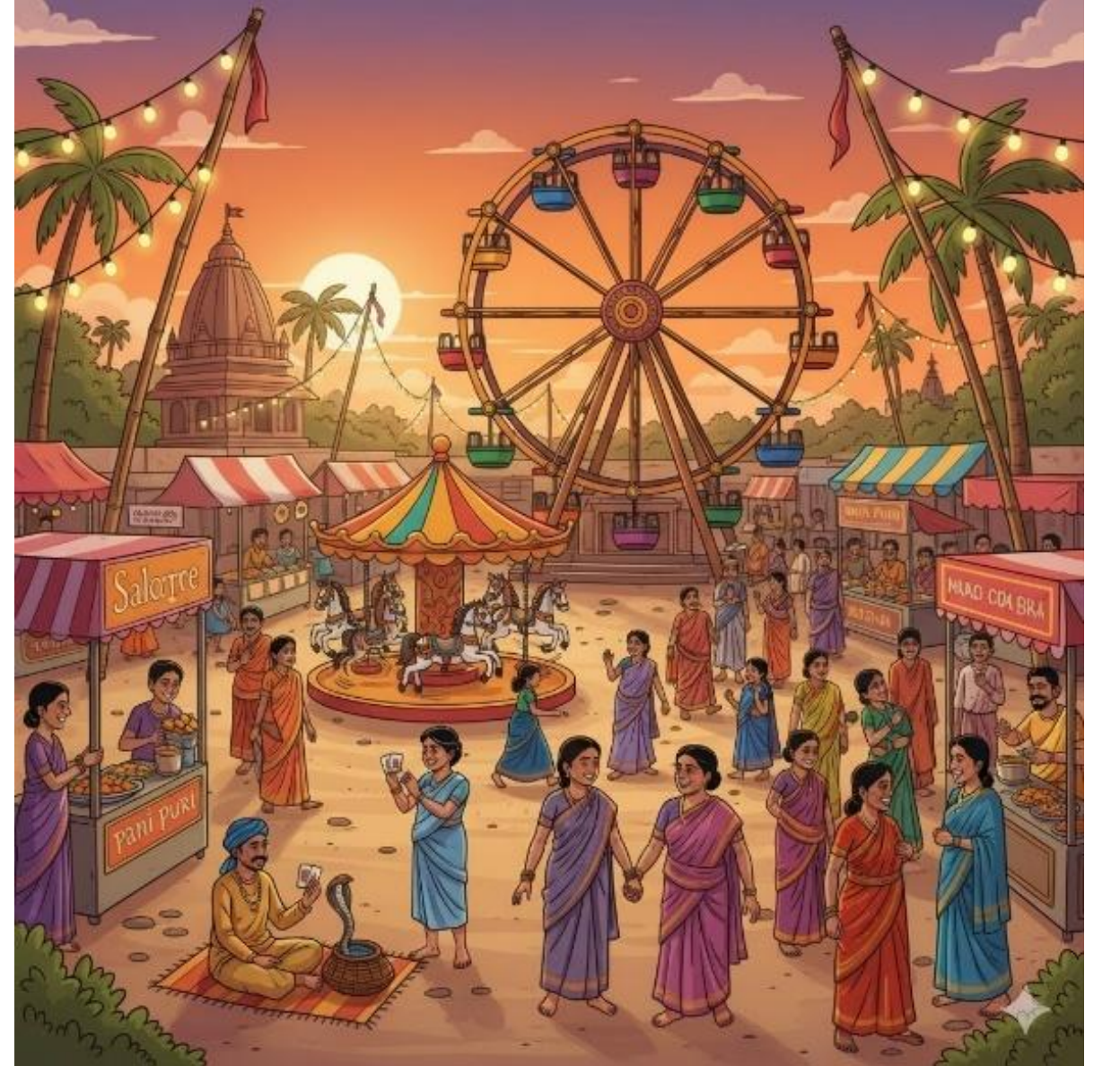
4) /dʒæ:ket/

ಜಾಕೆಟ್



5) /ɖʒa:tre/

ಜಾತ್ರೆ



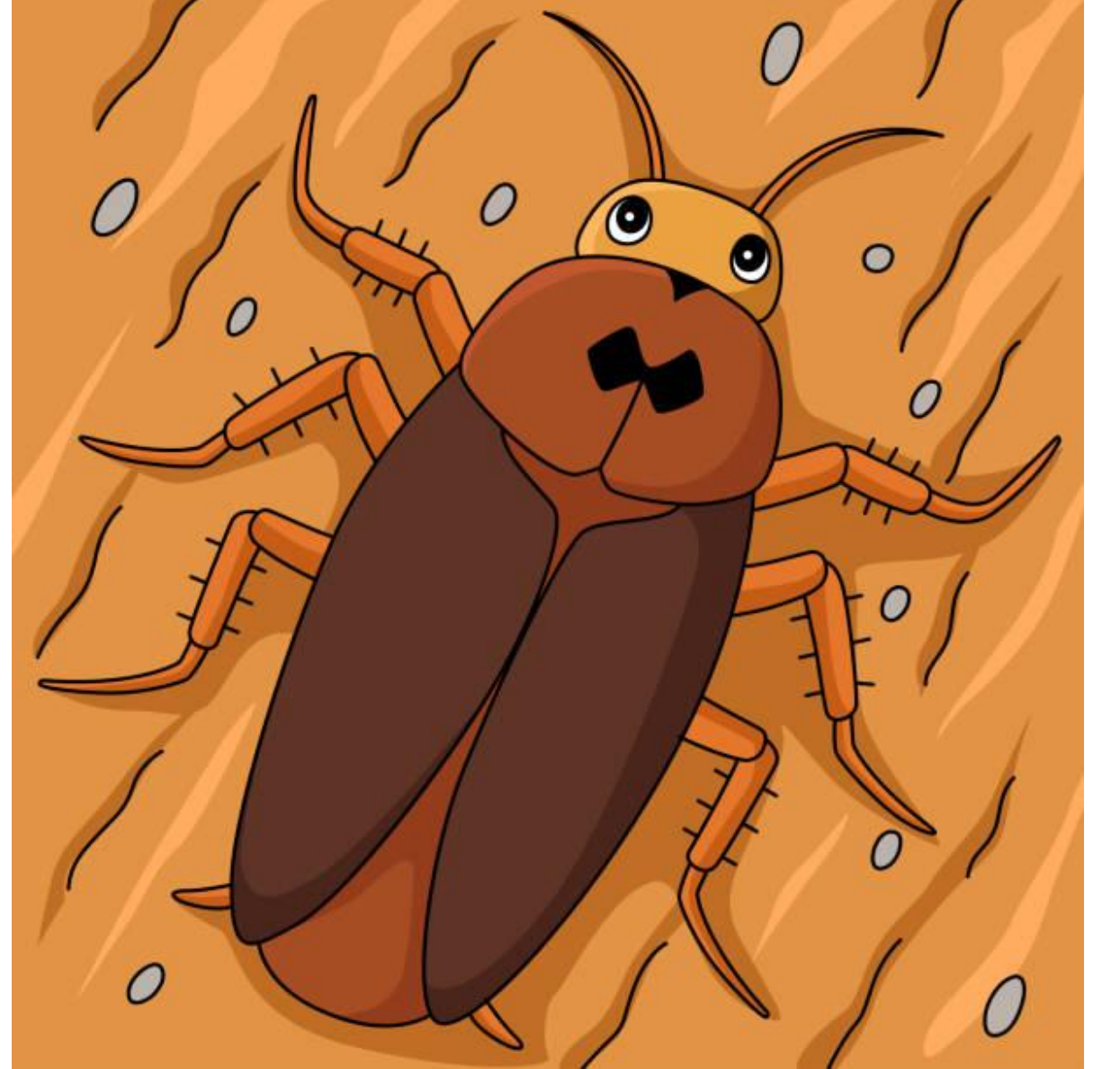
6) /ɖʒa:ru/

ಜಾರು



7) /dʒirale/

ಜಿರಳೆ



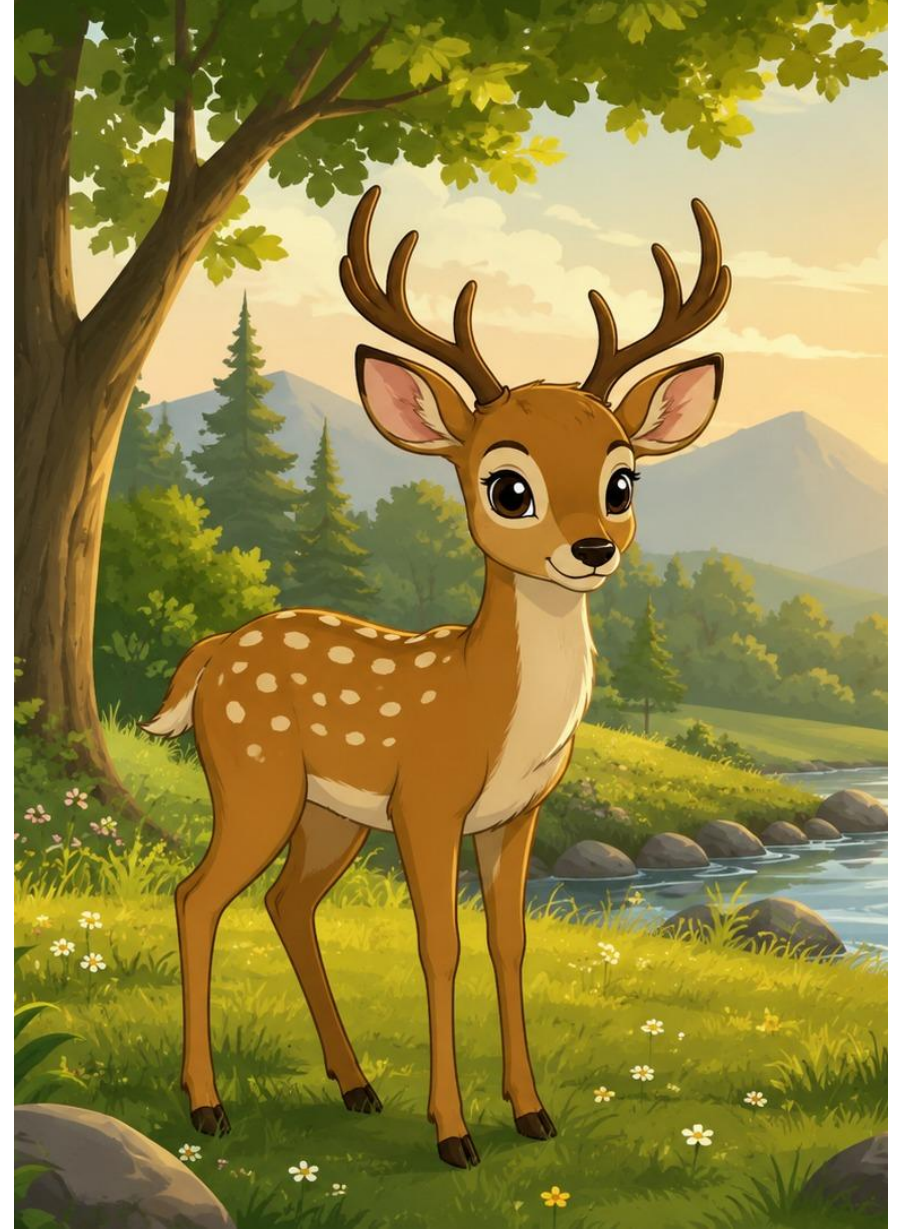
8) /dʒi:rige/

ಜೀರಿಗೆ



9) /dʒinke/

ઝિંકે



10) /dʒira:fe/

ಜಿರಾಫೆ



11) /dʒi:pu/

ಜೀಪು



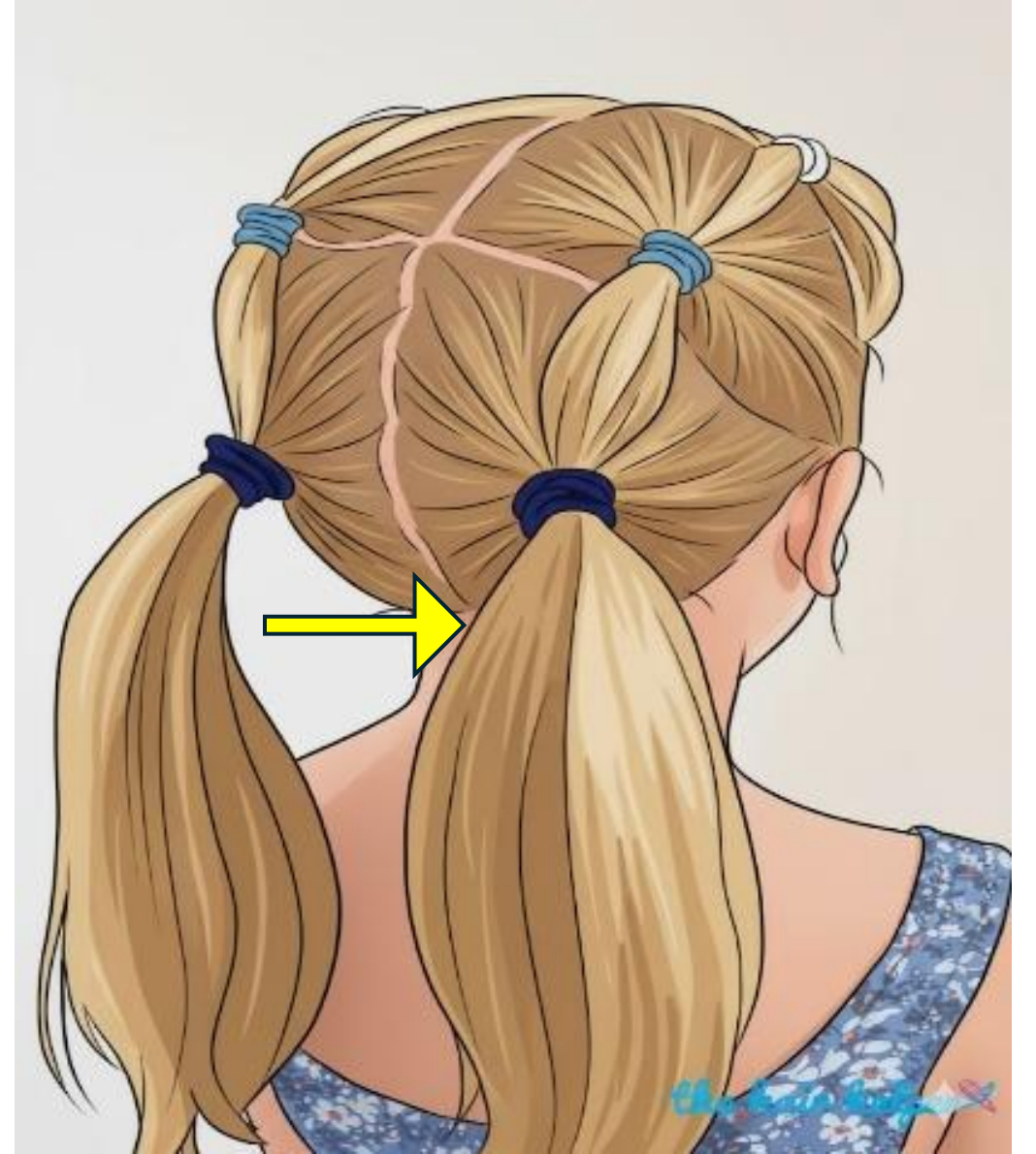
12) /dʒubba/

ಜುಬ್ಬಾ



13) /ɖʊttʊ/

ಜುಟ್ಟು



14) /dʒu:su/

ಜ್ಯೂಸು



15) /dʒu:ʔa:ʔa/

ಜೂಟಾಟ



16) /ɖʒelli/

ಜೆಲಿ



17) /dʒet/

ಜೆಟ್



18) /ɖʒe:ɖa/

ಜೇಡ



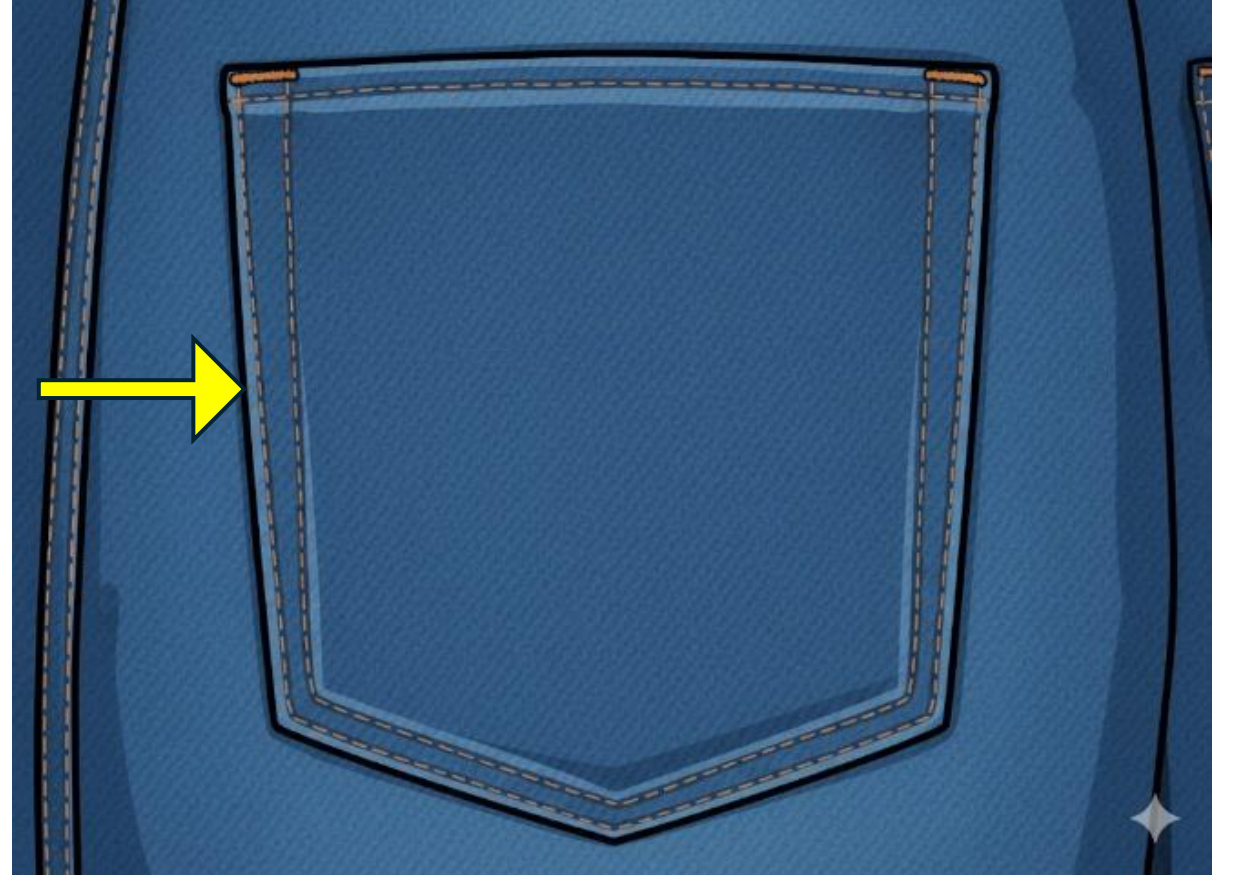
19) /dʒe:nu/

ಜೇನು



20) /dʒe:bu/

ಜೇಬು



21) /dʒo:la/

ಜೋಳ



22) /ɖʒo:kar/

ಜೋಕರ್



23) /ɖʒo:ka:li/

ಜೋಕಾಲಿ



24) /ɖɔllu/

ಜೊಲ್ಲು

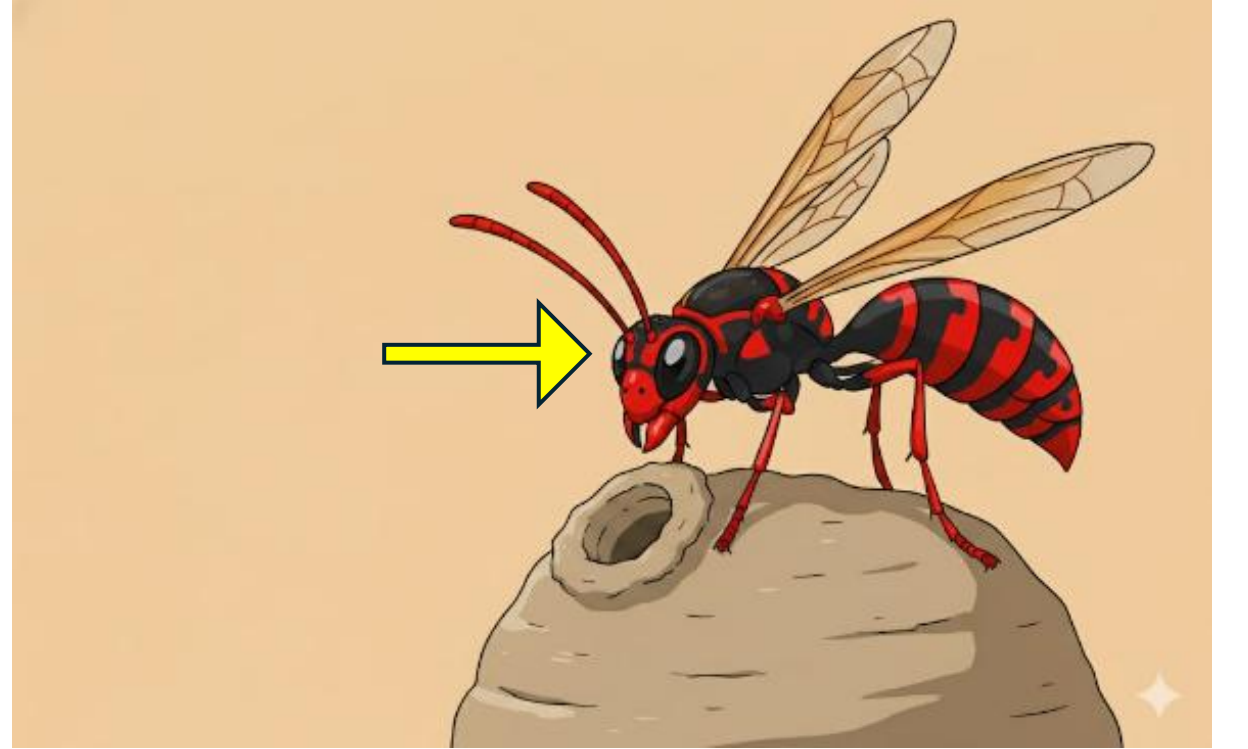


Target Sound /dʒ/

Medial position

25) /kaḍaḍa/

ಕೆಡೆಜೆ



26) /ra:ɖʒa/

ରାଜ



27) /adʒdʒa/

ಅಜ್ಜ



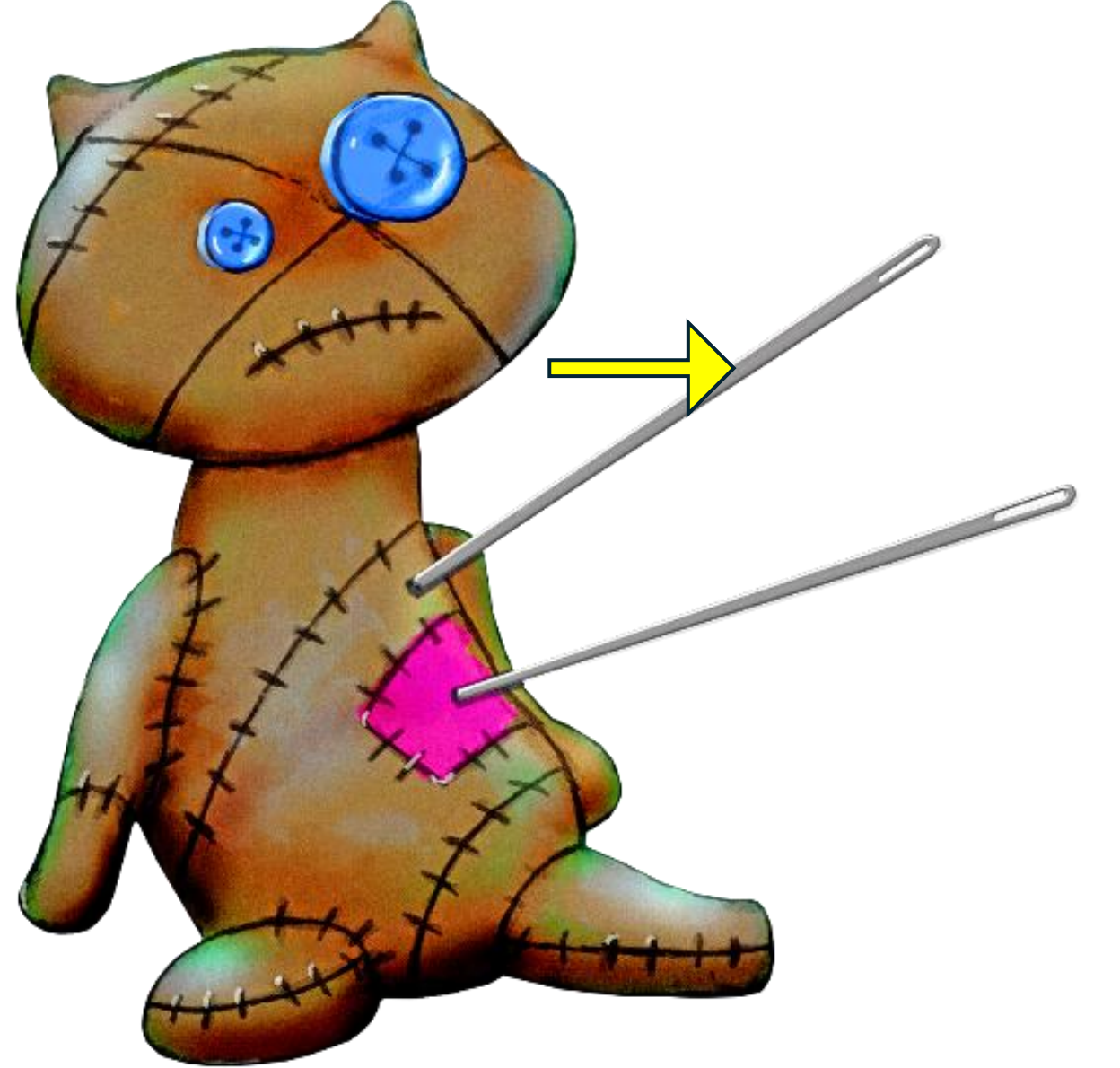
28) /kadɽɽa:ja/

ಕೆಜ್ಜಾಯ



29) /su:ɖʒi/

ಸೂಜಿ



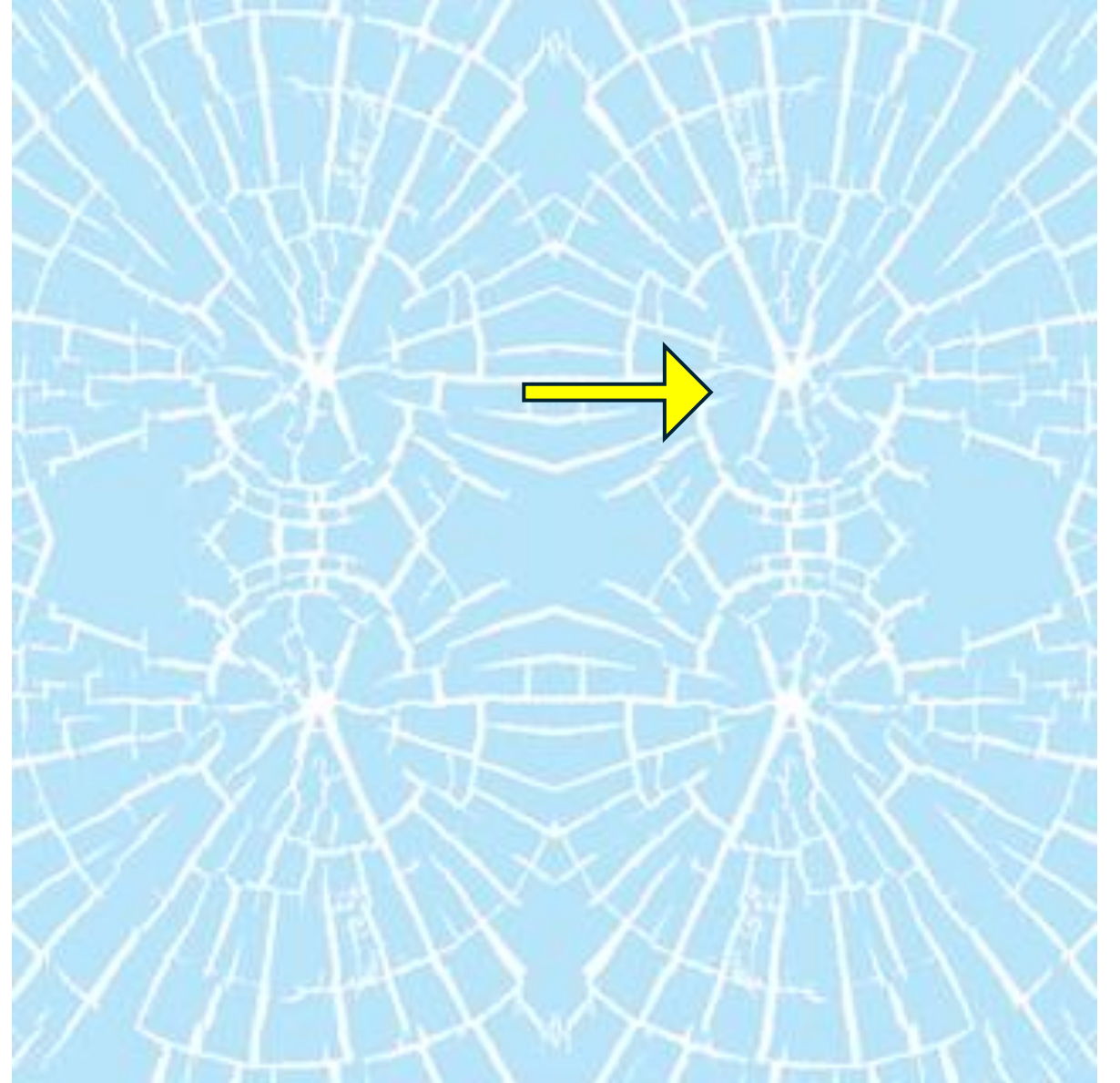
30) /gandzi/

ಗಂಜಿ



31) /ga:ɖʒu/

ಗಾಜು



32) /ka:ɖʁu/

ಕಾಜು



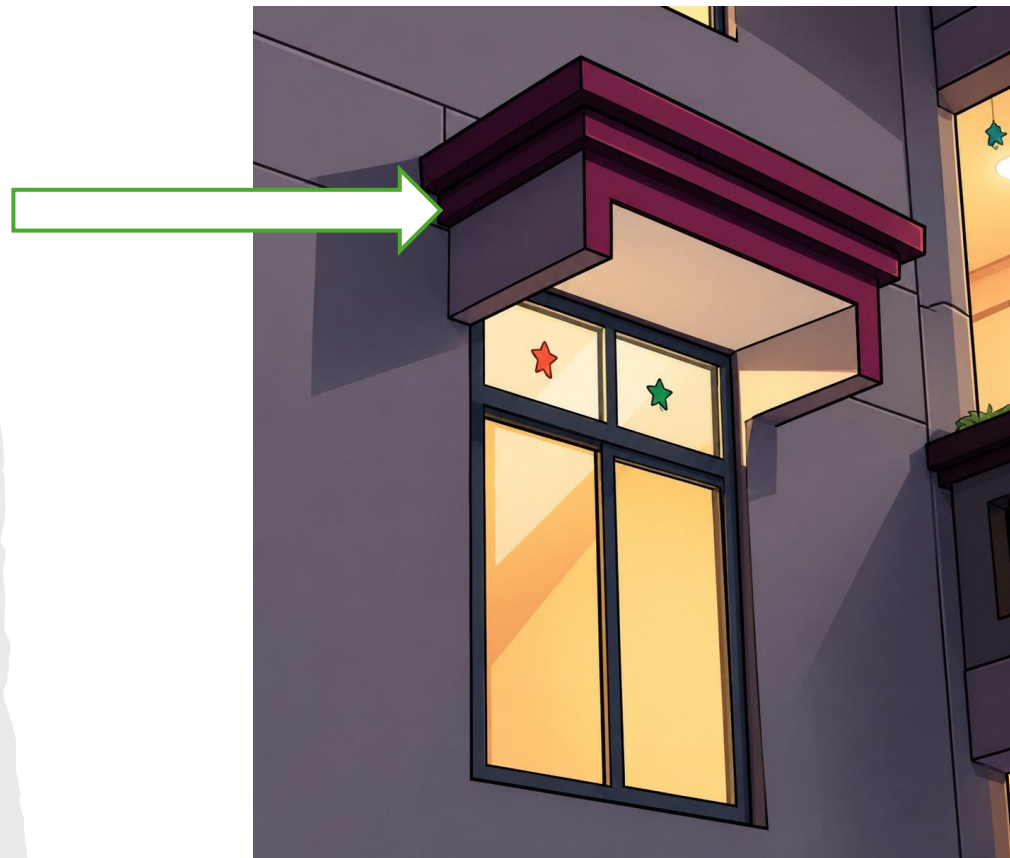
33) /godɔɔɔu/

ಗೊಜ್ಜು



34) /sadʒdʒe/

ಸಜ್ಜೆ



35) /gedɔɖɔe/

ಗಜ್ಜೆ



36) /hedʒdʒe/

ಹೆಜ್ಜೆ



Target Sound /s/

Initial position

1) /sara/

ಸರ



2) /samo:sa/

ಸಮೋಸಾ



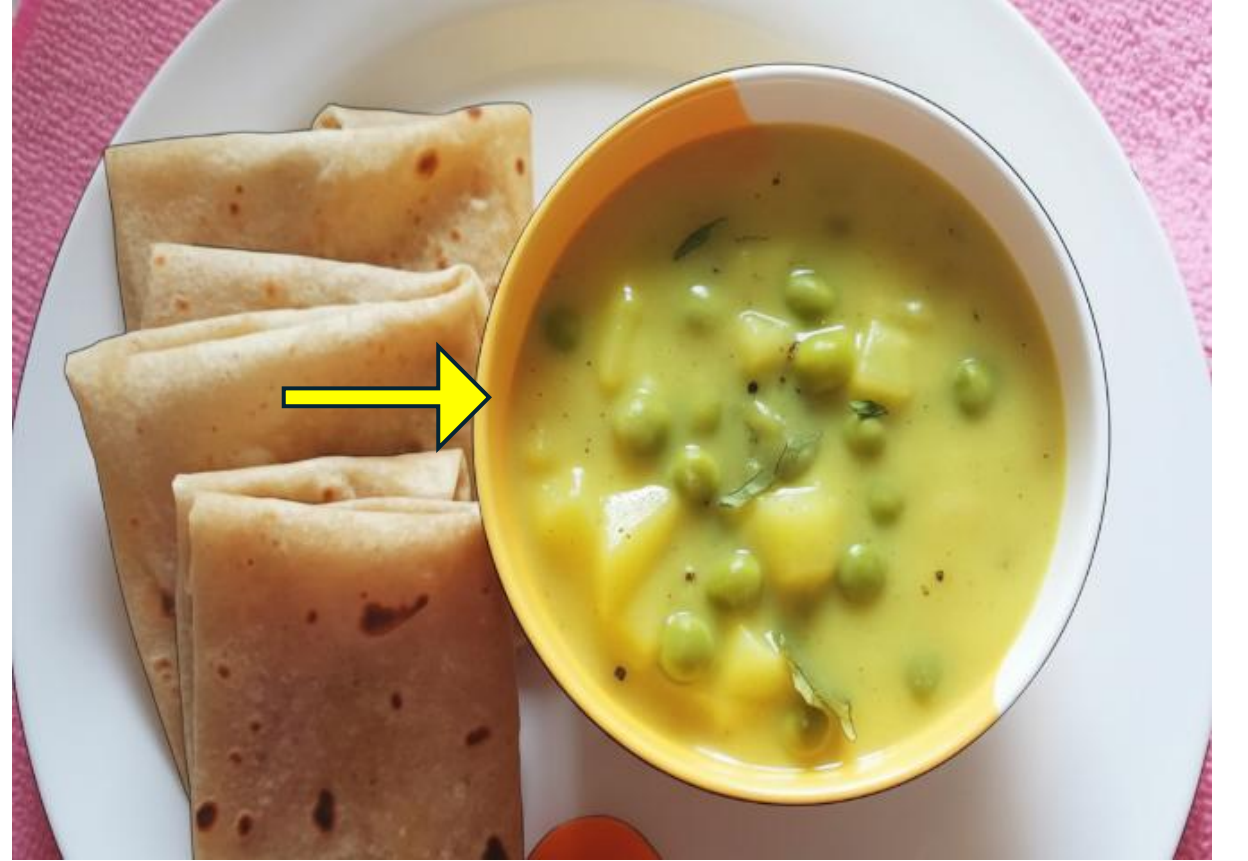
3) /saganɪ/

ಸಗಣಿ



4) /sa:gu/

ಸಾಗು



5) /sa:sive/

ಸಾಸಿವೆ



6) /sa:ru/

ಸಾರು



7) /simha/

ಸಿಂಹ



8) /sippe/

ಸಿಪ್ಪೆ



9) /sittu/

ಸಿಟ್ಟು



10) /si:re/

ಸೀರೆ



11) /si:nu/

ಸೀನು



12) /sunɥa/

ಸುಣ್ಣ



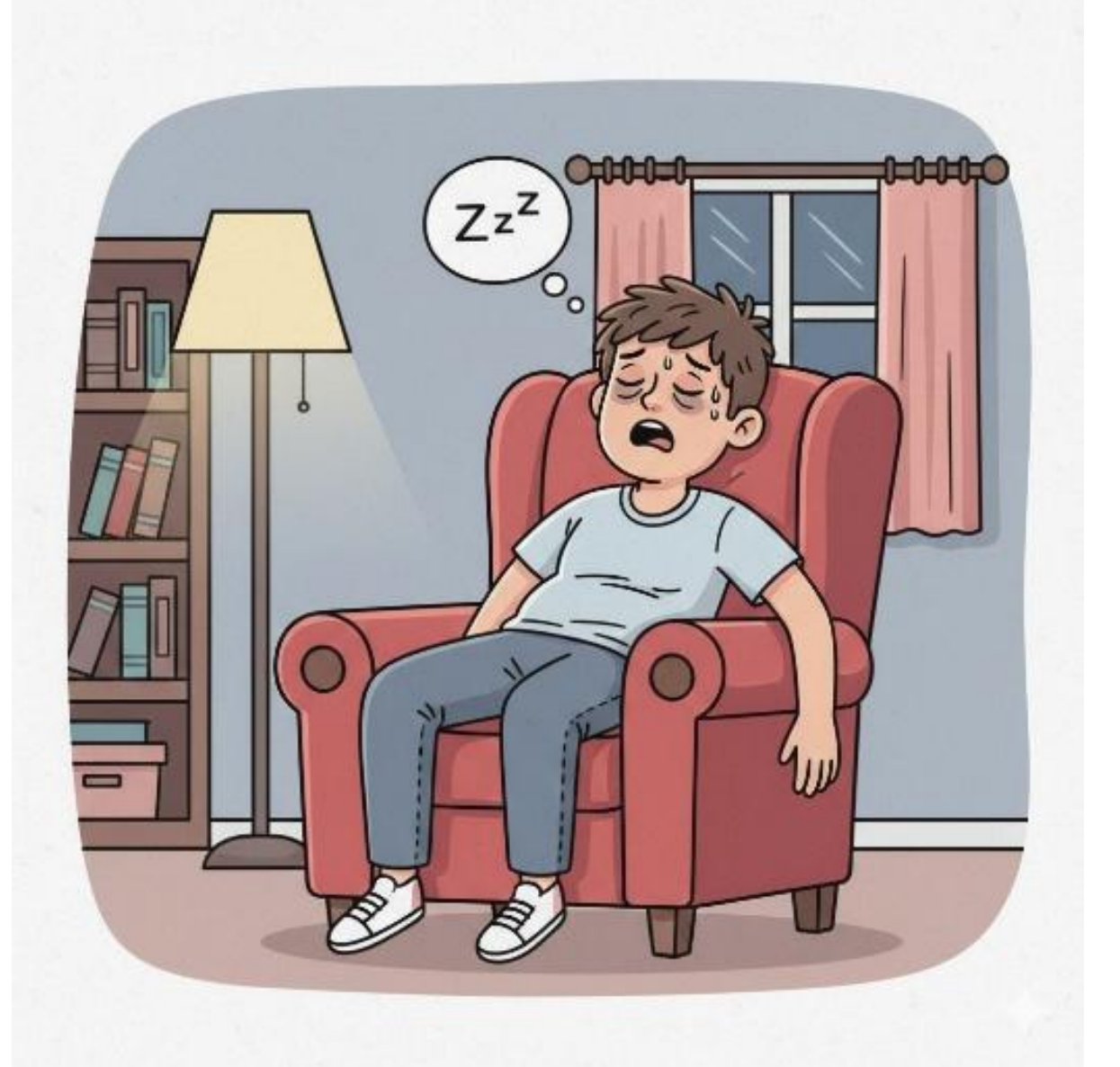
13) /suttu/

ಸುತ್ತು



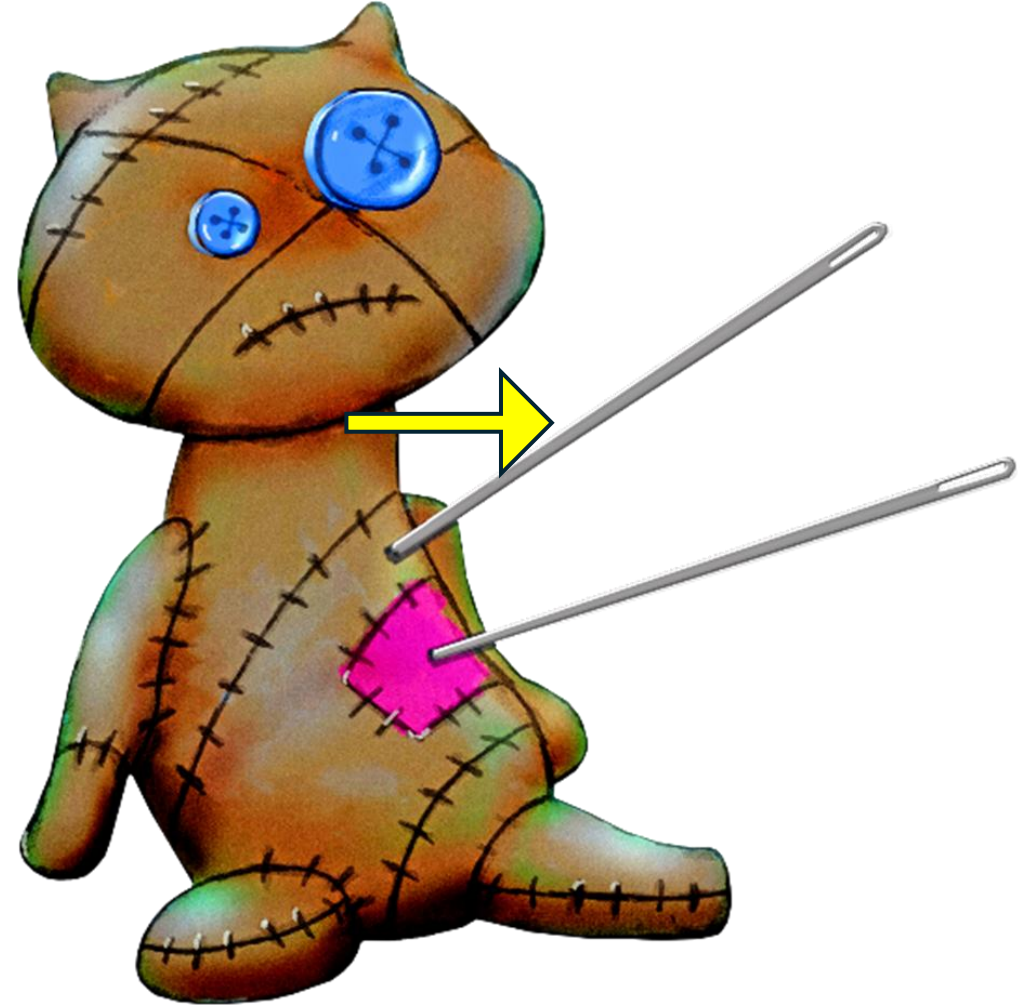
14) /sustu/

ಸುಸ್ತು



15) /su:ɖʒi/

ಸೂಜಿ



16) /su:rja/

ಸೂರ್ಯ



17) /su:par/

ಸೂಪರ್



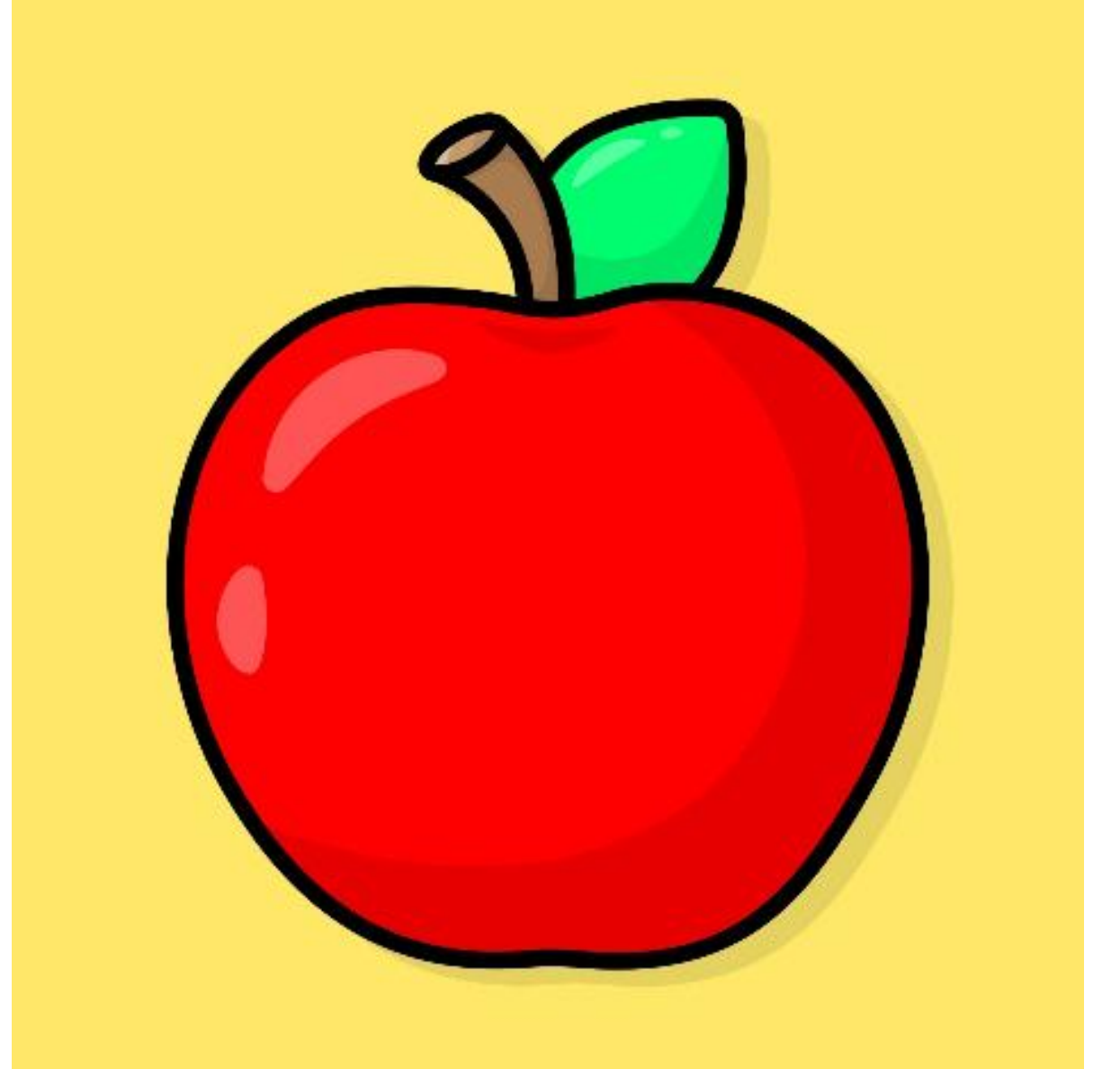
18) /seragu/

ಸೆರಗು



19) /se:bu/

ಸೇಬು



20) /se:ru/

ಸೇರು



21) /se:tuve/

ಸೇತುವೆ



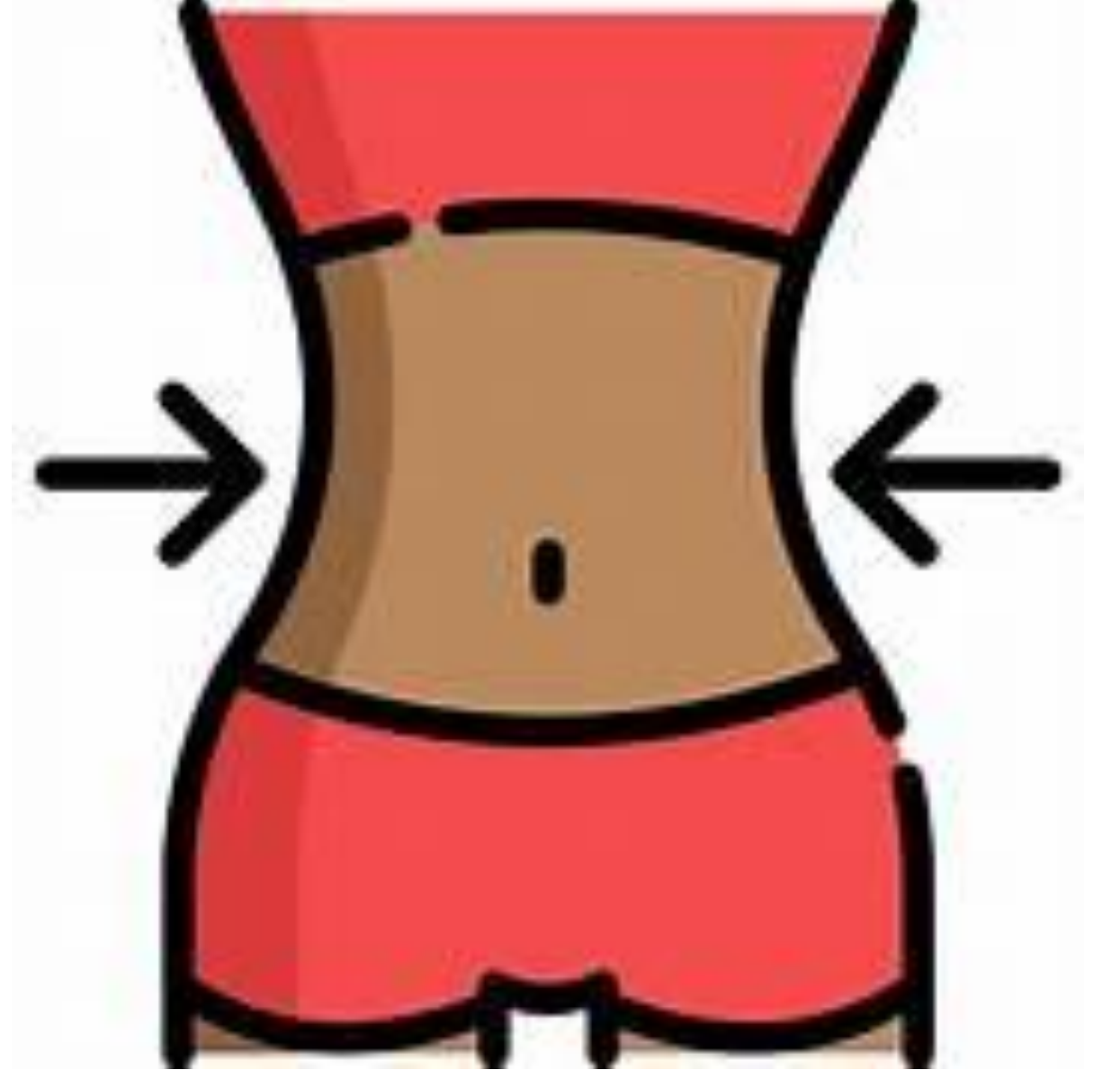
22) /soppu/

ಸೊಪ್ಪು



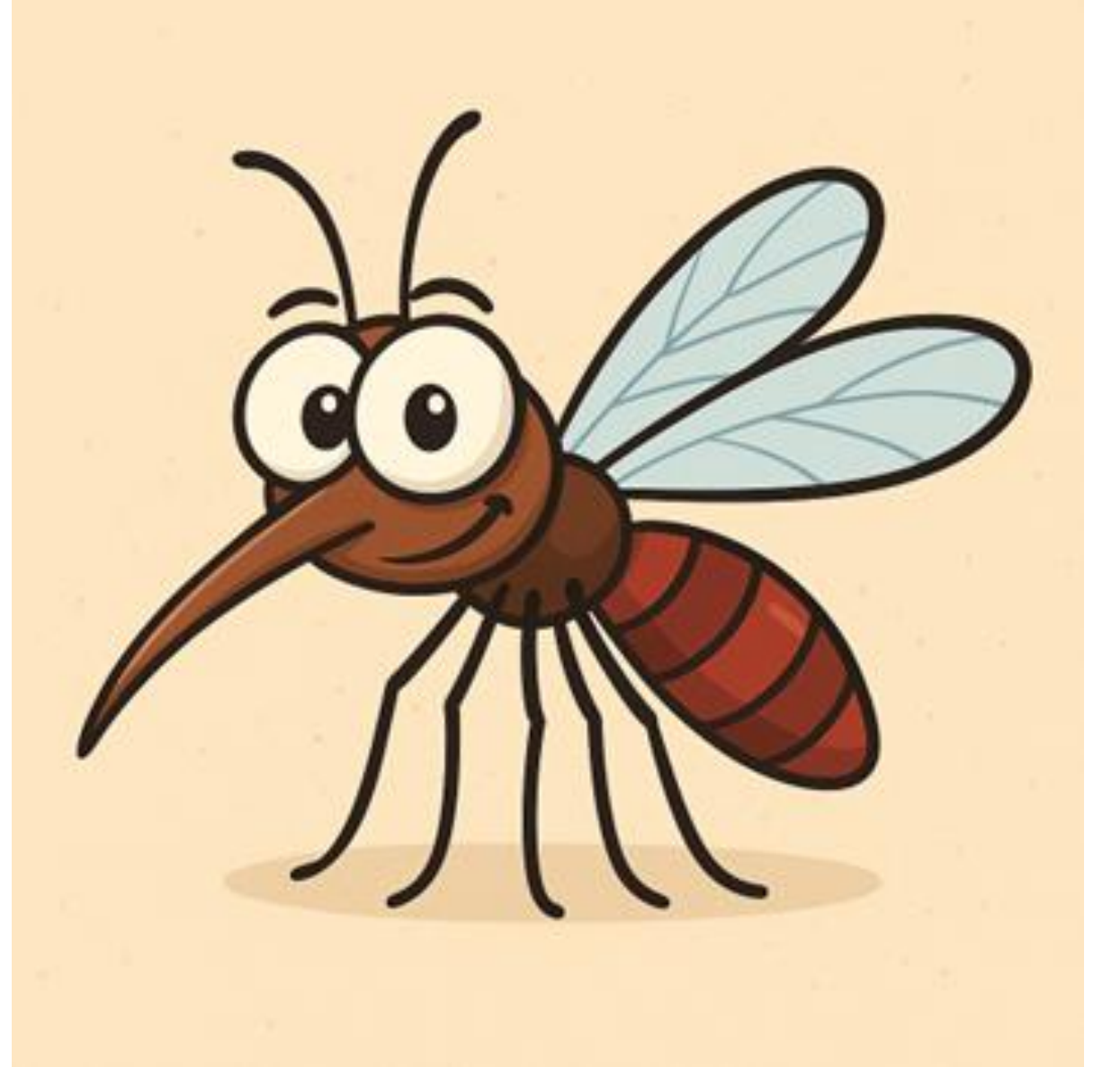
23) /sonʈa/

ಸೊಂಟ



24) /solle/

ಸೊಳ್ಳೆ



25) /so:da/

ಸೋಡಾ



26) /so:pu/

ಸೋಪು



Target Sound /s/

Medial position

27) /kasa/

કાસ



28) /mosa[e/

ಮೂಸಳೆ



29) /kesaru/

ಕೆಸರು



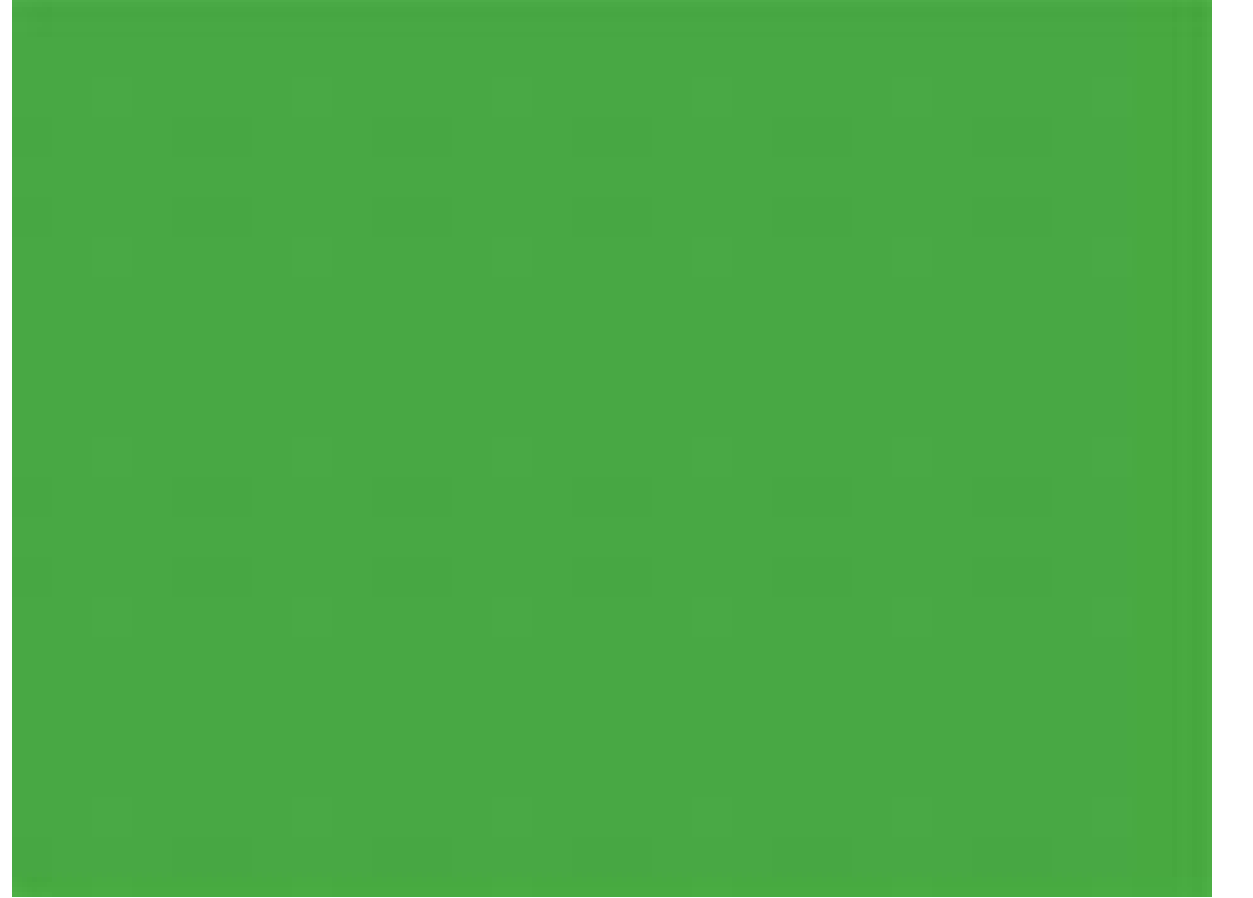
30) /masa:le/

ಮಸಾಲೆ



31) /hasiru/

ಹಸಿರು



32) /masi/

ಮಸಿ



33) /sasi/

ಸಸಿ



34) /masi:di/

ಮಸೀದಿ



35) /rasi:ti/

ರಸೀತಿ

PAYMENT ADVICE

😊 MONEYMATTER CORP.

EMPLOYEE NAME: JOHN SMITH	FOR EMPLOYEE RECORDS 
MONTH/YEAR: OCT/2023	
EARNINGS \$2500	
TAX DEDUCTION: \$300	
NET PAY \$2200	
AUTHORIZED SIGNATURE: 	

36) /hasu/

ಹಸು



37) /halasu/

ಹಲಸು



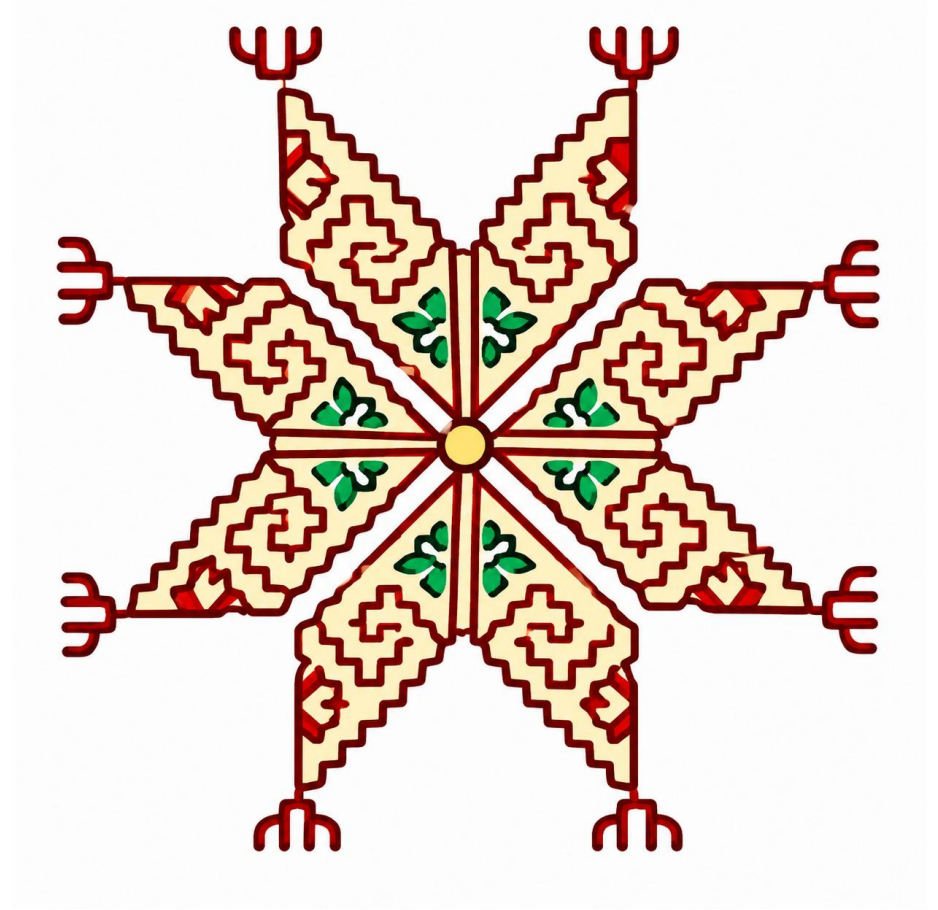
38) /bassu/

ಬಸ್ಸು



39) /kasu:ti/

ಕಸೂತಿ



Target Sound /ʃ/

Initial position

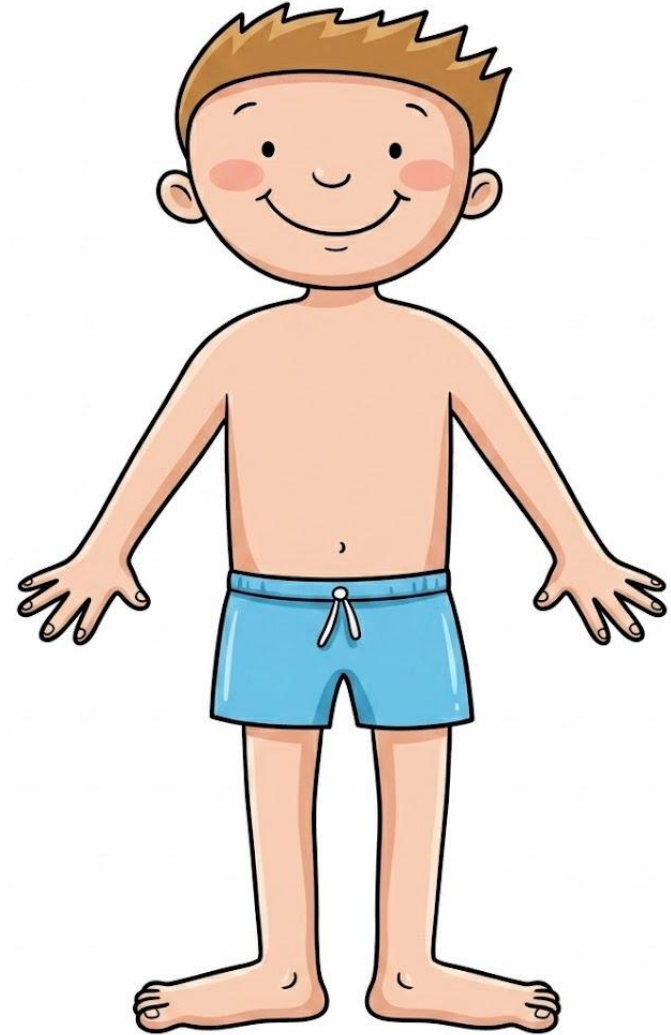
1) /ʃankʰa/

ಶಂಖ



2) /ʃari:ra/

શરીર



3) /ʃartu/

ಶರ್ಟು



4) /ʃa:mpu/

ಶಾಂಪು



5) /ʃa:lu/

ಶಾಲ



6) /ʃa:le/

ಶಾಲೆ



7) /jiva/

ಶಿವ



8) /ʃɪkʃe/

စိန်



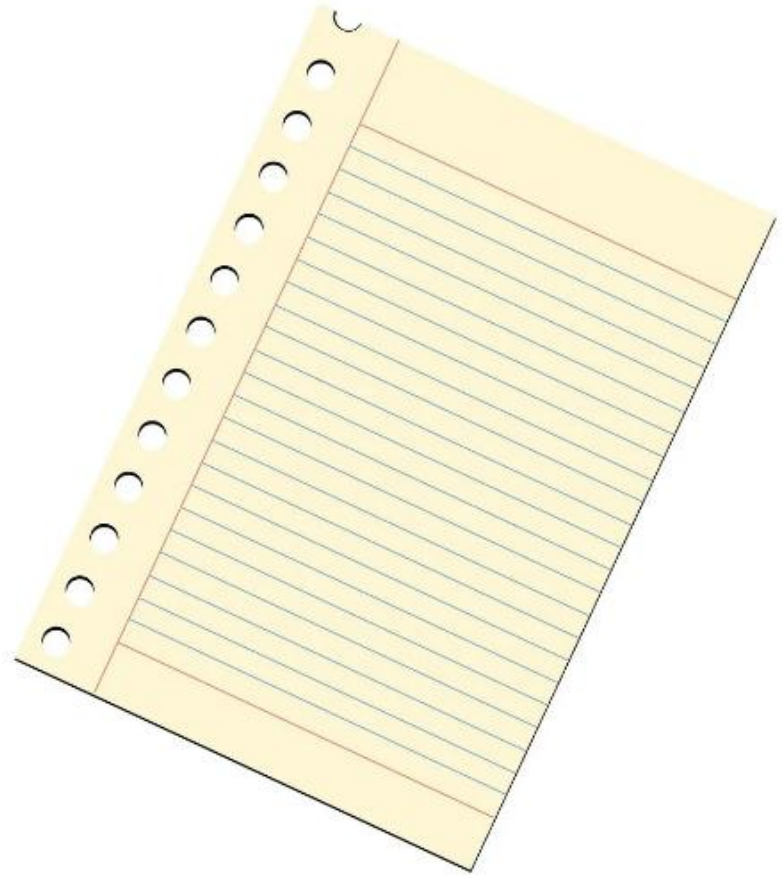
9) /ji:ta /

ಶೀತ



10) /ʃi:tu /

ಶೀಟು



11) /ಫು:ಡ್ತು/

ಶೂಜು



12) /ʃu:ʈingu/

ಶೂಟಿಂಗು



Target Sound /ʃ/

Medial position

13) /puruʃa/

ಪುರುಷ



14) /kafaja/

ಕೆಫಾಯ



15) /k^huʃi/

ಖುಷಿ



16) /ruʃi/

ಋಷಿ



17) /pakʃi/

ಪಕ್ಷಿ



Target Sound /r/

Initial position

1) /rakta/

रक्त



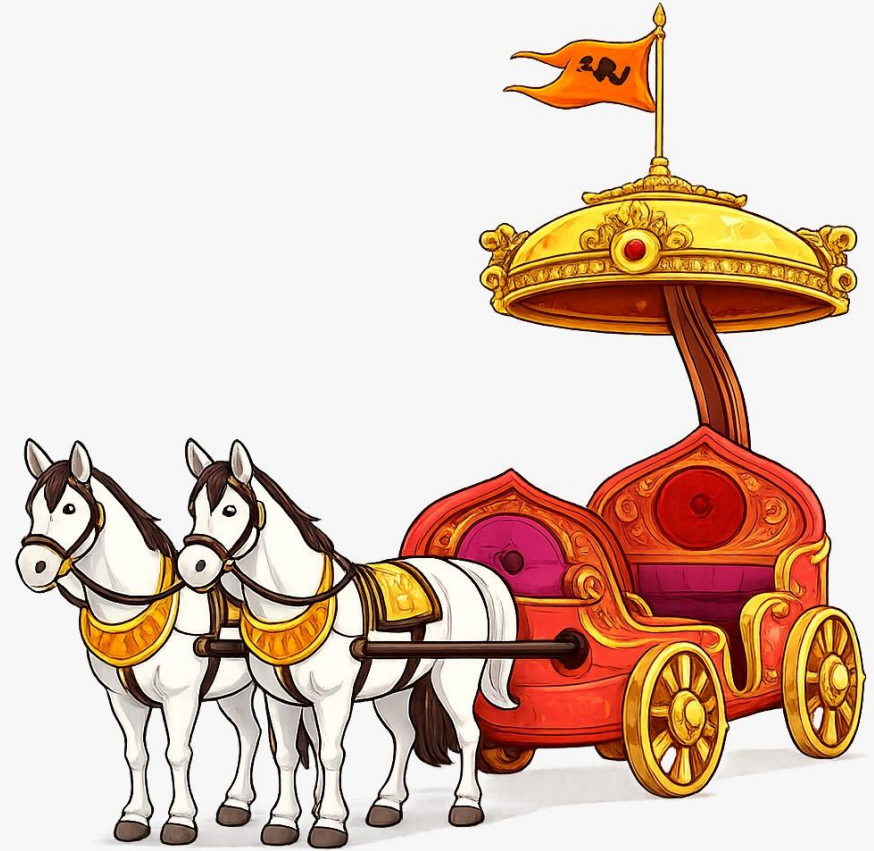
2) /rattu/

ರಟ್ಟು



3) /rat^ha/

રઠ



4) /ra:ɳi/

રાણી



5) /ra:ɖʒa/

રાજ



6) /ra:k^hi/

ਰਾਖੀ



7) /ripo:rtu/

ರಿಪೋರ್ಟು



8) /rikʃa/

રિક્ષા



9) /ribban/

ರಿಬ್ಬನ್



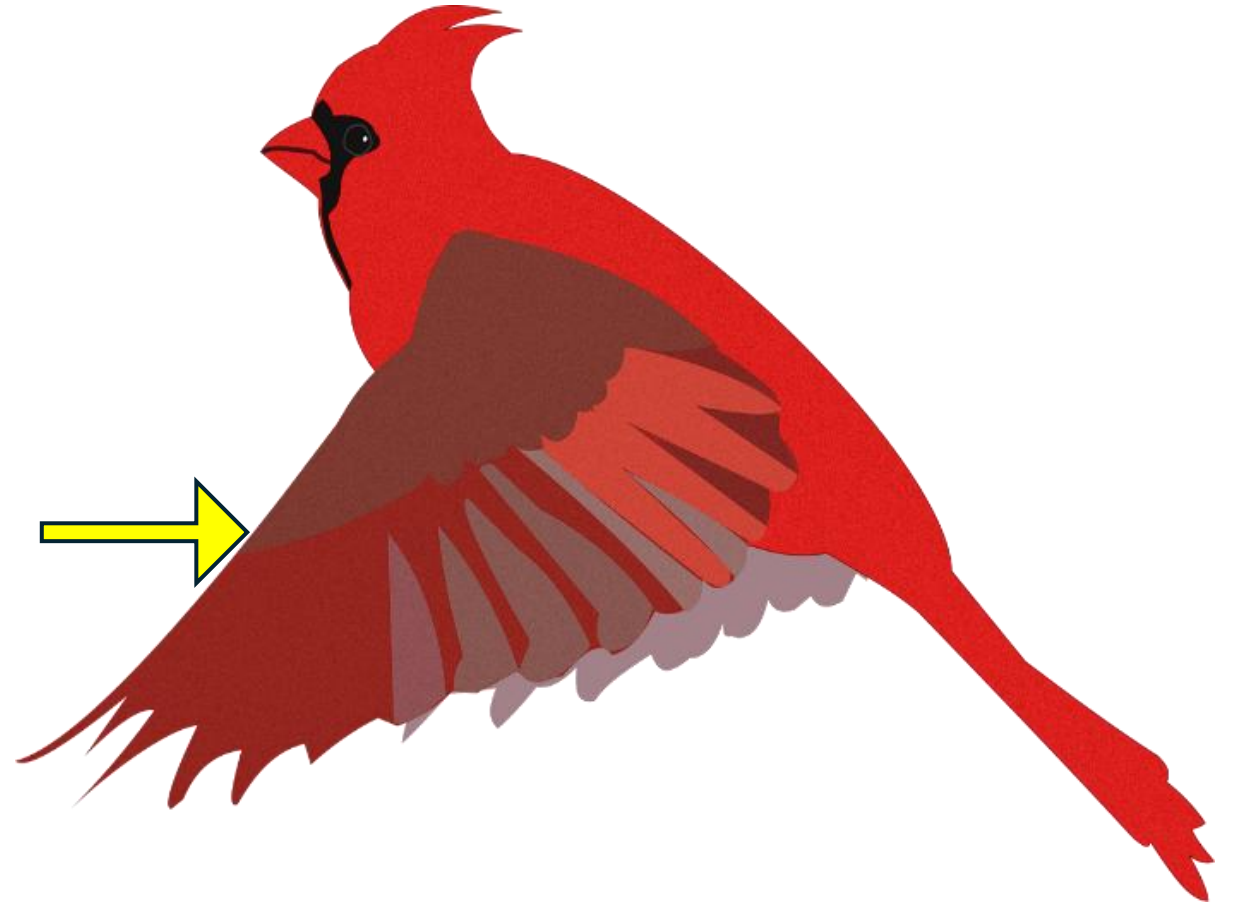
10) /rupa:ji/

ರೂಪಾಯಿ



11) /rekke/

ರೇಕೆ



12) /rembe/

ਰੰਬੇ



13) /re:diʒo/

ರೇಡಿಯೋ



14) /re:ʃme/

ರೇಷ್ಮೆ



15) /re:su/

ರೇಸು



16) /rotti/

ರೊಟ್ಟಿ



17) /ro:du/

ರೋಡು



18) /mara/

ಮರ



19) /karaɖi/

ಕರಡಿ



20) /ha:ra/

ಹಾರ



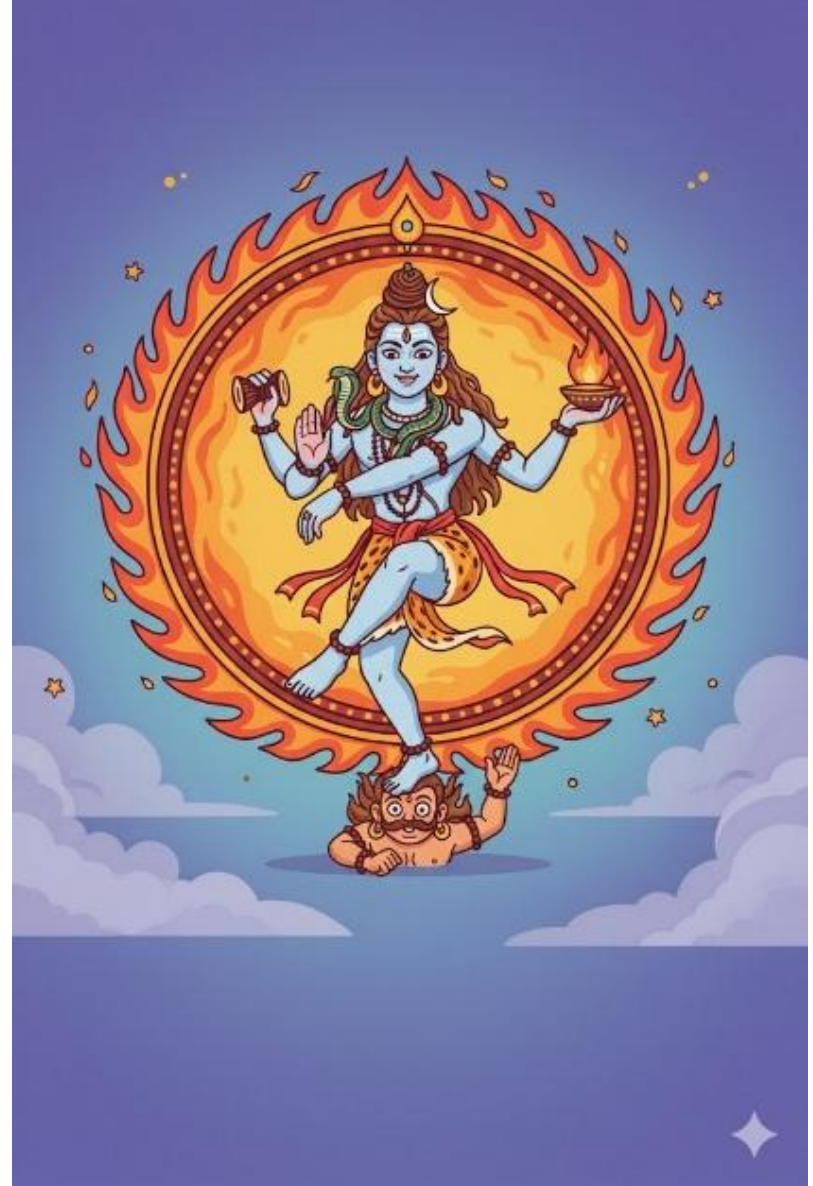
21) /kara:te/

ಕರಾಟೆ



22) /naṭara:ḍa/

ನಟರಾಜ



23) /aira:vata/

ಐರಾವತ



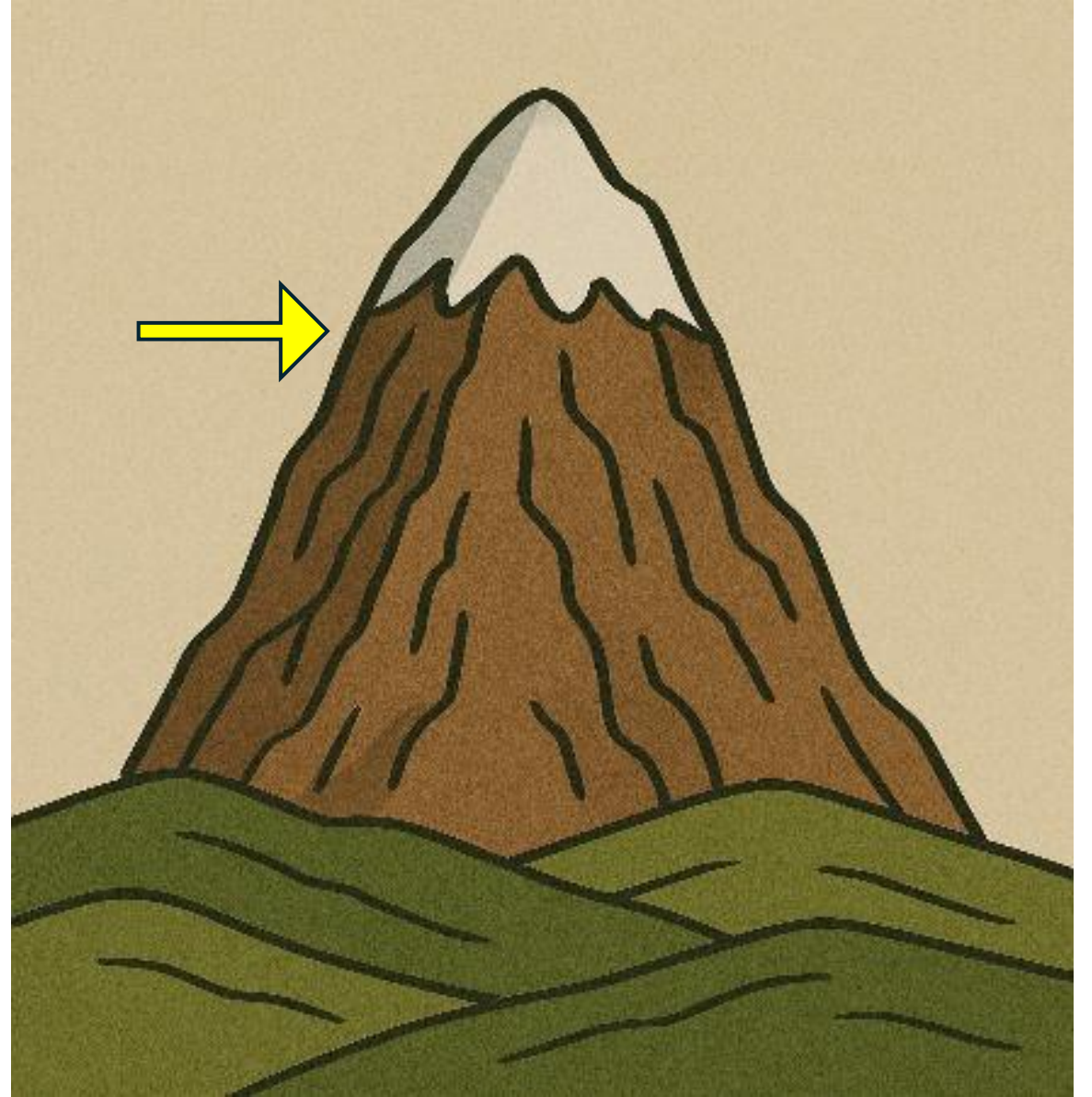
24) /kuri/

ಕುರಿ



25) /giri/

గిరి



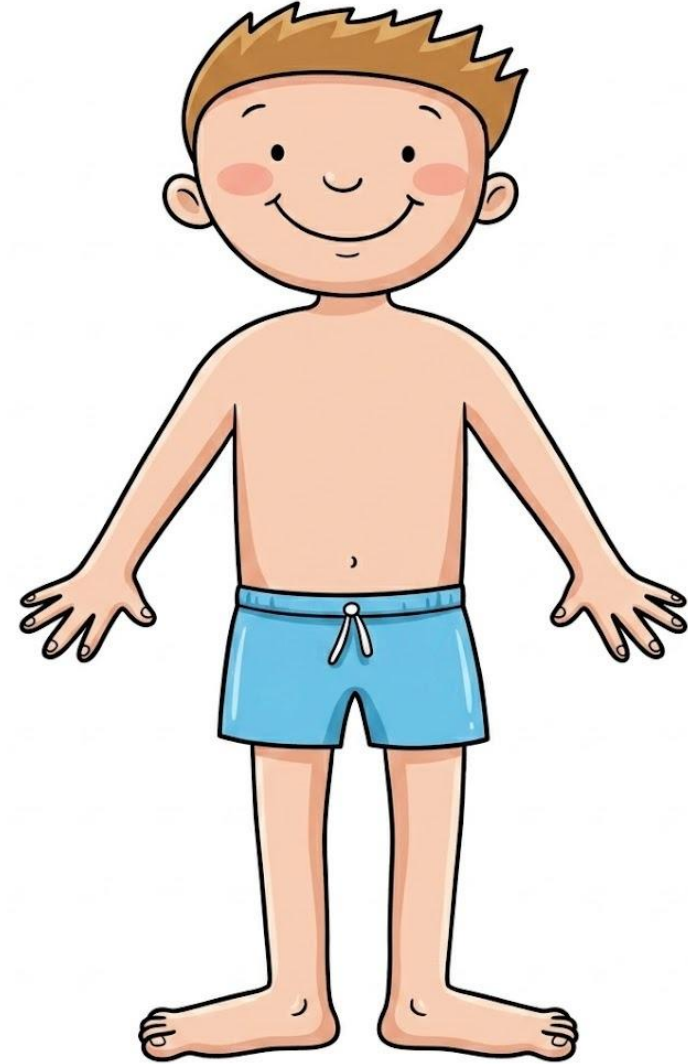
26) /hari/

ಹರಿ



27) /ʃari:ra/

શરીર



28) /kiri:ʈa/

ခိဝေဒ



29) /ṭagaru/

ಟಗರು



30) /kesaru/

ಕೆಸರು



31) /iruve/

ಇರುವೆ



32) /gere/

ဂံဝဲ



33) /si:re/

ಸೀರೆ



34) /ga:re/

ಗಾರೆ



35) /saro:vara/

ಸರೋವರ



36) /paro:ʈa/

ಪರೋಟ

