Cognitive Linguistic Study of Perception Verbs in Telugu

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by

P. Phani Krishna
15 CC HL 06

Centre for Neural and Cognitive Sciences

School of Medical Sciences

University of Hyderabad

(P.O.) Central University, Gachibowli,

Hyderabad – 500046, Telangana, India.

DECLARATION

I **P. Phani Krishna** Reg No: **15CCHL06** hereby declare that this thesis entitled "**Cognitive Linguistic Study of Perception Verbs in Telugu**" submitted by me under the guidance and supervision of **Prof. Ramesh Kumar Mishra**, Head, Center for Neural and Cognitive Sciences and **Dr. S. Arulmozi**, Associate Professor, Center for Applied Linguistics and Translation studies is a bonafide research work. I also declare that it has not been submitted previously in part or in full to this University or any other University or Institution for the award of any degree or diploma. I hereby agree that my thesis can be deposited in Shodhganga/INFLIBNET.

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Signature of the Student:

Phanikrishna

P. Phani Krishna

15CCHL06

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Date: 28/12/2020

Prof. Ramesh Kumar Mishra
(Supervisor)
Ramesh Kumar Mishra
Professor and Head
Centre for Neural & Cognitive Sciences
University of Hyderabad
Hyderabad-500 046. INDIA

Dr. S. Arulmozi 28/12/2020
(Co- Supervisor)
Associate Professor
CALTS, School of Humanities
University of Hyderabad
Hyderabad-500 046.

//Countersigned//

Prof. Ramesh Kumar Mishra
Head, Center for Neural and Cognitive Sciences.
Ramesh Kumar Mishra
Professor and Head
Centre for Neural & Cognitive Sciences
University of Hyderabad
Hyderabad-500 046. INDIA

28/12/2020
Prof. P. Prakash Babu
Dean, School Medical sciences
संकाय अध्यक्ष
Dean
चिकित्सा विज्ञान संकाय
School of Medical Sciences

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Chapter-1

Introduction

1.0 Overview

Our brain holds zillions of sensations through our eyes, ears, nose, mouth and skin which results in a never-ending sensation. Receiving such vast data by sense organs in microseconds by interpreting, retrieving, filtering, classifying, and analyzing, the received information can be seen as a process of cognition and perception. Homosapiens, the intelligent and powerful species than other life forms on this planet, understand and interpret their surroundings better. The ability to modify and change is what makes humans differ from other species. The vital sensory organs such as eyes, ears, nose, skin and mouth help to sense the environment by perceiving and interpreting the perceptual world.

We live in a world of perception. Perception is to become aware of something with the help of our basic senses such as seeing, hearing, smelling, tasting, and touching. The human sensory system is a real-time natural system where any stimuli is captured first directly by sensory receptors. However, it is not just gaining information from the senses but also to take it to the next step i.e. to understand the sensory input and interpret the surroundings. Every activity performed, every emotion felt, every piece of knowledge gained are mediated through the senses. Hence, sensory organs play a vital role in establishing an interactive interface between an individual and the external world. The sensory input which is interpreted in the mind is to be communicated with the outside world, which is where language comes into picture. A language possesses little value if it cannot be used to express sensory perceptions. Therefore, sensory perception and language share a symbiotic relation. This sensory system of humans is well distributed such that it is directly

connected to the external environment by sensory receptors to learn and function most of our cognitive abilities of the brain.

Language is important for humans to express feelings or experiences what they perceive through these senses. However, all languages may not offer adequate words to express experiences. This limitation of linguistic expressivity is known as 'ineffability' (Levinson and Majid, 2014), which has attracted the attention of linguists and later cognitive scientists who are engaged in serious research to find out 'Can the humans tell about mental objects formed in their minds by using language'? (Blake, Sobel & James, 2004). As humans often experience an amalgamation of sensory inputs, there is a pattern to the perception. For example, the sensory organ eye perceives colour along with other features like shape, size, and motion simultaneously. These features are inter-related which is due to the experience of perceiving these features through the same organ simultaneously. Motion can also be perceived through sound, but it is not associated with sight. The sense of sight can interfere with other senses, but vision is interpreted by a dedicated system called visual cortices in the brain. So, the words "sense" or "sensory modality" are going to refer to those perceptions that are perceived through a sense organ and interpreted in dedicated neural cortices in the brain.

It is a longstanding practice to study the connection between language and senses. Researchers have also investigated the number of words existing for a sensory modality (Viberg,1983). Others like Ullmann (1945) and Williams, (1976) also have discussed the nature of how frequently a specific sensory perception is utilized, how they are interrelated to each other, their polysemous nature and use of metaphors who refer to the characteristics of the world which has the basis of sensory vocabulary. However, it is important to integrate all the above aspects along with other subjects to have a holistic understanding of sensory modalities. The

interdisciplinary area of sensory linguistics studies how language is related to sense modalities. It deals with basic questions such as:

1. How the sensory perceptions are translated into words?

2. Which sensory perceptions are most common and frequently occurring?

3. How different languages are encoded with respect to perceptions?

This present work of Telugu perception verbs deals with similar understanding in terms of its descriptive, theoretical and methodological contributions. The descriptive understanding deals with the vocabulary of languages used to describe sensory perceptions. Major studies worth mentioning include, Kay and Berlin (1969) who investigated the language of colour; Barten (1998), Feld, et.al. (2004), Pérez-Sobrino and Julich (2014) works on sound and music, Popova (2005) who discusses about tactile sensation, Koptjevskaja-Tamm (2015) on temperature, Lascaratou (2007) and Semino (2010) on language concepts of pain, Backhouse (1995), Croijmans, et.al (2016), Majid, et.al. (2014) and (2016) on vocabulary related to taste and smell. Most of these works have focused on studying language senses or perception vocabulary but their focus was either on one or two sense modalities but not all five sense modalities and they all concentrated on euro-centric languages. Similarly, on Indian languages, there is less work carried out taking all the five sense modalities, especially in Dravidian languages.

According to Glenberg (1997), Wilson (2002), Gallese & Lakoff (2005), Gibbs (2005) and Barsalou (2008) there are two types of approaches, viz. embodied approach which sees mind and language as the product influenced and derives the construction from sensory systems and bodily

processes and the second approach which studies metaphors and polysemy that are central themes of language science and cognitive science.

In the study of metaphors and polysemy, there exist synesthetic metaphors (those words which use one sense to describe another sensory perception) which need to be mentioned. For example, “loud colour” or “sweet smell” are considered synesthetic metaphors that do not fit into existing theoretical frameworks as discussed above. The theoretical contributions which mainly focus on metaphors and polysemy not only relate to language science but also to cognitive science. After all, the intersection of language with perception is of primary interest to language sciences and cognitive science to understand the working mechanism.

1.2 Sensory Linguistics and Perception Verbs

Subsequently, there were studies on sensory linguistics using quantitative and few empirical methods. For details, see Connell & Lynott (2012), Speed & Majid (2018), Floyd, et.al. (2018); San roque et al.(2015). These studies discussed the methodological contributions which refer to the “how” in understanding of sensory linguistics and in what way these sensory modalities are exemplified by integrating data based on corpus. An integration of corpus data and human ratings incorporating statistical analysis can harness an incredible amount of theoretical information. These approaches have a strong quantitative basis applicable to sensory linguistics along with other fields such as linguistics and cognitive science. Within the above framework, they also put forward some empirical data designed for assigning cognitive processes that are based on the sensory perception verbs which give a deeper understanding.

It is recognized that most human behaviors are triggered by external stimuli in terms of event and time which are driven by interrupt mechanisms. Therefore, human sensory receptors

and derived sensations play a key role in explaining human behaviors and cognitive processes. Recent advances in cognitive informatics, neuroinformatics, and computational intelligence provide rational explanations for the human sensory system as smart interfaces between the brain and the external environment.

According to Wang et.al. (2006), there are five primary senses and seven perceptual senses that embody self-consciousness inside the brain. The five primary senses such as vision, hearing, smell, taste, and touch adopt physical or chemical receptors in order to transform real-world stimuli into uniformed electrical neurosignals in specialized neural pathways. According to Wang et.al. (2009), the perceptual senses such as spatiality, time, motion, equilibrium, posture, attention, and consciousness are recognized in most human behaviors and are triggered by external stimuli in terms of event, time and interrupt-driven mechanisms.

As discussed in Sarobji (1971) there are five senses i.e. sight, hear, touch, smell, and taste which are known as "Aristotelian senses". Though most of the research on language accepts the five-sense model, it is not universally accepted. Though the Aristotelian five sense model is not absolute, it allows us to draw generalizations from complex abstractions without looking into the meticulous distinctions that cannot be expressed through language. Apart from typology of senses, there are different versions related to hierarchy of the senses. The five-sense Aristotlelian model is highly debatable on the aspects of the possibility of having fewer or more senses. As Classen (1993) discusses, the question that extends to think if these five senses are separate enough or interdependent to be considered as one which is based on the classification of senses that depend on cultural practices.

If a native speaker is asked to mention what he considers a sense is, it would be different from the list of senses given by a native speaker of another language. There are some perceptions which do not fall under any of the five sense modalities, while there are others which seem to be a combination of two or more senses. For example, the perception of pain seems to be a touch phenomenon but the receptors in the brain which interpret pain are different from that of touch. Studies such as Craig (2003) and Tracey in (2005) consider pain to be a different sense by itself. This is one of the many examples of perceptions that do not fit into the five-sense model. Therefore, there is a necessity to classify the senses based on rigid grounds to work on a common platform. The strong connection between different senses pose further constraints on classification of senses (Spence, 2011). The cross-modal relation between smell and taste is a perfect example to illustrate the challenges posed in classifying the senses (Auvray & Spence, 2008; Spence, Smith & Auvray, 2015). Taste and smell interact on a behavioral and neural level. So, one faces a challenge in drawing a line of demarcation between the senses. The senses of humans always try to derive meaning from the perceptual content and they employ different semiotic tools to communicate.

The debate around the number of senses is just not alone in linguistics but also in cognitive sciences. Along with the debate there is a basic problem regarding its definition on what exactly a sense is. Most of the classifications are based on a set of rules to be adhered to by the members of that set to fall into that category. There is not a single ground which is accepted universally to distinguish between the senses (Macpherson, 2011; Cacciari, 2008).

What is the basic criterion to classify the senses? To answer this, should one classify senses based on the body organs used for perception? Should one Consider it based on the different neural receptors responsible for interpretation of different perceptions? The criterion based on the kind

of energy of the perception i.e. light energy (sight), mechanical energy (touch and hearing) and molecular energy (taste and smell) or Could it be based on many more questions of this kind. In addition to this, there could be many questions within a certain definition in itself. For instance, if one chooses body organs to be the criterion, what is a body organ? If eyes, nose, and ear are body organs and therefore considered as sense organs, what about the organs which are spread throughout like skin or hair? If we follow receptors to be a point for classification, there are neural centers in our brain which interpret more than one perception and some perceptions are decoded by more than one type of receptors. So, how do we draw a line to associate one receptor type to a certain sense? So, the grounds for differentiating the sensory modalities are highly debatable.

Keeping all the challenges in view, an obvious question is: what is an alternative model to the five-sense model? Since there is no one criterion to which all the researchers would agree to, there is no universally accepted set of sensory modalities. The reason for the situation is based on the culture one belongs to and the kind of approaches carried out by earlier researchers. But, if every researcher considers all the sense modalities for their work, it would be tedious to compare the data and analyze the date for further research. Hence, it is important to stick to the most common model in existence at present. As Macpherson (2011) points out, the five-sense model enables us to draw more generalized results in the study of language. Further he mentions that it could be customized later depending on the study one indulges in the five-sense model. Subsequently he discusses that the word sense refers to a major sensory organ which has a dedicated neural receptor system: eyes for the vision, ears for the hearing, skin for the touch, nose for the smell and tongue for the taste. Each of the respective neural subsystems indulge in interpretation of two or more perceptions. Yet one identifies primarily the visual cortex for vision, olfactory cortex primarily for smell and so on.

Another interesting set of senses which need special mention is the taste and smell duo which are strongly interconnected. Perception of a food flavour is often attributed to taste buds, tongue, and mouth, but the flavour we perceive when we eat is a combination of the sense of taste and sense of smell as discussed by Auvray & Spence, (2008) and Spence et al., (2015). The differences between these two senses can help us to learn more about their correlation and distinction. Further in the following section, it would be discussed about the combination of these two senses.

Some researchers have done a finer classification of senses for linguistic criterion. Ullmann, (1945), Whitney, (1952); Ullmann, (1959), Williams, (1976); Ronga, et.al 2012) are to mention a few. Different criteria followed by different researches pose difficulty to analyse across the studies. To avoid any further polarity, in the present work, we consider taking a neutral position to follow the five-sense model. The five-sense model might seem to pose limitations to the research. But it is a perfect compromise between oversimplification and generalization and extreme conditioning of study of perception verbs.

These five senses are also interrelated with the motor area of the human brain which is also linked with the sensory organs. It is evident from various experiments that sensorimotor processes play a key role in making meaning and understanding the language. They include perceptual stimulations such as action verbs like drive, jump and kick which are represented in the brain. When the subjects were asked to read or listen to those verbs they gave positive response to stimulations. The technique of neuroimaging (such as fMRI) aided the researchers to confirm that there is a relationship between language and perception. There are specific areas in the brain which correspond to specific areas of the body. Hauk et al. (2004) noticed fluctuations in blood flow of subjects when they were asked to read action verbs. They concluded that the blood flow is

increased in the brain area that corresponds to the leg when they read the verb 'kick'. Lacey et al. (2012) also found that there is increased blood flow in brains of the subjects when they read metaphors about texture. The words related to pain also showed the same results. In another experiment conducted by Citron and Goldberg (2014) they noticed that taste words and metaphors involving taste can also increase blood flow in humans. The research pertaining to vision further confirmed that perceptual simulation is possible with the language. Stanfield and Zwaan (2001) proved in their study that subjects formed visual representations and spatial orientations in their minds while reading sentences. The experiment conducted by Mannaert et. al. (2017) revealed that subjects formed visual representations of colour when they read descriptions about the traffic lights. Many other studies also found that mental simulation of visual shape, size, speed of motion and distance evoke perceptual experiences in humans. Winter and Bergen (2012) demonstrated that the response of subjects is very quicker to a loud sound than a quiet sound. The researchers demonstrated that all the five senses can invoke mental simulations and sensorimotor processes through language. Hence, it can be concluded that meaning is embodied as language mirrors to perceptual representations and stimulates sensorimotor processes in humans. The language only accommodates the words that can be perceived and the sensorial systems draw limits for the words whether to be encoded or not.

1.3 Semiotics, Metaphors and Perception

As we had discussed in the foregoing section about the sense and sense modalities, it is worth mentioning to discuss semiotics which also have a relation with language and perception. Semiotics is the study of signs and symbols and understanding its use in communication. It investigates how a meaning for a sign, symbol or word is created and how it is used in communication in the society. According to Saussure (1916 & 1959), a word is a combination of

concept (Signified) and sound-image (Signifier), the two being act as a link in making meaning in the mind. Few examples of semiotics are the traffic signs, emojis, brand logos, etc.

To begin with, the study of "how" meaning is deduced through perceptual inputs and semiotic strategies used to communicate sensory perceptions, it is very important to understand the semiotic channels. There are several semiotic channels/modes used by people to interact to achieve their communication goals (Wilce, 2009). Traditionally Peircean (1977) semiotics has three categories: icon, index, and arbitrary symbols. All categories have a special correlation between the signal which could be a sign, a word or a gesture and their intended sense. These relations involve perceptual similarity (icons), direct association (indices), convention (symbols) (as quoted in Clark, 1990).

People often use composite signals while conversing in the form of iconic gestures and paralinguistic features of body movements to portray the meaning of perceptual content. Icons always will have the direct relation between the object and what it refers to. The speech rhythm of a speaker varies with the context that is known as iconic prosody. This occurs when the speaker modulates a word iconically to depict a selective perceptual content. The lexicon of any language does not include such modulated words though they produce specific sensory meanings. Iconicity involves encoding a signal to get meaning through using a resemblance. It also emphasizes that there may not be any direct relation between the object and what it signifies. Indices is a sign that makes the meaning complete in a causal, spatial and temporal domain. For example, smoke points out the fire, dark clouds indicate rain and a skull is an index of danger. The final category in Peircean semiotics is the symbols which are arbitrary in nature and they work in contrast to icons and indices. There is no perceptual resemblance or direct connection, symbols make meaning through arbitrariness (Saussure, 1959). Clark (1996) reconceptualises Peirce's three-dimensional

categorisation of semiotics into “depicting” or “demonstrating”, “identifying” and “describing-as” which are analogous to icons, indices, and arbitrary symbols, respectively. In the subsequent discussion, Clark (ibid) also emphasizes that these three forms are not mutually exclusive but are often interconnected in “composite signals” which is an integration of two or more signals to communicate.

Later, several other researchers also followed Clark’s classification. Enfield (2008) elucidated “composite utterances” which fuses gestures (icons or indices) with speech, Kendon (2014) put forward that “semiotic diversity” which emphasizes in what way the utterances constantly consist of amalgamation for the diverse semiotic schemes. We will discuss briefly the above three forms of semiotic channels along with other two means which enable in encoding the perceptual inputs namely: Iconicity, Indexicality, Arbitrariness, Technical language, Metaphor.

In the description of sensory verbs where the researcher has focused on whether there was an interconnection between the sensory verbs or the verbs of perception and icons, indices and symbols. As a part of the test and implementation, Perlman et.al. (2014) explained that they have taken an example of a teenage girl who wins a massive lottery. In her description to her friends, she says “I won a huuuuge lottery” along with moving her hands apart. This expression which carries the various semantic layers communicates the perception of big victory. Her movement of hands is an example of iconicity which gives us the meaning that is perceived even though there are no extra words. The lengthening of the vowel (in the word huge) could be an example related to iconicity which is generally termed as “iconic-prosody” or “vocal-gesture”.

Similar studies have been carried out by Hilnton, et.al. (1994), Fischer (1999) and Dingemanse, et.al. (2015). One of notable points from these studies exemplifies that iconicity is

the commentary that goes over any sport. For example, in cricket commentary, the speech rate of the commentator increases as the ball passes among the fielders to make a run-out, and similarly the pitch of the commentator's speech increases when the ball goes to the boundary. These are some of the examples of perception that is related to the amplitude of the words used. The "iconic prosody" does not belong to the standard diction of a language. It is an alteration to the existing words to communicate certain perceptions. However, some perceptual information can be a part of the lexicon through phonological identity or sound symbolism put forward by the naturalistic school of thought. For instance, the words "boom" and "pop" represent the sensory meaning through phonological iconicity. Such words belong to the formation "onomatopoeia" which means describing sounds with the help of onomatopoeic sounds. As rightly pointed out by Winter et.al. (2017), some onomatopoeic words are added to the vocabulary like neigh, bleat, hoot, and cuckoo. For example: the bird called "Killdeer" makes a sound "kill-dee, kill-dee, kill-dee" and the "Common poorwill" which sings "poorwill, poorwill, poorwill" (ibid). Winter et.al (2017) further questioned which words are most iconic in a language and found that the words related to sight are least iconic, whereas words pertaining to auditory and tactile sensation are much iconic followed by gustatory and olfactory words. He concluded that portrayal of sensory perception depends on the availability of sensory content which in turn rely on modality of expression. In the earlier studies, Vickers (1984) and Dacremont (1995) mentioned that the difference between the words assigned comes from the difference in frequencies of the words themselves when they are uttered.

Apart from onomatopoeia, other sets of words are also available in languages which are termed "ideophones". These ideophones evoke a sense of sound using various sensory perceptions: sound, motion, colour, smell, texture (E.g. zigzag, hurry bury in English and galagala, caracara,

barabara in Telugu). Similarly in Hindi, a major Indo-Aryan language, "hich hichana" means being hesitant. Iconicity also poses two constraints to the expression of sensory inputs. Firstly, it is the fact that it is "subjective" which means the relation between signal and the intended meaning is never singular. Secondly, it varies from language to language. Iconicity is based on the sounds and its patterns available in the languages (Styles & Gawne, 2017). Iconicity is more directly connected to sensory perceptions as compared to other semiotic modes. After a lot of research, it is found that iconicity is more effective with certain perceptual sensations associated with speech sounds (Lockwood & Dingemanse, 2015; Winter et al. 2017). Ideophones are seen to be efficiently encoding sound, the movements, vision and then followed by other sensory perceptions but as a final point it talks about cognitive states (Dingemanse, 2012). Winter et al., (2017) investigated 3000 English words related to perception and found that vision words are least in terms of iconic and words of touch and sound are more iconic followed by smell and taste. In 2018, Perlman and others considered spoken English and Spanish languages along with American and British sign languages to understand which words are more iconic in what kind of language. It was found in the both language systems, words related to tactile words are seen to be more iconic. While words associated with sound are more iconic in spoken languages, words associated with olfaction, vision and gustation received anti-correlation between the perception and iconicity. Hence, iconicity as a semiotic channel is relatively efficient for some sensory information than others. But some perceptual content like colour are challenging to iconically depict in any sensory modality.

Indexicality of sensory verbs, a common example for indexing, is the act of pointing a finger towards an object or person to indicate something (Clark, 2003; Kendon, 2004). For example, there are 2 boxes with sweet cookies and salty cookies in them, respectively. A point can be used to indicate the flavour by pointing a box. The point can be conceived as a flavour only if

the context is relevant, otherwise it is indicating a box which does not relate to any perception as such. Humans are equipped to identify a perceptual aspect based on its source even if the object is not physically present (ibid). Croijmans & Majid (2016) called this as a source-based strategy which is illustrated using phrases such as "it tasted like spinach" or "that fragrant is like petrichor". This seems too different from the pointing method. But they share some commonalities. Firstly, both the ways identify perceptions in an indirect way by referring to an object. Secondly, both the pointing gestures and source-based language are highly dependent on the "common ground" (Clark,1996). The interpretation of the gesture by the hearer could be different from the speaker's intended meaning if they do not have common background knowledge or visual common ground or olfactory common ground. The description like "that smells like Sriracha" could refer to the acidic smell due to vinegar, spicy nature, the peppery smell or the garlic overpowering the perception. Even though Sriracha is a noun, any of the perceptions above can be interpreted by the hearer. This is a limitation of source-based strategy. Another limitation is the fact that both the speaker and hearer should have knowledge about the source, which is Sriracha here (Levinson & Majid, 2014). Both the parties involved should have tasted it once to relate to the description. The sensory modalities whose words are mostly identified using source-based language are taste, smell and sound (ibid). Often when asked what something smells/sounds like, we associate the answer to something which has odour/a creature or object which produces a sound like the one in question (Huumo, 2010). Source-based language finds its utility among the experts in a field, especially in food/beverage tasting. Since the connoisseurs have a common training ground in the field and expert knowledge, source-based language provides room for precision in judging the taste of coffee, tea, or a wine. If a third party enters the conversation, it is a jargon for the hearer as he does not share common grounds with the other two parties. In languages like English it is not really

required to use simile to describe source-based language. Source terms can be picked to alter the existing adjectives to convey the message. Some of the source-based descriptions made their way to the lexicon of a language like the terms salty, nutty, silky, and caramelized. There are a few source-based words whose source is not known to many, yet widely used. For example, the word crimson is used to describe anything which has a strong red colour attached to it. But little do the speakers know that the word crimson refers to an insect, called "qirmiz" (an Arabic word) which produces a red dye. Different languages use different methods to obtain source-based descriptions. Some languages use the technique called reduplication which is a morphological process where a part of the word/the whole word is repeated exactly or with small change to describe a perception. Example: "Erupu vaṇṭidi" in Telugu refers to the colours which are red and like. Erupu means red in Telugu.

The third category of Peircean category, i.e. symbols which are arbitrary in nature encode a perception. This is called "describing-as" by Clark (1996). Most of the English words belong to this semiotic strategy such as sight, dark, lit for vision; sour and sweet for taste; hot and cold for touch, but for sounds it is loud whereas for smell it is fragrant and foul. In the above-mentioned instances, we interpret these terms only when their meaning is known beforehand. Once the words are learnt, the descriptions become clear and specific. These are directly related to the sensory features and often used a single word to describe in contrast to the semiotic strategy of using indices or iconicity. Using arbitrary symbols is simpler because most of the words are part of the vocabulary of a language and hence, they are widely understood and expressed by the users of the language. Often arbitrary symbols function with other strategies to form composite signals. The words beeping and banging are party iconic, partly arbitrary, and peach and nutty are a fusion of arbitrary symbols and source-based strategy.

Along with the above three Peircean categories, we also have language equipped with technical terms to understand sensory perceptions but discussing these technical terms is not part of the semiotic approaches but still can be used for understanding sensory perceptions. An example for technical language is explaining the blue colour light as "the light whose wavelength is 500 nm" or defining a pitch by mentioning the frequency in Hertz. Since technical language is different from the above discussed approaches, it depends on recognizing different elements within the scientific features to interpret gestures. It is also strongly dependent on the cultural changes in the language. The lexicon of technical language keeps changing and expanding as humans keep establishing knowledge about various perceptions. Technical language often needs expertise in a system to interpret the signals. But there are some words which are comfortably interpreted by the public (Porcello, 2004), as seconds, minutes, and hours many years back, those people working in that system would understand. But now it is a commonly used word among English speakers referring to temporal measurement, while meters, miles, and kilometers are used to describe spatial domain. Sometimes the reference to time, space and position could be different in different frameworks. In that case, knowledge about that system and definitions of the terms are to be known to interpret the gestures/measurements. In terms of rooted physical facts it is fascinating to learn that there are very few methods of representing taste and smell scientifically (Dubois, 2007).

Along with the technical words, there are other sets of words which have extended meanings which are called metaphors. Metaphors are the part of figures of speech of any given language. Metaphors carry loads of semantic features which are either direct or indirect in nature. Some metaphors along with the major connotative meaning, also express metaphysical meaning which have to be understood indirectly. For example, words like smooth and sweet describe perception but they can also be used to describe other perceptions such as music which is sweet

and fragrant flavours that are smooth. Such words are termed as “synesthetic metaphors” by Ullmann (1959) Shen (1997) and Lievers (2015). Some of the words which are sensory in nature or sometimes fused. This fusion may be a combination of two or more sensory words which belong to the core semantic domains. Most of the metaphors used are extension to the existing sensory words that convey the meaning in the context (Lehrer, 1978). Metaphors occupy a major part of the total words in the lexicon of the language.

1.4 Models of language and Perceptions

A view in terms of study of perception verbs is when traditional cognition theories are based on the premise that the mind manipulates abstract concepts to derive meanings from symbols without paying attention to bodily experiences. In other words, there is no substantial relation between the body and mind. In contrast to earlier theories, embodiment theory considers that the mind does not function without bodily experiences. For instance, when we discuss inanimate objects like chairs, pens lack the cognitive experience. Hence, the embodiment theorists believe that the body has great influence over working brains as both are profoundly interconnected in terms of human cognition. The mind does not exist on its own without a body and it is not confined to brain function alone but also controls other parts of the body. According to Winter (2019), there are two types of views with respect to meaning of a language -- modal view and amodal view. The amodal view is also known as symbolic view of meaning, in which the mind derives meaning from abstract symbols without any relation from the sensorimotor process of perception and action. On the contrary, the modal view states that mental representations not only stimulate the sensorimotor process responsible for perception and action but also develops concepts in human minds (ibid).

According to Gallese and Lakoff (2005) embodiment signifies that humans interact and interpret the world with their senses and bodies in order to structure and organize human cognition and language. Evans (2007) defines embodiment that the concepts and meanings are organized in the human mind as a result of the bodily experiences gained from the environmental interactions. Further Willems and Francken (2012) point out that perception and action are not two separate entities as the two are much applicable together for our thought process as per embodied cognition. We know that language stimulates certain sensory processes in our minds but embodied theorists explore the extreme relation between language and perception. The degree of embodiment has been divided into strong and weak embodiment views. While the strong embodiment view considers the direct link between sensorimotor processes and semantic representations, the weak embodiment view explains that semantic representations are not fully affected by sensorimotor processes (Meteyard et al. 2012).

Further, according to modal view, mental simulation is defined as a mind activity that tries to interpret the meaning of a language. The speakers of any language convey their meaning through embodied objects and experiences. The perceptual experiences are often imitated through mental simulation. The language users engage the same neural circuitry involved in perception and action while processing particular sensory content related to sight, hear, touch, taste and smell (Hauk, Johnsrude, & Pulvermüller, 2004; González et al., 2006). In addition Bergen (2012), Connell & Lynott (2016) draw an understanding definition for mental simulation by contrasting it with mental imagery. On the other hand, mental simulation is less intended when compared to the mental imagery. Many studies assume that the mind uses the same neural circuitry and processes involved in perception for mental imagery too.

Jean Savarin in the 18th century states that "smell and taste are in fact a single sense, whose laboratory is in the mouth and whose chimney is in the house" (as quoted in Piqueras-Fiszman, 2014**).** Words used to describe taste are not always exclusive from those of feel and smell (Lehrer, 1978). As Lehrer stated, smell and taste can be extended by prefixing the adjectives like sharp and smooth to taste such sharp taste and smooth taste. The same holds true with regard to the domain of touch perception. In another context, as Lehrer (1978) stated, touch can also be extended by prefixing the adjectives like sharp and smooth to touch such sharp touch and smooth touch. But the expression sharp pain is considered as a metonymic expression by Semino (2010). It can describe the pain caused due to an external factor like a knife which is a sharp object. It can also ascribe to internal tissue or muscle pain which is like the pain triggered due to a cut from a knife. Irrespective of the cause of the pain being external or internal, it is interpreted by the same neural receptor in the brain (Craig, 2003). Hence words like sharp is a broader concept that embodies different types of pain. For more details on the combinations of sense and illustrations, see Guest, et.al., (2002), Suzuku, Gyoba & Sakamoto (2008).

Colour is the topic which has been discussed at length starting from the stoic school of thought which has more involved in general enquiry of nature in which language is a primary study. It also has been studied very widely all over the globe in various disciplines viz. linguistics, psycholinguistics, psychiatry, cognitive linguistics and other fields. In recent time, colour has become a hot topic and centre of attraction in cognitive linguistics. The first epoch-making study on color terms was carried out in 1969 by Berlin and Kay. Subsequently many researchers have worked on colour terms from different perspectives. In the present study colour also has been taken into consideration to map it with the sense modalities.

To understand the colour words, one has to look from various dimensions, especially from semantic and cognitive perspectives. While explaining colour terms Cacciari (2008) compared colour terms as a continuum of wavelengths. The colour 'red' is defined by a wavelength of 650 nm. A margin of ±5nm is still going to include the wavelength in the colour red. Though there is a range of wavelengths, the neural receptors activated to perceive those wavelengths are the same. At times, even if the wavelength is farther from the defined one, the colour could still be perceived as red. A shade of orange is called 'brick red' in some linguistic societies. A similar pattern can be observed with the usage of colour blue to describe sky and ocean, though they correspond to different chromatic bands (ibid). But in both the cases, we do not need to map a relation between red (in brick red) and red (in blood red) or blue (in sky blue) and blue (in blue ocean). The usage of red to describe brick red is not different from describing a smell to be sweet or a sound to be rough. In both the colour and taste-smell cases, there are two different versions of the same meaning. Some researchers also claim that cross modal perceptions are based on emotional processes irrespective of the language perceptions involved which were proved experimentally by Palmer et.al (2012). They studied the association between music and colour and tried to map music and colour on the basis of emotions (high notes and bright colour which are related to happiness). The words 'loud colour' and 'loud perfume' entail a mapping of "unpleasantness" onto vision and smell modals rather than a mapping of acoustic qualities (Barcelons, 2003, Tsur, 2012).

Likewise, sweet and smell are used to associate and map in order to indicate that smell also is like taste. In addition the adjective smooth is used for pleasant characteristics of smell which are associated with 'sweet'. So, in the expression, the evaluative meaning of sweet is significant and not the olfactory perception in the expression. Therefore, humans consider the denotational and evaluative meaning associated with words before choosing them in their conversation. Words

such as bad, nice, ugly, and beautiful are associated with evaluation as a central part of their representations. Sometimes, the evaluation process prevents the usage of such words even when it fits, due to several implications of the words.

1.5 Perception and Hierarchy

This section examines the hierarchy of senses which can be classified based on how frequently a sense is used to describe another sense. Various researchers have proposed different models of hierarchies related to sense modalities. One such model is Ullmann (1945) who discussed about the hierarchy of sense modalities on a horizontal axis (from right to left) as follows:

a. Touch < heat < taste < smell < sound < sight

The above linear order as proposed goes from "lower" senses to "higher" senses. The qualities of the lower senses are evident in the source domains than that of higher senses in the target domain. Ullmann's directionality in the hierarchy of senses affirms that a metaphor with source domain from lower sense than that of the target domain is cognitively more attainable than a metaphor with reverse directionality. Examples of the expressions in harmony with this hierarchy are cold smell (heat-to-smell), warm colour (heat-to-sight) and rough sound (touch-to-sound). The proportion of expressions congruous with this hierarchy is larger than those which are not as analysed by Byron and Keats. Ullmann (ibid) also observed similar trends in the lexicon of other languages which include French and Hungarian. Later studies also showed left-to-right transfers in languages such as English, German and Russian (Day, 1996; Williams, 1976; Mendelson,1984). Further, it is attributed to classical languages like Hebrew and one of the major tonal languages

like Chinese and logographic language, Japanese which are non-Indo-European languages (Shen, 1997; Whitney, 1952; Yu, 2003).

Later, through experimental studies researchers like Shen (1997), Shen & Aisenman (2008) identified the intersecting outputs with the proposed hierarchy. It was observed that the expressions which are hierarchy-congruous were retained in the memory than those expressions which are incongruous with the hierarchy. For example sweet smell is better remembered than smell sweetness. The experimental studies concluded that the hierarchy-consistent expressions are more intuitive, accessible, and easily interpreted (Shena & Cohen, 1998; Shena & Gadir, 2009; Shinohra & Nakayama, 2011).

At the same time, Williams (1976) proposed a more complex hierarchy which is depicted below (as appeared in William, 1976):

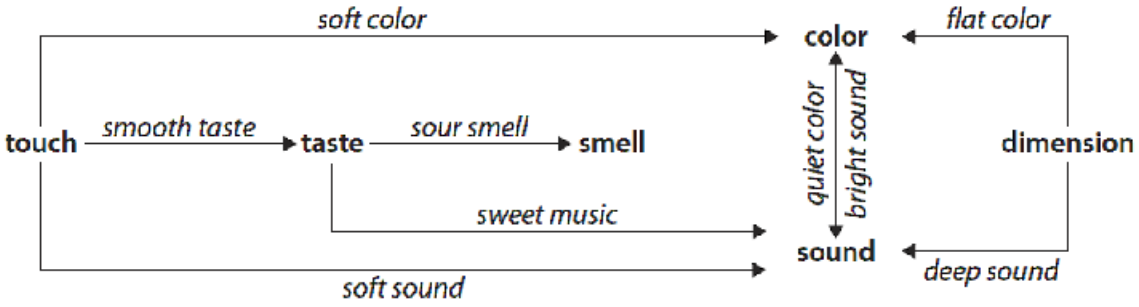

Figure 1: Williams' hierarchy of sense metaphors (1976, p.463) with corresponding examples.

Though there are various hierarchy models, it was Ullmann (1945) who proposed hierarchy model on horizontal axis that does not explain about heat explicitly but explains in his paraphrase whereas Williams (1976) explains hierarchy model by combining touch and heat senses under one category, i.e. touch. Similarly, Williams differentiates in another point from Ullmann, i.e. the

sense of vision as “colour” which excludes vision expressions such as brightness, transparency, shape, and size from that of other hierarchies.

However, (Ronga, et al., 2012) mentioned in their study about the inclusion of many vision related expressions such as bright, dim, light, dark, clear, and faded. It is to be noted that the colour node in Williams’ hierarchy is similar to the vision node in Ullmann’s hierarchy. The difference to be noted is the inclusion of a new feature which is named as dimension that includes all the para-features in Williams’ hierarchy. The dimension embodies the spatial domain like shape, angle, and size. It includes words like big, small, low, high, shallow, deep, full, empty, and so on. Since there are words under the category of dimension which can be separated into different categories, (Ronga et.al. 2012) indicate the lack of a set of rules applicable for words under the dimension feature. Final property of Williams’ model to be noted is the bidirectionality nature between colour and sound. It is supported by expressions such as ‘dark sound’ and ‘loud colour’.

As it was discussed in the foregoing section regarding heat, Ullmann (1959) identified that there is no clear cut line between sound and colour in the hierarchy. Though the symbolic representation ranks colour higher than sound, the bidirectionality is mentioned in his description. Another interesting observation is the little contribution of ‘smell’ as a source word. In the flow chart, smell is described by taste perception but there is no arrow pointing outwards from smell. This was already identified by Ullmann by analysing the low number of words which use smell to describe other senses. Williams’ model also does not depict a direct map between touch and smell.

When it comes to a question of symmetricity, there arises the question of unidirectional or bidirectional (asymmetric) in nature. Unidirectionality means the transfer of words in one direction, usually represented from left to right but the reverse direction is not possible. While

asymmetry means bidirectionality is possible but the proportion of expressions in one direction outweighs the proportion in the reverse direction. With the already established data, we can say that the hierarchy is asymmetric and not unidirectional in nature (Ullmann, 1959; Shen, 1997; Strik Lievers, 2015). Another important question that rises while talking about asymmetrical nature is how strong or weak is asymmetry for a specific combination of senses.

According to Shen (1997), 73% of synesthetic metaphors in Hebrew poems were in harmony with the hierarchy. The idea of hierarchy of senses, where the relation is depicted in the form of a linear order, is consistent only when there is a clear classification of different senses. It means that touch can be ranked as the lowest in the hierarchy when it is well separated from other sensory modalities that are in the linear order. Therefore, the hierarchy of senses usually rely on five-sense models.

The association between words and sensory modalities enables us to understand why some sensory expressions are more frequent than others. The word sweet for instance is both olfactory and gustatory but the denotational meaning compels us to associate it with the taste sense. The argument here is not about the translation of taste meaning to smell meaning, but if the semantics of taste-related words that occur in the lexicon of smell-related words. The relations drawn between linguistic hierarchy and the language-external aspects of perception do not have any cause-effect mapping (Williams, 1976).

Though there are various prominent models such as Ullmann (1945), Williams (1976) and subsequent models, they have discussed either on linear order or birectional order. But the model which was advocated by Viberg (1983) seems to be the most prominent in the field of language and perception.

Viberg's (1983) survey of perception verbs focused on the sense modalities of languages. For this survey he examined 53 languages from various language families. To analyze the sense modalities of the languages under consideration, he chose to work on three specific field components namely, activity, experience and copulative or source-based. In his view, the perceiver's process of any activity which is controlled is termed as Activity (ex: looking at someone/something) and the state of any activity that is not controlled is terms as Experience (ex: to see something/someone) and Copulative is phenomena based selection or construction of words in a mental state of experiencer based knowledge omitted by the perceiver (ex: the door looks huge or see the tree is big). This combination of three specific components with the five sense modalities may be lexicalized in various languages into 15 diverse perpetual situations. Viberg's analysis on English language states that for activity of vision and hearing there are two or more basic expressions, but for olfactory, tactile, gustatory situations there is only one single verb. Further to test this model, 15 different sentences related to senses are translated from 53 languages that are used to see the semantic space that determines whether each language has perception verbs. After the analysis, he proposed a new concept which is different from the other models, i.e. universality. His universality hierarchy of senses modalities reflects the major understanding that these verbs have directionality of its meanings that are extended to also most all the languages.

See > hear > touch > taste, smell

This hierarchy is represented in the horizontal axis (from left to right) as against the Ullmann (1945) hierarchy which is from right to left. His hierarchy which is considered universal in nature looks for the polysemous extensions across the sense modalities. In this model, Viberg (1993) highlights vision as the prominent modality compared to the other sense modalities. The following are valid reasons in his model that why vision is given importance.

1. Vision of all senses has a high number of lexical words.

2. Vision may have more non-perceptual extension i.e. meanings concerning cognition in large numbers and for social interaction.

3. Vision can predict more lexicalization patterns while comparing other verbs.

The frame of reference related to perception varies from person to person. Humans perceive their surroundings through their sense organs and express their experiences through different languages. The fundamental question lingering the linguists for decades is "Why do humans perceive things differently though they use the same sense modalities? In order to get answers, linguists often carry out cross-linguistic studies to know the similarities and differences in languages for conveying the perceptual experience. The perception verbs are imperative to any language as they explain perceptual experiences and temporal content. They are used to convey experience involving senses. Many researchers like Sweetser (1990), Evans & Wilkins (2000), Majid & Levinson (2011) and San Roque et al. (2015) tried to classify perception verbs based on different criterions but Viberg (1983) was the first who attempted to encode the sense modalities of verbs on a large scale through his pioneering study 'The verbs of perception: A typological study'. As pointed out earlier, as part of his study, Viberg compared 53 languages and found a fundamental pattern underlying among the perceptual verbs and concluded that some languages which lack the typical five-sense modalities use a single polysemous verb for multisensory modalities. Below we reproduce Viberg's model that appeared in 1984 for ready reference.

Viberg's basic paradigm of perceptual verbs based

Sense modality	Experience	Activity	Phenomenon-based
VISION	*see*	*look*	*look*
HEARING	*hear*	*listen*	*sound*
TOUCH	*feel / touch*	*touch / feel*	*feel*
TASTE	*taste*	*taste*	*taste*
SMELL	*smell*	*smell / sniff*	*smell*

Figure 2: The Basic paradigm of verbs of sensation in English

In his model, Viberg made a clear distinction on experience-based verbs. The subject-oriented perceptual verbs focus more on the subject's (perceiver) involvement in the process of perception. These verbs are commonly classified as transitive verbs which in turn are divided into two sub-categories viz. subject-oriented agentive perceptual verbs and subject-oriented experiencer perceptual verbs. In simple words, the verbs indicating uncontrolled perception are called experience verbs and those indicate controlled perception are known as activity (agentive) verbs. The subject-oriented agentive perceptual verbs indicate the subject's intended act of perception; On the contrary, the subject-oriented experiencer perceptual verbs refer to the subject's accidental act of perception.

Based on Viberg's model, the following Telugu examples can be examined:

Telugu:

(1) *Kr̥ṣṇuḍu vārta-lu vinnā-ḍu*

Krishna listened to the news

Krishna is the grammatical subject of the verb 'listened to' who is intentionally involved in the controlled act of perception. Look at the example given in (2)

(2) *kr̥ṣṇuḍu ā vārta vinnāḍu.*

Krishna heard the news.

In this example, the subject heard the news by mere accident and unintentional i.e., subject-oriented experience perception verb.

The other examples involving sense modalities of vision in Telugu and English are as follows:

See in English, *Choodu* in Telugu are experience verbs; *Look* in English and *kanipinchu* or *choopu* in Telugu are agentive verbs; *Hear* in English and *vinu* in Telugu are experiencer verbs; *Listen* in English and *alakinchu* or *vinu* are agentive verbs. The verbs related to other senses such as *touch* (*taaku* in Telugu), *taste* (*ruci choodu* in Telugu) and *smell* (*vaacana choodu* in Telugu) can be both experiencer or agentive. The verbs *touch* and *smell* in Telugu have serial verbs comparing to the other sense modalities such as *see* and *listen*.

For object-oriented perception verbs (source-based verbs), the object of perception is the grammatical subject instead of perceiver. These verbs are commonly classified as intransitive verbs. In these contexts the speaker assesses the state of the object of perception. Examples from Telugu are examined below:

(3) *Ramya andaṅgā kanipistundi*.

Ramya looks pretty.

In the above example (3) the speaker explains what she visually perceived about Ramya but not the latter (object) explaining her beauty for herself. The Telugu verb, such as '*undi*' (non-masculine singular [female/neuter]; *undi* can also be used for the representation of property) whereas '*unnaadu*' represent only masculine singular. This distinction plays a significant role in deciphering the sensory verbs of English ending with '-s' or '-es'.

Based on the above analysis on English, Viberg generalized the components of perceptual verbs based on grammatical subject's base selection of experience, activity, and base selection of perceiver's object perception (copulative). The copulative verbs add adjectives or nouns to the sensory verbs to explain a particular sense modality based on source or object. A copulative expression considers the perceived thing of a speaker as a grammatical subject (e.g. Ramya looks pretty).

There are several differences between different senses and various studies imply different forms of asymmetries connecting the senses (Spence, 2011). The explanation proceeding language-external perceptions attracts counterattacks by a set of alternative data. The touch-to-sight asymmetry established by Shibuya et al., (2007) was on the argument that it is vision which dominates the aspect of touch in perception but, Ronga et al. (2012) puts forth a similar reasoning but in a reverse direction. This is because the sense that dominates in perception alters with context and perceptions in question. For example, vision dominates sound in the spatial domain and sound dominates vision in the temporal sphere (Morein-Zamir,et.al, 2003). The answer to the question which asymmetry should be considered, is incomplete with further research and proof. As discussed, perceptual accounts are classified based on the accessibility factor. But many researchers do not approve of it. Accessibility was attributed to how directly is the stimulus related to the perception, but psycholinguistics bases the definition on the speed of processing a

perception. The experiments show that people process visual and audition verbs as associated with the touch verbs (Connell & Lynott, 2014). At times, accessibility is based on the word frequency, where vision is the most frequent sense which makes it most accessible (Harmon & Kapatsinski, 2017). The idea of distinguishing senses into higher and lower domains is not supported by neuropsychological data. Also, the notion of one sense being more differentiable than the other (Williams, 1976) is not consistent with the sensory sciences. Other studies by Shen , (1997) that support the hierarchy-consistent words to be natural and easier to memorize do not necessarily support that asymmetries are grounded in accessibility of perceptions. Therefore, there are multiple limitations with the perceptual accounts which includes the absence of actual perceptual evidence (neuropsychological and linguistic), lack of closed-circuit logic, and the lack of constraints on perception-language mappings. Only experiments which are carefully conducted to connect the language and perceptual stimulus can support the idea of perceptual accounts. Marks (1965) explored the connection between sound and sight, by using phrases like dark cough and bright sneeze to showed that subjects matched this phrases to a loud auditory sound stimulus or bright visual stimulus, that is to say people are matching that is loudness to brightness, to show perceptual evidence in real life (ibid).

There are three commitments or principles that form the basis of any method to be followed (Lakoff, 1990; Lakoff & Johnson, 1997) for forming a theory and collecting data. Lakoff and Johnson broadly describe three cognitive linguistic commitments in compliance with theoretical and methodological consideration, they are as follows:

1) The Cognitive Commitment

2) Convergent evidence commitment and

3) Generalization commitment.

The cognitive commitment states that theoretical concepts and logic should furnish the specific functions of mind that are sensually and cognitively realistic. In other words, the general principles of the language must be characterized in accordance with the other cognitive disciplines which also engage in the study of the human mind and brain such as psychology, neuroscience, philosophy, psychophysics and artificial intelligence. The language and linguistic organization should not confine to specific cognitive principles of language but to general cognitive principles. There is a need for sensory linguistics to adhere to cognitive commitment as it heavily depends on the contributions made by cognitive and psycholinguistic processes. The researchers affiliated to the domain of sensory language are often criticized for neglecting the extralinguistic data offered by other disciplines and very rarely including those data into their research. The cognitive linguists should pay attention to the cognitive commitment and must incorporate extralinguistic evidence into their theories and models (Dąbrowska, 2016).

The second commitment, converging evidence commitment requires that linguistic concepts, theories and logic must merge evidence gathered from different sources. The converging evidence must lend support to the linguistic concepts and hypotheses considering their assumptions and limitations (Gries et. al, 2005). It is important for researchers in cognitive linguistics to employ all available methods to draw research conclusions as no single method is adequate to analyze human language. As the complexity of human language makes it more important to use every possible method. Gonzalez, et.al. (2007) demonstrated that a great number of methods are available for cognitive linguists to analyze corpus, theories and gestures. The converging evidence commitment calls for the engagement of triangulation and different methods to analyze the outcome of the research.

Finally, the third commitment, i.e. the generalization commitment states that linguistic theory and concepts must provide empirical generalizations from broader range phenomena. In order to draw generalizations from different languages, one has to analyze three language components namely categorization, metaphor and polysemy. A theory which covers a wider range of data is preferred over the theory which includes a smaller range of data. The linguists must prefer theories which encompass a variety of data than limited data (Markman, 2008). The generalization commitment made it possible to combine the grammatical system with the lexical system paving a way for a whole theory of grammatical and lexical structure.

The study of perception verbs is seen under the light of cognitive linguistics. Cognitive linguistics has a lot to do with the functional methods of language. It is important to note the strength of this field is in its broad methodological and theoretical basis which is both cultural and physiological study of language and having a great emphasis on the influential theories from fields like philosophy, psychology, linguistics, anthropology, artificial-intelligence, and neuroscience with the practice of the analytical and methodological tools. All these tools investigate phenomena that are theoretically addressed and have given a strong connection for understanding the cognitive linguistic phenomena on understanding interactions of language and mind. Its interdisciplinary nature has a strong influence in the study of language in terms of knowing both conscious and unconscious part of the mental activities of language.

Though perception was extensively researched in linguistics, cognitive linguistics has given a new dimension to the researchers on the field itself as it is evident from the foregoing discussion. In the cognitive perspective one has to understand perception which is one of the primary forms of information of the world around us and its understanding. Cognition is one of

the key elements in processing things around us. It captures the information and gives input about the external world which gets translated by its capability. Later, the captured information dynamically make sense of the information through sensory organs. Being an active cognitive process, perception processes the stimulus from the environment with both bottom-up and top-down processing, i.e. we are not only driven by the stimuli that we receive but anticipate certain stimuli that control perception. Undoubtedly conceptual knowledge is based on the primary form of awareness where the evidence is collected in one way or another through perception. Perception can be viewed as immediate and direct cognizance of entities external to the perceiver. Unfortunately, the nature of perception was left debatable and has never been defined adequately, due to the research on the cognitive function which does not clearly categorize whether a disruption of cognitive activities are due to a defect in a sensory or perceptual process. The process in short is that allowing information using sensory input/information which is made meaningful. So, one can conclude that Viberg's (1983) model is more suitable in the direction of perception verbs from a cognitive linguistic perspective.

1.6 Telugu Verbs and Perception

Telugu is one of the major literary languages of South India which attained classical language status in 2008. It is also one of the scheduled languages of the Constitution of India. It belongs to the second largest language families of India, i.e. Dravidian family of languages. According to Krishnamurti (2003) and Subrahmanyam (1977), Telugu is classified under South-Dravidian. Telugu is spoken in the Indian states of Andhra Pradesh, Telangana and few other states like Karnataka, Tamil Nadu, Maharashtra and few areas in Odisha. Apart from the Indian states, it is also used as a diasporic language in few countries. Apart from this, the language is recognized

as a minority language in the Union territory of Yanam. Among the largest spoken languages of the world, Telugu secured 11th place with 82 million native speakers (Ethnologue, 2019).

The language spread in the United Andhra Pradesh in 22 districts. Later after bifurcation the same language is considered as the official language of two independent states, viz. Andhra Pradesh and Telangana. If one looks at the variations of language, there are four varieties of Telugu language viz. Kalinga, Coastal, Rayalaseema and Telangana. Kalinga variety is spoken in three districts of Northern Andhra Pradesh (Srikakulam, Vizianagaram, Vishakapatnam); Coastal variety is spoken in seven districts of Central Andhra Pradesh (East and West Godavari, Krishna, Guntur, Prakasam and Nellore); Rayalaseema variety is spoken in Southern Andhra Pradesh (Chittoor, Cuddapah, Kurnool, Ananthapuram) and Telangana variety is spoken in the newly emerged state of Telangana consisting of nine districts which are further divided in 31 administrative districts. Among the four varieties of Telugu language, a considerable amount of variation can be observed at phonological, morphological and syntactic levels. Within morphology, verb morphology has the highest amount of differences among the four varieties of Telugu. Though there are many variations in Telugu language, especially verb morphology, the researcher has taken into consideration only Telangana Telugu, especially verbs. In future, one can take up all the four dialects and check the same model for the future research on cognitive linguistics.

1.6.1 Verbs

Most of the verb morphology in Telugu language is agglutinative in nature where the affixes are attached to the root of the verb. Affixes will include person, number, gender and grammatical particles such as progressive markers, tense markers and clitics. Telugu verb

morphology is subdivided into simple, complex, finite, non-finite, negatives, inflectional, compound and serial verbs. All these subdivisions of verb morphology heavily undergo morphophonemic changes at various levels. Along these subdivisions, we have other grammatical categories which play a very important role in verb morphology, i.e. tense. Tense in Telugu is executed into past and non-past where future is included in the non-past but indicated with time adverbials like *irooju, reepu, ellundi,* etc. Major scholars who worked on Telugu language can be categorized into two sets, viz. Western (Missionaries) scholars and Indian scholars, especially linguists. These include missionaries like Francis Whyte Ellis, Caldwell, Emeneau, Asher, Andronov, C.P.Brown, Thomas Burrow are a few missionaries who came in as Civil servants in the early Madras Presidency. Among the Indian scholars P.S.Subrahmanyam, Bh.Krishnamurti, Chekuri Ramarao, B.Ramakrishna Reddy, Nagamma Reddy and Uma Maheswar Rao are to mention a few who worked extensively on verb morphology. Within the verb morphology, finite and non-finite forms occupy major chunks. In the following sections, one can observe the finite and non-finite verbs relating to sense modalities.

Person-number-gender execution in Telugu

Personal Pronouns	Person-number-gender suffix
neenu 'I'	*-nu* '*neenu cadivee-nu*' 'I studied'
nuvvu 'You sg'	*-vu* '*nuvvu cadivee-vu*' 'You studied'
miiru 'You pl'	*-ru* '*miiru cadivee-ru*' 'You studied'

vaadu 'He'	*-du* '*vaadu cadivee-du'* 'He studied'
aame 'She'	*-di* '*aame cadivin-di*' 'She studied'
adi 'It'	*-di* '*adi cadivin-di*' 'It studied'
vaaru 'they	*-ru* '*vaaru cadivaa-ru'* 'they studied'
avi 'they neuter'	*-ai* '*avi cadiv-ai*' 'they studied'

1.6.2 Execution of Tense in Telugu

Telugu exhibits two tense model which differs from other South Dravidian languages. In this language we have only past and non-past tense. Future is indicated by the time adverbials before the non-past. The following paradigm can be observed in Telugu language.

Person	Past	Non-past
1s	*caduv-a-nu*	*i-roju* or *repu caduvt-ta-nu*
2nd	*caduvu-a-vu*	*i-roju* or *repu caduvu-ta-vu*
3rd.s.m	*cadiv-a-du*	*i-roju* or *repu caduvu-ta-du*
3rd.s.f	*cadiv-in-di*	*i-roju* or *repu caduvu-tun-di*

3rd.m.p	*cadiv-a-ru*	*i-roju* or *repu caduvu-ta-ru*
3rd.f.p	*cadiv-a-i*	*i-roju* or *repu caduvu-ta-i*
1st.p	*caduv-a-mu*	*i-roju* or *repu caduvt-ta-mu*
2ndp	*caduvu-a-ru*	*i-roju* or *repu caduvu-ta-ru*
3rd.p.n	*cadiv-in-i*	*i-roju* or *repu caduvu-ta-i*

1.6.3 Finite Verbs

Finite verbs are either simple or compound in nature. Most of the finite verbs have three sub-divisions, viz. stem, tense-mode suffixes and personal suffixes. For example, *vandi-iti-ni* 'I cooked'. A simple finite verb has always one base or stem in the whole construction. It can be substituted with other classes like past, habitual, negative, imperative, prohibitive and other types of finite verbs.

Past: *caduv-e-nu* 'he studied'

caduv-e-nu 'she/it(f.n.sg.) 'studied'

caduv-e-mu 'we studied'

caduv-i-ri 'they studied'

caduv-iti-vi 'you (sg,) studied'

caduv-e-du 'he (sg.) studied'

Habitual: *caduvu-taa-nu* ‘I study’

caduvu-taa-mu ‘we study’

caduvu-tun-di ‘She studies’

caduvu-taa-du ‘He studies’

caduvu-taa-ru ‘they study’

Imperative: *caduvu* ‘study (sg.)’

caduvandi ‘study (pl.)’

Prohibitive: *cadav-ak-u* ‘don’t study’

cadav-oddu ‘don’t study’

cadav-ak-andi ‘don’t study (pl.)’

1.6.4 Non-finite verbs

Non-finite forms are the one which have the meaning of incompleteness. They come in the form of suffixes attached to the root of the verbs. The following are some of the non-finite verbs discussed in Krishnamurti (1961).

Past-participle	*caduv-i*	‘having studied’
Past-adjective	*caduv-ina*	‘that studied’
Conditional	*caduv-ite*	‘if studied’
Habitual adjective	*caduv-edi*	‘that studies’

Negative participle	*caduv-aka*	'not studied'
Negative adjective	*caduv-ani*	'that not studied'
Infinitive	*caduv-an*	'to study'
Present participle	*caduv-uttunna*	'studying'

To conclude, Telugu has both finite and non-finite verbs. Tense is executed only in the past and non-past. The future is taken care of by the non-past with the implementation of time adverbials before the verb. Gender also in singular is masculine vs non-masculine where in plural it is human vs non-human. All the essentials of verbs are taken care of in the above discussion which will be helpful in the analysis of perception verbs indirectly.

1.7 Objectives

The major objective of the present work is to study the verbs of perception with cognitive experiments and corpus-based method on Telugu language. The following are the specific objectives:

1. to study verbs of perception (five sense modalities) in Telugu and to discuss the earlier works on perception verbs
2. to classify the verbs of perception based on their semantic extensions and frequency of occurrence and find out the association between perception verbs on diverse human subjects and their cognitive abilities
3. to investigate whether perception verbs are language specific or universal as suggested by Viberg (1983)
4. to examine the Telugu perception verbs from a corpus-based approach.

1.7 Methodology

As part of the study, 158 subjects were selected whose mother tongue is Telugu language. The subjects are a conglomeration of aged, adults and visually impaired. Their age ranges from 20 to 65. Among the subjects, some of them are bilinguals too. While conducting experiments, monolingual as well as bilingual ratio was also considered. In order to execute the research, the following experiments were conducted: metaphor generation task, flanker task, Corsi task, LexTale task, Semantic Fluency Task and Language Questionnaire, rating task, odour memory task, self-paced reading task and free-sorting task. All the above experiments are used based on their suitability of the sense modalities. Along with the above experiments, corpus analysis was also done which was collected from the subjects for the frequency of occurrence. After the analysis, the results were tabulated and represented in the form of graphs.

1.8 Limitation of the Study

The present study on the Cognitive study of Perception Verbs in Telugu has taken into consideration all the five sensory perception verbs which are discussed at length in the 3rd chapter. The study includes the extensions of perception verbs which are part of figure of speech i.e. metaphors and lexical relations like polysemy. The study discussed at length the four sense modalities viz see, smell, taste, touch except hear. The reason for exclusion of hear is the non-availability of subjects at the critical gesture of Covid-19. This inhibited the researcher to conduct the experiment on the subjects with regard to the sensory modality hear. However the study on perception verb of hear is included in the corpus analysis along with other sensory modalities.

1.9 Organization of the thesis

The thesis is organized into five chapters.

Chapter 1: The first chapter deals with the background of the study, objectives of the study, and limitations of the study and the methodology of the study.

Chapter 2: The second chapter discusses the theoretical foundations related to perception verbs. The chapter also provides an overview and comparative studies of earlier works on perception verbs along with a basis for the present work on Telugu language.

Chapter 3: The third chapter "Cognitive study of Perception verbs in Telugu" mainly deals with the four sense modalities, viz. see, smell, touch and taste. For these sense modalities mentioned, experiments are carried out to examine various cognitive and linguistic abilities of the subjects.

Chapter 4: The chapter on "Corpus Analysis of Perception verbs" concentrates on the data collected from the subjects on all the five sense modalities. As a part of the analysis, Telugu corpus was drawn to find out the frequency of perception verbs in Telugu and a graphical representation presented in this chapter.

Chapter 5: The Chapter on "Summary and Conclusion" details the work carried out and gives future directions.

Chapter 2

Theoretical Foundations

Working on the perception of verbs with a focused view started in the second half of the 20th century. Many works during this time have been carried out either as a research or project and most of the research focused mainly on the perception verb *see*. Among such works, Sibley's (1955) pioneering work on *Seeking, Scrutinizing and Seeing* which mainly concentrates on perception verbs, particularly on the vision verb *see* along with the observation verbs. By taking the vision verb *see* he exemplifies that the verb *see* which is meant for *looking at something* also performs the functions of seeking, scrutinizing and looking at. In order to highlight the vision verbs, he took the text from the book entitled *The Concepts of Mind* authored by Ryle as a corpus for his analysis. By considering the corpus from the book, he categorized the verbs that are connected to perception into two types: viz. Task verbs (e.g. scan and search) and Achievement Verbs (detect or solve). Along with the categorization, he also made a keen observation from the corpus that some of the verbs might fall in both the categories (e.g.) taste and smell, which is debatable. The following are some of the verbs which can be useful for debate whether they fall under some category or in either one of the categories such as scrutiny verbs or seek verbs. Examples such as 'look for' and 'listen for' shall fall under seek verbs and 'look at' and 'watch' will fall under scrutiny verbs. Further he extended his argument saying that the verbs of seeing are directly or indirectly interlinked to each other logically. Subsequently, he discussed the difference between retention and protracted achievement wherein he highlights the occurrences and relation of the verbs, time duration and usage of the verbs. Finally the paper also explains a deep understanding of perception verbs that are not merely achievement verbs. Also notes that all the related verbs of see have an underlying visual specific activity irrespective of its categories.

Later when the research spread from individual researchers to organization, one of the organizations in England, i.e. Oxford arranged a series of lectures in 1962 by J. L. Austin. In the series of lectures on *Sense and Senibilia* by Austin, focused on describing sense modalities. In these lectures, Austin puts forward the thoughts by highlighting the knowledge of sense perceptions which has to be known by reality either directly or indirectly that focuses on the perception of mind. Further, he states that no one can perceive the world with single perception but with multiple perceptions or senses. Mind was the central point in his discussion and related senses with mind which can be dependent or independent of its perceptual capacity. During the discourse of the lectures, he criticizes the philosophical view of native realism and depiction along with illusion and delusion.

Gruber's (1967) article on '*Look and See*' illustrates the semantic and syntactic relations of the words *look* and *see*. But this paper does not talk much about verbs from the perception perspective rather consider the verbs look and see under verbs of motion. Later he also highlighted that these verbs have the nature of behaving as a transitive and intransitive verb. The verb see is seen as transitive in the example: *"The bird saw the nest".* When a sentence is formed in a given language, with the perception verbs with the intermediation of prepositions, it is considered as an intransitive as seen in *"It is easy to see through this glass".* Further he made a clear distinction where the word *"see is diametrically opposed to look: look is Agentive and takes prepositions based on TOWARD; see is non-Agentive and takes prepositions based on preposition TO".*

Vandevelde's (1977) paper on *Mistake and Views of See* is a criticism of J. S. Gruber's (1977) speculation on the verb of *see* being a non-agentive and verbs of motion. His claim is satirized by Vandevelde by exemplifying its semantic and syntactic features. In this article he claims that the preposition 'to' in an ordinary sentence is generally acceptable whereas it is not

acceptable after the verb *see*. For instance, the sentence, *the bird saw the tree* does not permit the preposition `to'. It applies to other prepositions such as *in* and *against*. Since the verb *see* has properties of motion (as discussed by Gruber, 1967), it is not perfect as it oversees the perceptual aspects. Similarly, a word like *gaze* is not always close to the verb *see,* but the visual experience of *gaze* is not seen as a verb of motion *see*. Later Vendevelde describes how Gruber has classified the non-agentive verb by considering the motion verb *see* as shown for the agentive aspects of the verb *see* below: *(a) an Agentive verb can be substituted for in all cases by the phrase do something; (b) an Agentive verb can be modified by a purpose clause beginning with in order to; (c) an Agentive verb can be modified by manner adverbials like carefully.* Finally the author disagrees with the claims of Gruber classification and his description of the verb *see.*

Chinfa Lien's (2005) paper on *Verbs of visual perception in Taiwanese Southern Min: A Cognitive Approach to Shift of Semantic Domains* looked at the three verbs of visual perception namely, *khoann*, *kinn*, *siong*. The paper concentrated on elaborating the three verbs under consideration for its polysemous nature as well as the interaction between visual perception and other semantic domains. For this purpose, the author has considered a range of related senses associated with each verb on the basis of semantic co-composition of the verb *khoann*, *kinn*, *siong* and its object. The paper finally concludes that the three visual perception verbs have developed into showing grammatical functions in the form of aspect marker and achievement markers.

The following sections from here onwards relate to the topic which are discussed in various conditions of time and space. Hence, they are not put in the chronological order due to the loss of connectivity and cohesion.

In the research paper on *Lexical factorization and syntactic behavior Pustejovsky and* Joshi, (2017) tries to analyze the verb *see* and its most related senses. In the analysis the author

comes up with 60 words that are related to the verb *see.* Among the 60 words, some of them are directly related to verb *see* and others can be seen as representative or extended meanings. The author has observed that the uses of the verb *see* as transitive as well as intransitive. Within the 60 words, 25 words have been considered representing for both visual and non-visual senses. Though there are non-visual senses, the author indicated them as visual aspects, and treated the words like *frown, scowl, wink,* and *blink* as non- visual senses. Verbs such as *signal, point out* and verbs such as *meet* and *go to* are also not considered as extensions of the verbs *see* by the author. Further he argued that the main aim of sense modalities vision is dependent on the location and involves other semantic domains. These can possibly be investigated in the future research.

Neagu, (2013) in his informative paper titled *What is universal and What is language specific in the polysemy of perception verbs?* examined the polysemous meanings in English, Romanian and French from a cognitive linguistic perspective. The analysis between the perception verbs and differences between them are significantly elaborated in this work. The author has made a distinction between congenital polysemy and gradual polysemy. For testing the polysemous nature, the author has taken data from English, French and Romanian languages. Further, the author analysed the data from the cognitive perspective to see how words which are polysemous in nature exhibit metaphorical senses.

Sweetser (1990) discussed in her paper on *Metaphorical and Cultural aspects of semantic studies* the perception verbs in a different manner by revisiting the Indo-European languages from the semantic, diachronic and cognitive perspectives. However, the view of Sweetser (ibid) is that there is cultural influence in the semantic extensions of the perception verbs, for instance the progressive verb "seeing" is mainly associated with intellectuality. Further she has also taken into consideration of Evan and Wilkins that in Austrian languages *think* and *know* are considered as

perception verbs with which are relativistic and universal in nature. Subsequently she also discusses about Ibarretxe-Antunano who illustrated the five sense modalities based on the phonological and psychological properties of the perception. Finally Sweetser (1990) focuses on the three degrees of compositionality: 1) Ambiguous extension, 2) Verb driven extensions and 3) Argument driven extension. She concludes by saying that the degrees of compositionality can be related to gradable polysemy which hypothesizes that different elements in a sentence form extended meanings.

Ibarretxe-Antuñano's doctoral work (1999) *Polysemy and Metaphor in Perception Verbs: A Cross-Linguistic Study* is a cognitive semantic account of perception verbs in three languages, viz. English, Basque and Spanish. In this work, the author has explored why and how one's experience and understanding of the five sense modalities constrain and shape the way one creates mappings between the physical domain of perception onto the metaphorical and abstract conceptual domains of experience. The author has concentrated in the work on the analysis of the polysemy that exists in the perception verbs in the languages under consideration. The aim of the work is to find out whether there are semantic extensions and the role of polysemy in the languages. Further, the researcher has investigated in finding out whether there are any universals with regard to polysemous senses.

Santos's (1998) study on *Perception Verbs in English and Portuguese* is an investigation of tense and aspects systems of Portuguese (European) and American English. This paper is a reinterpretation of the author's 1996 doctoral work from a contrastive semantic perspective on the two languages. For the present work, the author has consulted a corpus consisting of translation pairs from Portuguese and English, especially texts consisting of perception verbs. The overall goal of the present work is to provide a contrastive grammar of Portuguese and English from a

corpus linguistic perspective, with particular focus on perception verbs involved by using translation pairs. In this study, the author has tried to observe the following: 1) Whether perception verbs are frequent in Portuguese and English, and 2) Aspectual classification by considering the translation pairs of both the languages. Further, the translation of Portuguese perception verbs, especially the translation of perception verb in *Imperfeito* or *Perfeito* are investigated and whether *Imperfeito* get translated to *could* in English. Another observation that he made is whether negation in English reverses markedness, i.e. whether *couldn't* is less marked that *didn't.* Similarly, the author has analysed the translation of English perception verbs. While examining the written and spoken discourse, the author observed that verbs of perception are very frequent in these languages, especially vision verbs and in the process of translation some aspects of perception which are native to those languages are lost and this could be attributed to aspectual gap rather than lexical gap.

The paper on *Contrastive study of a perception verb in English and Russian: Fee vs Cuvstvovat* by Rylina, (2012), is a contrastive analysis of perception verbs *'feel'* in English and '*cuvstvovat*' in Russian. The author points out that the verb *feel* in sentences of English had invoked by expressing an active and a cognitive perception. From the analysis, the author found that the verb *feel* a being transitive verb has its own distinctive characteristics whereas the Russian equivalent *cuvstvova* has two morphological features like reflexive pronoun and indicating the imperfective and perfective aspect. Further the paper argues that the hierarchy model proposed by Viberg (1983) suits perfectly for Russian language. The paper also highlights the semantics of the verbs *feel* and *cuvstvovat* from the perspective of Viberg's model which speaks about the agentive and copulative aspects of sense modalities, especially for the sense of touch. The following

sections further reviews studies related to experiences, especially visual and perceptual experiences.

Edwin and Goodwin's (1985) work on *Language of shared attention and visual experience: a functional study of early nomination* is a thought provoking paper in the area of cognitive science, especially the perceptual verbs *look* and *see.* In the study the main concentration was put on the development of utterance in relation to the immediate environment of the children in their early speech. For the study the researchers have taken two children and collected the speech conversations from their discourse. From the analysis the researchers identified that nominating factors were initially acquired as components of particular patterns in relation to the context and environment. As part of the study they have taken the caretaker's speech and the discourse between the children and the caretakers. The study found out that individual words are acquired in a particular pragmatic context because their intial meanings are functional rather than referential and hence, they cannot be described in terms of semantic features or prototypical referents. The study also states that the individual words should not be characterized by expressive cognitive concepts. Finally the study suggests that the perceptual words *look* and *see* have their development from the idiosyncrasies in pragmatics as well as semantics.

Brewer, (2011) in his article on *Perception and its objects* is a supportive paper which highlights empiricist insights on perceptual experience. In the paper the researchers mainly speak about the physical objects which are mind-independent and are highly emphasized by empiricists. Further hallucination and illusion express an untenable mind which is dependent on objects. In this view he criticizes that the current orthodoxy appeals for the replacement of direct objects with a claim of perceptual experience which are characterized by representational context rather than

independent content. Finally he suggests that modern empirical insight is steady even in the case of illusion and delusion.

In the subsequent research titled *Perception and its* Objects, Brewer, (2011) discusses the fundamental problem in the philosophy of perception compared to the current theoretical conception of perceptual experience. He also discusses the philosophy of perception and how we should best understand the fundamental nature of perceptual relation with physical objects in the environment around us. Further he states that to avoid fatal problems that confront in early modern conception of perception a perception analysis in representational content is needed. Finally the author provides a critical and historical account on the philosophy of perception in order to endorse a defensible evidence of empirical insights of realism which is correlated to the mind as independent in relation to the objects in the environment around us.

Sathian's (2005) research article on *Visual cortical activity during tactile perception in the sighted and the visual deprived* is an experimental research which was carried out by demonstrating the activity of visual cortex during the tactile perception. The subjects considered for the study are visually impaired who have the visual deprivation in different durations. The primary discussion of the paper highlights the investigations on visual cortical activity which according to him are regularly associated with neural processing that involves tactile inputs in normal individuals. Later part of the paper depicts the possible and impossible reasons of visual cortical activity in the blind subjects. Subsequently the paper highlights shifts and effects in visual deprivation individuals by examining the involvement of visual cortex and language.

In the subsequent research by Sathian K and R Stilla (2010) on *Cross-modal plasticity of tactile perception in Blindness* discusses mainly on cross-modal plasticity which according to them resulted from visual deprivation. The Author opine that tactile perceptual performance in the blind

is practice related even though there are unsolved questions regarding the influence of braille reading experience. Finally the study suggests that in the visually impaired people, plastic changes are frequent over a period of time during the day.

Whitt's (2011) paper *(Inter) Subjectivity and evidential perception verbs in English and German* is a constructive paper from the corpus linguistic perspective. The study mainly focuses on examining verbs of visual perception in English (*see* and *look)* and in German (*sehen* and *aussehen*). As a part of the study he reviewed the concepts and approaches to subjectivity and intersubjectivity by taking into consideration evidentiality. He highlights how speakers and writers relate to the addressee called `stance and engagement'. The study is diachronic in nature because it considered two time periods involving modern and early-modern periods. He found that perception verbs in English and German express evidential meaning in a number of patterns which are linked to the subjective meaning constructions.

The research article on *Universal meaning extensions of perception verbs are grounded in interaction* by Lila San Roque and others (2018) is a corpus based study involving conversational discourse involving 13 languages from various language families. They included five major national or international languages and eight under-developed tribal languages. These languages covered continents like America, Asia, Africa and a few islands of Pacific ocean. The language families include Austronesian, Barbacoan, Duna-Bogaia, Indo-European, Mayan, Mon-khmer or Austroasiatic, Niger-Congo, Sino-Tibetan and Tai-Kadai. The study is broadly divided into three parts, viz. building lexical frequency, providing semantic and pragmatic association of perception verbs and extensions of perception verbs.

Niladri Sekhar Dash and S.Arulmozi's (2018) book on *History, Features and Typology of Language Corpora* mainly concentrates on Indian language corpora. The book has extensively discussed the corpus from various languages of India belonging to the four major language families of India. In one of the chapters, the authors discuss the problems involved in the translation of parallel corpora, especially those sentences involving different types of verbs including semantic extensions. The book has also taken into consideration people who belong to various disciplines viz. descriptive linguists, psycholinguists, sociolinguists, historians, comparative linguists, social scientists and people who are involved in interdisciplinary studies of linguistics and cognitive science on how they face problems in translating corpus which are polysemous in nature.

To sum, this chapter mainly highlighted the landmark works in the area, especially from the cognitive perspective. As part of this preliminary research, the researcher has taken into consideration studies from west as well as the south Asian context, particularly from the Indian perceptive. The overall understating of the chapter gives an idea that most of the studies are eurocentric comparing to Indian context.

Chapter 3

Cognitive Study of Perception Verbs

3.0 Introduction

The present chapter deals with the cognitive aspects of the sense modalities viz. vision, smell, touch and taste by excluding the fifth sense, i.e. hear. All the four sense modalities in the chapter focuses mainly from the cognitive perspective rather than the linguistic perspective. Each sense again is subdivided and explained with theoretical as well as experimental evidence. For all the four senses, data is collected from the intended subjects which are mentioned in the methodology section earlier. Along with the general mentioning in the methodology section, the clear description for each sense is provided in the respective sections in this chapter. All the four senses are presented in the vertical direction, i.e. from vision to touch leaving out hear which is horizontal in the human body.

3.1 Vision

As it was mentioned in the ancient texts, "*sarvendriyanam nayanam pradanam*". Vision plays a vital and important role in our daily life which directly or indirectly helps all human beings to go back to the past and see what happens and also go forward and see what happens. For every human being, without vision is considered as hell. Even in the literatures of the world languages, if you consider English language, where one of the great poets, John Milton penned the great two epic books on *Paradise lost* and *Paradise regained* after he lost his vision. In these books, he discusses things that he has never envisioned or seen in his entire life when he was possessed with vision. Though he lost his vision at the age of 50, he foresees the future and the past with his eyes. So in the case of blind people, how they will see the world around them is the most important

thing. This has been a research topic for many interdisciplinary studies, especially in cognitive sciences. In the following section study, it is intended to check out how blind people see and perceive the world around them in comparison to the normal people.

3.1.1 Earlier Studies

In the area of perception verbs, metaphors play a vital role. The reason is that they explain about the surrounding world by using a vocabulary which has a hidden meaning or a clarity in expression which try to map similarities in two different expressions. The result of the senses in any human kind should be closely associated with vision in order to understand the physical or mental world. Along with these associations, metaphors explain associative perception to bring out total understanding. Cognitive scientists usually do not identify metaphors as just a figure of speech but as a neural mapping that impacts how people imagine and think in daily life. They also enable us to describe abstract fields (emotions, opinions, space, time etc.) using more associative knowledge. The above statements clearly endorse that metaphors and cognitive science have a close relation which were supported and advocated by several studies. According to (Sweetser 1990), several non-physical words acquired their meanings when metaphors of physical meaning were extended in the usage of non-physical words. For example, "see" is used analogously to "understand", where the 'former' is a physical word while the 'latter' is a non-physical term. Likewise, the usage of metaphors emphasises the understanding of language between the speaker and listener. The linguistic understanding is a cognitive aspect which relates to the linguistic "metaphors". According to Grady (1999), most of the theories on metaphors do not explain why some domain mappings are not feasible. But, metaphoric language is considered to be an expression of creative thinking. The cognitive aspect of metaphoric generation is not yet explored to a good extent. Metaphoric mappings can be viewed as either of the two categories: metaphors

which express similarities and metaphors that institute categorical memberships. The method of mapping, however, depends on the extent of conventionality, form of grammar and order of the words.

In general, metaphor generation is classified into conventional and novel metaphors. Conventional metaphors are based on Contemporary theory of Metaphors (Lakoff & Johnson, 1980). According to this theory, metaphor is not a language affair but that of thought and reason, which is a cross-domain mapping with respect to conceptual systems. Source-domain is where we extract metaphorical expressions while target-domain is where we try to understand a certain thing using the knowledge of source-domain. Mapping is of primary importance along with language in metaphors. The conventional way of using metaphors involves conceptualising words in source-domain to infer something in target-domain. If language was primary, different linguistic expressions refer to different metaphors. For example, the phrases: spoon-feeding information, food for thought, digesting facts, and half-baked ideas converge to the mapping between food and ideas – "Ideas are food". Here, food has been conceptualised as an idea and it does not alter with varying linguistic expressions. Other examples of conceptualising one domain into others are: "Love is Journey", "Argument is War", and "Social organisations are Plants" (Lakoff & Johnson, 1980).

On the other hand, novel metaphors are those that do not link source to target in a straight-forward way. Novel metaphors are unique, creative, and often do not fall in our structured knowledge. They can be considered to be extensions to conventional metaphors. For example, "I found myself in darkness while in the middle of life's road". Here, the conventional metaphor "Life is a Journey" extracts the meaning out of the novel metaphor "Life's road". It is therefore understood, from both conventional and novel metaphors, that thought, and reason play a vital role

in metaphor generation while language is secondary. Hence, it is necessary to explore the cognitive functions related to conventional and novel metaphors generation.

Within the field of metaphor generation, this work is confined to metaphors of perception. The investigation of how we understand the five senses construct how we map the perception (physical) domain onto abstract domains metaphorically (Sweetser 1990). Studies that were done previously on metaphor generation have observed that cognitive functions contribute to novel and conventional metaphor generation. As discussed above, metaphor generation is often related to creative thinking and thereby, to cognitive abilities. Cognitive abilities such as vocabulary, selective attention, and working memory seem to have played a major role in generating conventional and novel metaphors. Beaty and Silvia, 2013 investigated the contribution of Cattell-Horn-Carroll (henceforth CHC) model of intelligence in the generation of different types of metaphors. The CHC model is a three-layered model necessarily consisting of Fluid Intelligence, Crystallized Intelligence, and Broad Retrieval ability. CHC is a significant theory for the study of human intelligence.

Fluid intelligence is a capability of reasoning and solving new problems without reckoning to pre-existing knowledge or skills. Abstract thinking and logic are used to solve novel problems. Therefore it is shown that creative thinking is dependent on the fluid intelligence of a person. Solving a puzzle or mathematics problem, creative activities such as painting, composing music or dance demand utilisation of fluid intelligence. However, Crystallised Intelligence refers to the ability to solve problems by relying on the knowledge acquired through experience or education. This type of intelligence is employed when one faces problems that call for previously attained knowledge and skills. Literary tests that check vocabulary or grammar, having a basic knowledge of various subjects involve the usage of crystallised intelligence. The Broad Retrieval Ability is

the faculty to store and retrieve the information as and when necessary. Examining broad retrieval ability and mental speed enables the understanding of divergent thinking which in turn is a measure of creativity of a person. Divergent thinking is the ability to think in many different possible ways to an open problem. It involves thinking in a non-linear manner and finding different ways of solving a problem. For instance, as a part of the Indian Air force recruitment process, a blurry picture is shown to the candidates and they are asked to describe the picture according to their intuition. This instigates a divergent thinking process in the brain of the candidate which may come up with many likely descriptions justifying the shown image. Several researchers made the participant take different tests and to generate metaphors to then classify cognitive abilities associated with the generation of conventional and metaphor generation.

Abilities that are likely to play a role in generation of metaphors are working memory (*Corsi or digit span test*), selective attention, vocabulary knowledge, inhibitory control measures which were examined to understand their effect on generating conventional metaphor. Selective thinking is the competence to focus only on a part of the available information which is relevant and ignore the irrelevant information (Kenemans et al., 2005). The dependence of attention and metaphor generation is not exclusively studied yet. But few studies stated that the dependence on working memory and attention mechanisms have been attempted (Kane and Engle, 2002) but these are still unclear in the framework of metaphors. Several experiments were conducted to test the comprehension of metaphors. These experiments include testing quality of the metaphors produced based on span test (Chiappe & Chiappe, 2007) and inhibitory control measure; fill in the blank test including different situations to investigate verbal fluency, vocabulary and executive functions such as working memory (Taylor, 1947). As a result of these experiments, it was comprehended that crystallised intelligence and working memory impact the generation of

conventional metaphors but these claims are mostly on the Eurocentric subjects and on age groups which range from 18 to 30 and all these studies that focus on these abilities do not clearly consider the bilingual factors in relation to monolingual speakers. To explore the cognitive mechanisms influencing novel metaphor generation, fill in the blank space in between these research this study will try to shed some light. Analysis of creative metaphor generation is a result of the study of fluid intelligence which involves inductive reasoning values (non-verbal, visual, and spatial). In addition to the study of cognitive mechanisms involved in the generation of metaphors, it is interesting to study how metaphor generations are processed cognitively. Few fMRI studies probe in how subjects create metaphors and which areas were in activation during the process of metaphor generation. Increase in brain activity was observed in the left-hemispheric region, posterior cingulate cortex and left dorsomedial prefrontal cortex. The left dorsomedial prefrontal cortex was activated during the process of metaphor production and was linearly proportional to the creativity of the metaphors generated. The non-literal language (generally metaphors) induced higher activity in the brain as compared to normal conversational language. It is also interesting to note that the same brain areas are activated for metaphor comprehension and generation, though the cognitive mechanisms involved are different (Benedek, et.al. 2014).

The present study has its major focus on the verbs of perception especially how the verbs of vision act in terms of generation of metaphors which will be discussed in the following sections. However, as a whole the verbs of perception largely refer to "see, hear, taste, smell, and touch", and can be broadly classified into three groups:

(I) The set of verbs which work involuntarily. They are known as *passive perception verbs* (Poutsma, 1926). For example:

(4) *raamu-du oka pakshi-ni cuus-aa-du*

Ram-NOM one bird-ACC see-PST-3rd.SG.M

Ram saw a bird

(5) *ramyaa-ki gadi-lo caapa vaasana vacc-in-di*

Ramayya-Nom-ACC temple-LOC fish smell come-PST-3rd.SG.NonM.

Ramya smelt fish smell in the room

(II) The set of verbs which "perceive expression deliberately controlled by humans", They are also called *active perception verbs* (Viberg,1983). For example:

(6) *ramudu oka cheTTu vanka cus-a:-du*

Ram-NOM-PNG one tree at see-PST-3rd.SG.M

Ram looked at a tree

(7) *Neeta Caapa va:sana chu:s-in-di*

Neeta-NOM fish smell come-PST-3rd.SG.NonM.

Neeta smelt the fish.

(III) The third group of verbs are those whose subjects are the stimuli of perception. They are also known as *flip verbs* (Rogers,1971;1972). For example:

(8) *ramudu a:nandam-ga kani-pis-tunna:-du*

Ram happy-ADVM look-seem-NPST-see-PST-3rd.SG.M

Ram seemed happy

(9) *Neeta manci vasana kodu-tun-di*

Neeta good smell spread-NPST-come-PST-3rd.SG.NonM.

Neeta smelt good.

The first set of verbs refer to experience, the second refers to the activity (which is the focus of the present study) and the last set of verbs refer to perception. These perception verbs are polysemous as well as metaphorical in nature. Metaphors as tools of language are not only characterised by the poetic language but the process of it being cognitively involved has a major focus while addressing deep rooted phenomena. A word having multiple meanings, also known as polysemy, is an intrinsic facet of all linguistic systems (Dikker, et al., 2010). For example, the word sweet is used to describe different sensory modalities: sweet fragrance, sweet voice, and sweet taste. Here the word "sweet" exhibits different meanings in the three different phrases but they are all related to the meaning sweetness and these meanings are nevertheless used in metaphorical generation.

Researchers are particularly interested in the study of metaphors of perception as it constitutes the convergence of physiological experience with linguistic systems of humans (Howes, 1991; Classen, 1997). Polysemy and extended meanings are common in all languages. "I see" is used to mean "I understand". In this example, seeing refers to a physical experience while understanding is more abstract and emotional which is not related to the literal meaning of seeing. Those perception verbs that do not translate literal meaning but are semantic extensions to the word are also called as "Transfield meanings" (Matisoff, 1978). It is inaccurate to think of metaphors as a characteristic of just language, they are found to be the process of human thought process. Metaphors are a way of understanding the surroundings largely involved in both voluntary and involuntary processes. Metaphors are so deeply rooted in our cognition that we sometimes use them involuntarily (manasia, 2016). Conceptual metaphors which are the foundation for different

linguistic expressions and having extended to cognitive concepts which examines the language. Metaphors often translate a relationship into a concept by intersecting from one to the other. This transposition is based not only on physiological experience but also on social and cultural experiences. As discussed earlier, Viberg in 1983 extensively studied passive perception verbs to find the plausible direction which is to see hierarchy models and just followed certain polysemy trends (Ullmann, 1945 and Williams, 1976) but did not consider the other aspects of language involvement. In other words, if a word is visually perceived initially this process allows extensions for audition, touch and taste if yes, what is the hypothesis behind it. Likewise, when verbs of perception have metaphorical characteristics which also define the way language works are to be understood which are not considered in previous studies. Sweetser (1990) also advocates the unidirectional extension of meanings from physiological experience to abstract or cognitive aspects. The source domain of a metaphor refers to the physical experience while the target domain is the perception of emotions'. San Roque, Kendrick et al., (2017) conducted a study to learn the extended meanings of perception verbs on the grounds of day-to-day conversations. The data was collected from daily life informal interactions in thirteen different languages. In each language, a set of perception verbs, for each of the five sensory modalities, which had multiple meanings were recorded using Viberg's (1983) method. The dataset considered does not provide quantitative dominance of one sensory modality over others. Also, the study concluded the presence of extended meanings. However there seems no empirical evidence for all these claims. These words were investigated regarding meaning and form to identify polysemous nature among the five sensory modalities in different languages. It was observed that the vision modality had a rich collection of extended meanings. Levin (1993) in her seminal work on *English Verb Classes and Alternations: A Preliminary Investigation* has classified a set of English verbs among those, the

verbs of perception are extracted and classified, where in Vision verbs related words extend in varied numbers. Similarly, Sweetser's (1990) work talks about the extension of particular verbs denoting verbs of vision where the words like see, know, watch out, look are visual in the literal meaning, but they intend to other extensions such as knowledge, understanding, being attentive against a threat and so on; similar attempt has been made in the present work later. Similarly, other sensory modalities were also explored in terms of understanding their metaphorical extensions. Gibbs (1991) affirms that metaphorical extensions in experimental results may give more insights in understanding metaphors. While mapping the metaphors it is not only random or arbitrary but the concept of metaphors are induced in mind and everyday experience of the physical and cultural world. It is captivating to note the impact of universal and culture-specific experiences on the perception verbs have an impact on the metaphorical expressions. It is also interesting to understand the consequences for the study of the nature of abstract thoughts (Danesi, 1990). There seems to be a bias towards sight modality which may give rise to the varied formula for "Thinking is Seeing" (Dundes, 1972;). Hoffman (1985) further presented a wide range of the applicability of this formula, from conventional to novel metaphors. Some examples from Telugu presented below:

(10) *idi anta nee nammakam meeda a:darapadi untun-di*

this all you belief on depend be-come-PST-3rd.SG.NonM.

It is all dependent on your 'outlook'.

(11) *nuvvu chepp-in-di na:ku anta-ga ardam ka:ledu*

you-Nom tell-PST-3rd.SG.NonM. me fully-ADV understand not

I do not quite "see" your point.

The strong association between visual perception and abstract domains proposes a sensorial base to cognition which is explained by (Arnheim, 1997) in his book "Visual Thinking". According to Arnheim (1997) thinking happens in the sphere of sensory modalities. He also adds that perceptions are structured by us into a comprehensible form which enables us to think and understand. The usage of conventional or novel metaphors takes place instinctively in our daily communication which is explained in the statement "abstract thinking is an extension of bodily experiences" (Johnson, 1987). A more general pattern constitutes the interaction between perception and cognition which is "Thinking is Sensing". Example: the book stinks, she touched upon my views, the level of heat is over my head (Benjamin Lee Whorf, 2012). However, the universalisation of this correlation between sight and intellect is highly questioned by many researchers (Fernandez, 1991; Kövecses,2005). Abstract thinking is not restricted to visual metaphors only, but it is extendable to other terms. Example:

(12) *parpakvata chendani a:lochana*

riped not thought

Food: *half-baked* idea

(13) medadu-ku metA

thoughts in brain-DAT food

food for thought.

Structures:

(14) mu:la siddantam

corner/foundation theory

foundation theory

(15) drav-arupamlo unna dabbu-lu

liquid-in the form be money-PL

liquid money

To reinforce the association between visual metaphors and abstract thinking, a set of four hypotheses were considered by Danesi in 1990 and the strength of the claim was tested. The hypotheses were based on the existing psychological and linguistic evidence:

a. Iconicity Hypothesis: In the modem of Cognition and Perception the aspects of vision and visual thinking are dominant.

b. Sense-Implication Hypothesis: abstract thinking derives from the sensorial domain.

c. Cross-lingual Hypothesis: Visual metaphors are observed in phylogenetically-unrelated languages (those languages which do not have lexicon which represents evolutionarily developed objects or a feature of an organism).

d. Glottogenetic Hypothesis: Core vocabulary referring to abstract thinking are largely based out of visual metaphors.

A theoretical inquest of the set of hypotheses led to the conclusion that abstract thinking indeed related to sensory modalities and especially to the visual system. At this stage it is interesting to look into Nietzsche's (1979) who has come up with a model that has a four-stage concept formation viz.Nerve impulse, Image, Sound/word and Concept. The concept of the nerve impulse which is the perceptual input formed into an image is the base for concept formation. This correspondence between the images and sound produces metaphors which are stored in the

memory to form concepts. Nietzsche (ibid) further argues that cognition is just the fabrication of image-led speech. Among the lines Antuñano (2008) was interested in investigating whether perceptual metaphors are arbitrary or motivated? In other words, why see translates to understand and *bright* to happy? The author questions the interdependence of perception and cognition to be universal or language dependent. The arbitrariness in the connection is restricted after an extent and is based on physical and socio-cultural experiences. This dependence on other parameters is called motivated language or an embodiment in cognitive linguistics. It is now captivating to understand if this conceptual grounding is universal or language specific. Since all our in-built mechanisms with regard to sense modalities are the same, the way we interpret the world should be in similar lines. So, we can assume the extended meanings (semantic extensions) to be universal. But it is to be noted that vision is not always related to knowledge or understanding in all languages. Evans & Wilkins (2000) and also state that hearing verbs also extend to "know", "understand", "remember" and "think" while sight or vision words refer to desire, aggression and supervision. Similarly, the smell is the leading perception in Ongee language of Andaman Islands (Classen, et.al. 1994) and touch for Tzotzil language of Mexico (Classen, 1993). There are some cultures where a combination of sensory modalities drives their cognitive abilities. The dominance of vision over cognition is not shared by all the languages but it is prevalent in most languages. Some languages like English, Spanish and Basque, despite the genetic differences, share the same extended meanings of see, hear, and smell because of common cultural backgrounds. Therefore, to understand the motivation behind the extended meanings of perception verbs, it is essential to consider biological and cultural backgrounds (Levinson, 2000). From the available literature, the idea of metaphorical mapping or generation has given some idea but knowing it from different languages and different subjects such as monolinguals and bilinguals further will shed new insights

in the processing of metaphors. The present study has attempted to focus on how the older age bilinguals and monolinguals percept and generate the metaphors. The study by Cosco et.al. (2014). investigates the association of novel and conventional metaphor generation and influence of cognitive functions among bilinguals and monolinguals and advocates that physical activity and cognitive strength enables "healthy ageing". One such mechanism which helps in reduction of cognitive ageing is bilingualism due to which several researchers are interested in the study of the connection between multilingual people and cognitive advantages (Bak et.al. 2014). Bilingualism has been a highly debatable topic of late. Studies showed bilinguals tend to activate information of both languages to some degree while one of the languages is active (Kroll, et.al 2012). Researchers found a positive relationship between bilingualism and cognitive functions like monitoring (Costa, et al., 2009), selective attention (Chung, et.al. 2017), attentional disengagement (Mishra et.al. 2012) and better inhibitory control (Green, 1998). Bialystok (2017) affirmed that bilingual individuals outperform their monolingual counterparts in tasks that demand executive control. It was further added that the bilingual advantage was observed at all age groups who shared the same age and backgrounds (Białystok et.al. 2012). Hilchey et.al. (2015) found few evidence that support the hypothesis with response to bilingual children having an advantage in inhibition and conflict monitoring. Further, the cognitive effect of bilingualism can be observed more in older ones than the younger people due to their usage for a longer-term and higher experience. In addition to cognitive advantages, various researchers also provide us with evidence which reveals neurological effects. Lesser degradation of white matter substance and better anterior connectivity is observed in older aged bilinguals in comparison with monolingual counterparts (Abutalebi, et.al., 2015). Additionally, increased tissue density in cortical areas

corresponding to cognitive functions was reported in older bilinguals (Gold, et.al., 2013, Perani et al., 2017).

However, there are also studies which contradict the bilingual advantage experienced on cognitive functions. Paap and others (2015) conducted tests to investigate bilingual advantages that yielded null results and those tests which resulted in significant advantage were carried out on a small scale. These findings were strengthened by neuroimaging results which did not identify any behavioural advantage in bilinguals despite having found different patterns of cognitive functionality specific to a task (Ansaldo, et.al., 2015). When mechanisms with higher cognitive control were isolated the performance of monolinguals and bilinguals were on the higher side comparable (Paap, et.al. 2014). Ivanova et al., (2016) study stated that older bilinguals show lower performance in inhibiting while switching between languages. Some studies also showed that individuals who are bilinguals for a lifetime are less prone to neurodegenerative diseases and neural tissue density is conserved (Alladi et al. 2017). In contradiction to this line of study too, several other researchers did not find any age difference in the onset of dementia (Lawton, et.al. 2015) or Alzheimer's disease (Clare et al., 2016) among monolinguals and bilinguals based on hospital records. Most of the studies that substantiate bilingual advantage uses inhibitory control tests like Simon, Stroop, or Flanker tests. Simon test measures the response-stimulus compatibility (Simon, 1969). According to Simon (ibid), there is an innate tendency to respond to the source of stimulation. Reaction time is measured between trials in response to the stimulus. Simon test helps in the design of human-machine interfaces. Eriksen Flanker task (1974) is a test for selective attention and inhibition is used to analyse the ability of a person to differentiate between relevant and irrelevant information concerning a context. Three types of stimuli are used in Flankers test viz. congruent stimuli, incongruent stimuli, and neutral stimuli. The congruent stimulus is when

the same response is called for the target and appears identical. Incongruent stimulus calls for the opposite response as that of the target whereas the neutral stimulus does not call for either the same response or opposite response. As discussed earlier studies metaphor generation and attention have relevance. As discussed in the previous sections, metaphor generation may have contributed to the executive functions. Therefore, a probe into a novel and conventional metaphor generation in older bilinguals and monolinguals invokes an understanding of the effect of bilingualism on different cognitive mechanisms as well the contribution of the test batteries in this process. In the following section, we will discuss the methods adopted to conduct different tests and the results obtained by statistically analysing the data.

3.1.2 Materials and Methods

Subjects

For the conduct of experiments on the perception of vision viz. metaphor generation task, flanker task, Corsi task, LexTale task, Semantic Fluency Task and Language Questionnaire, fifty-six subjects were chosen. A total of 56 subjects were chosen for the purpose i.e. 28 older bilinguals and 28 older monolingual subjects within the age group of 50-65 years are taken into consideration for the purpose of the study. The mean ages are 55.57 (bilingual group) and 54.33 (monolingual group). All the subjects are native Telugu speakers and who have the background of good health with no history of cognitive impairments or neurological disorders. The researcher has taken oral and written consent before starting the experiment and all the subjects participated in the experiment voluntarily. The subjects who participated in the experiment do not have any previous exposure to the experiment conducted.

3.1.2.1 Metaphor Generation Task

The Metaphor Generation task is one among the tasks used in cognitive studies. The task is meant to access the generative capabilities of metaphors by individuals in the concept. This test was used by Kasirer and Mashal in 2016. Similar concept is used in our study but this task uses the classification of metaphors of Ibarretxe–Antuñano (2002) in the perception domain in order to study and analyze one of the perception verbs i.e. see.

Apparatus and Stimuli

In the present experiment which is a self-paced task the subjects were asked to generate novel and conventional metaphors based on the vision metaphors proposed by Ibarretxe–Antuñano (2002) which are translated into Telugu. These perceptual domain oriented sentences in Telugu language are given as examples to create the novel and conventional metaphors.

Procedure

This is a paper and pen task where subjects were individually given 30 minutes time to finish the task. If a novel metaphor was generated, 2 marks were awarded and if a conventional metaphor was generated 1 mark was awarded. If the subjects were using the same words or repeat the word 0 was awarded and the frequency of the zeros were also measured. A Telugu language expert cross-checked and coded the score along with the researcher to check the variability and reliability.

Results

In this task, both bilinguals and monolinguals were asked to generate vision related novel metaphors in Telugu language. If they generated correctly 2 marks was awarded, 1 mark for

conventional metaphor, and in case of repetition or no metaphor generation, 0 marks were given. All the results were noted, extracted, and distributed with respect to mean (M) and standard deviation (SD). The calculated mean and standard deviation are: Older Bilinguals - Novel metaphors generation based of perception verb of vision [M=2.07, SD=1.06], Conventional metaphors generation based on perception verbs of vision [M=2.0, SD=0.943] and Older Monolinguals - novel metaphors generation [M=1.14, SD=1.268], Conventional metaphors generation [M=1.73, SD=0.813]. The study shows that a statistical significance [t= 3.452, 6.143, p=0.01] exists among both the groups which depicts that older bilinguals are better in generating novel and conventional metaphors compared to monolinguals. However, the repetition among both groups was not significant [t=32.714, p=0.69] which shows us that both groups are similar in the repetition of metaphors [As shown in Table-1]

Variables	Bilinguals n=28		Monolinguals n=28		paired t-test analysis		
	Mean	SD	Mean	SD	t	df	Level of significance
Novel Metaphor	2.07	1.016	1.14	1.268	3.452	1	=0.01
Conventional Metaphor	2.00	.943	1.73	.813	6.143		
Repetition	1.11	.737	1.18	.983	32.714		=0.69

**p < 0.05 is measured as level of significance*

Table-1. Metaphor generation task showing the association between both older Bilingual and monolingual groups.

3.1.2.2 Flanker Task

Eriksen & Eriksen (1974) Flanker Task is used to assess the selective attention capabilities. This task measures the response time of the subjects while responding to relevant targets by excluding the irrelevant targets.

Apparatus and Stimuli

This is a laptop based experiment (Javascript) was used for the experiment and each trial of the task started with a fixation sign at 500ms and a stimulus will appear in the centre of the screen at 1500ms. Stimulus patterns consisting of (ffffff) congruent trial and (hhfhh) incongruent trial were presented on a 15.6 inches screen with 70Hz flickering frequency rate on a white background.

Procedure

Subjects consisting of old-age monolinguals and bilinguals were asked to sit comfortably with the laptop and asked to concentrate on the stimulus and when a pattern of stimulus appeared, subjects were asked to respond by pressing the "F" or "H" for the corresponding middle letter. The trial interval between each stimulus is 1500 ms and all the subjects were asked to be focused and quickly press the respective keys. The overall trials are 839 where 31 trials are practice versions and 808 are experiment test-based which took approximately 30 minutes to complete.

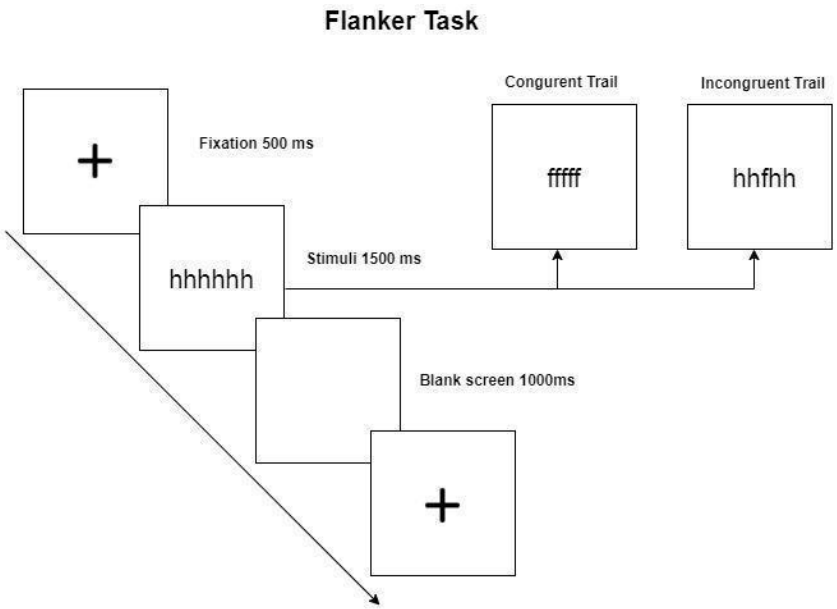

Figure-3. Flanker task stimulus illustration presented on 15.6 inches laptop screen with 70Hz flicker frequency on a white background.

Results

Responses from both the group's (older bilinguals and monolinguals) were extracted and verified for confounding variables and segregated from the raw data for final analysis. Total trials involved in the experiment were 839 among which 31 (3.69%) trials belong to the practice task which is not a part of analysis. Final 808 (96.31%) trials were included for analysis. Both the groups' reaction times (RTs), congruent and incongruent responses were investigated. Mean and standard deviation (SD) of RTs was used to interpret the results. These were extracted individually from all the subjects for each trial and they were compared to the overall mean and standard deviation of both the bilingual and monolingual groups.

When we studied the association between RTs of older bilinguals and monolinguals with respect to the paired t-test, the following results were obtained: In Older Bilinguals - Congruent stimulus [M= 441.91, SD=208], Incongruent stimulus [M=501.10, SD=131.6] and for older

Monolinguals – Congruent stimulus [M=608.92, SD=109.01]. The association between RTs of bilinguals were significant [t=3.896, r= +0.83, df=2, p<0.01]. This implies that bilinguals showed lower RTs which reveals that bilinguals are more attentive or focussed than monolinguals as the correlation between the RTs and attention is positive. [As shown in Table-2]. The mean comparison between both the groups' congruent and non-congruent trials RTs and are illustrated in the bar graph [As shown in Figure-4].

Additionally, we also considered Bayesian factors and Chi-Square test to find the group differences between the older bilingual and monolingual subjects. Results of this test showed a significant likeli-hood ratio between both the groups [χ^2= 11.90, df=5, p=0.03]. These findings suggest that bilingual participant groups have higher attention and faster reaction times compared to the monolingual group.

Reaction Time	Bilinguals n=28		Monolinguals n=28		paired t-test analysis			
	Mean	SD	Mean	SD	T	r	df	Two-tailed significance
Congruent	441.91	208.16	608.92	109.01	3.896	+.083	2	< 0.01
Incongruent	501.10	131.64	630.47	110.31				

**p < 0.05 is measured as level of significance*

Table-2. Flanker task showing the association between both older Bilingual and Monolingual subjects.

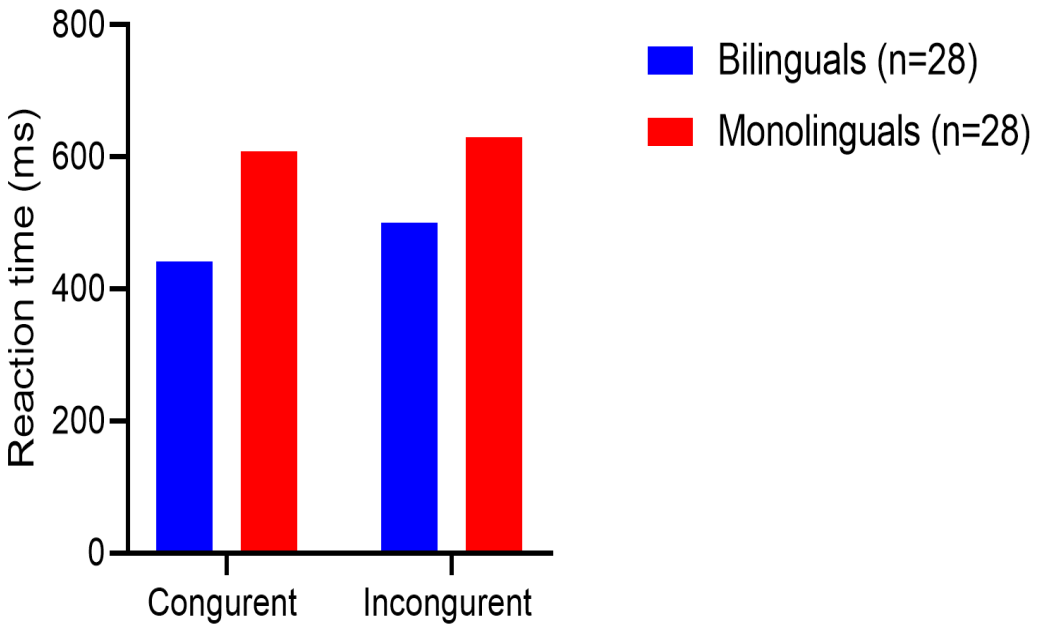

Figure-4. The Bar graph showing the Congruent and Incongruent Mean RTs difference between Older Bilingual and Monolingual groups.

3.1.2.3 Corsi Task

The Corsi task is used to measure the working memory and this task was developed by Corsi, (1972) this task was later upgraded and its computerised format is widely known and used, corsi block-tapping task.

Apparatus and stimuli

Psytoolkit, an online platform was used where stimuli was presented on a 15.6 inches laptop screen with 70Hz flicker frequency and the test began with a set of stimuli that flickers on the monitor into pink colour square blocks.

Procedure

The subjects consisting of both older monolinguals and bilinguals were made to sit comfortably in front of the laptop and asked to see and remember the sequence of the square boxes and respond quickly to the same sequence of boxes that were flickering. If subjects respond to the correct sequence then the test continues, else it gives three chances, and the task will end with the score and errors report. The stimulus illustration is shown in Fig-5.

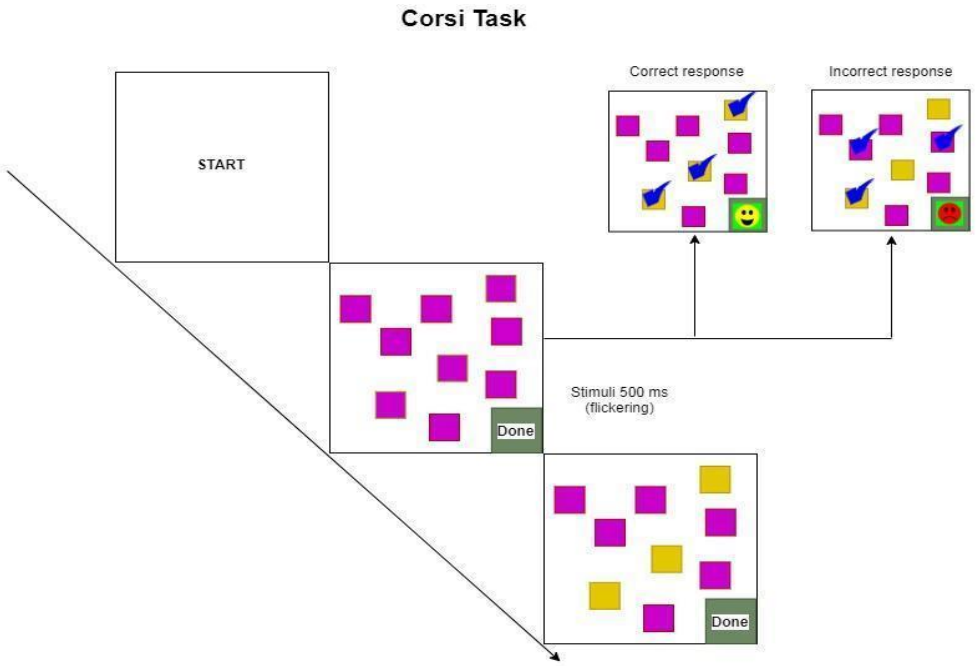

Fig-5 Corsi task stimulus illustration presented on 15.6 inches laptop screen with 70Hz flicker frequency on a white background.

Results

We administered the Corsi task to study the working memory association between both older bilinguals and monolinguals. In this working memory task, the Corsi span of bilingual subjects is [M=6.82, SD=0.772] and monolinguals is [M=3.67, SD=.209]. The difference between

both the groups was measured using a chi-square test which detected a statistically strong significance [χ^2 =11.37, df=3, p< 0.05]. This shows that bilinguals are better than monolinguals in storing the working memory as well. However, the error rate between both groups was not significant [χ^2 =5.56, df=3, p=0.62]. Although the error rate was similar in both groups memory performance was higher in bilinguals than monolinguals [As shown in Table-3].

Corsi span task	Bilinguals n=28		Monolinguals n=28		Chi-square test		
	Mean	SD	Mean	SD	χ^2	df	Level of significance
Corsi span	6.82	.772	3.67	1.209	11.37	3	< 0.05
Errors	2.46	.637	2.63	.742	5.56		=0.62

**p < 0.05 is considered as the level of significance*

Table-4. Corsi task showing the association between older Bilingual and Monolingual.

3.1.2.4 Semantic Fluency Test

This task was used to assess the verbal fluency in L2 as this task takes note of the number of words obtained in one minute time Kavé (2005).

Apparatus and stimuli

This is a self-paced task where all the subjects are asked to utter as many words as possible from their experience and knowledge based on four parameters viz. Birds, Vegetables, Animals, and fruits in one minute.

Procedure

Subject answers (i.e. number of words) are noted and the time is monitored by the researcher, so that subjects can complete the task in one minute. The variables considered from this test was semantic fluency score (SFS).

Results

In this task, we measured the semantic fluency of both bilinguals and monolingual subjects. The variable measured in this test was Semantic Fluency Score (SFS). Mean and SD were used to see the distribution of semantic fluency between both the groups. In the bilinguals - [M=84.15, SD= 5.28] and monolingual - [M=36.23, SD=9.38], were observed and the mean difference is higher in Bilinguals than monolinguals [t=2.51, df=1, 95%CI = -244.24 to 64.63, p=0.02] which showed a significant association. These findings suggest that old-age bilinguals are higher in producing words than the semantic fluency score of monolingual subjects.

Bilinguals n=28		Monolinguals n=28		95% Confidence Interval		One-Sample t-test		
				Lower	Upper	t	df	Level of significance
Mean	SD	Mean	SD	-244.24	364.63	2.51	1	=0.02
84.15	5.28	36.23	9.38					

**p < 0.05 is considered as the level of significance*

Table-5. Semantic fluency scores showing the association between both older Bilingual and Monolingual subjects.

3.1.2.5 LexTALE

Cognitive researchers used this test to see the proficiency in English, to understand the level of English language of the subjects in an experimental setup. (Lemhofer, 2012)

Apparatus and stimuli

This is an online based computer task (laptop), which has 60 trials and takes approximately 3.5 minutes to complete the task.

Procedure

In this task subjects were asked to respond if the given word in English is a word or non-words and the mean of the final scores were calculated.

Results

In this task, we measured the L2 language proficiency among both the groups. Mean, SD was used to see the distribution. In bilinguals, the LexTALE score is high [M=8.9643, SD=1.23] when compared to the monolinguals [M=5.74, SD=0.83]. One-sample t-test showed that significant [t=4.56, df=1, 955 CI= -13.12 to 27.83, p=0.01] association exists and these findings explain that old-age bilingual subjects have a stronger language proficiency in L2 than monolinguals. [As shown in table-6].

Bilinguals n=28		Monolinguals n=28		95% Confidence Interval		One-Sample t-test		
				Lower	Upper	t	df	Level of significance
Mean	SD	Mean	SD	-13.124620	27.830020	4.56	1	p = 0.01
8.9643	1.23	5.7411	0.83					

**p < 0.05 is measured as level of significance*

Table-6. Lextale scores showing the association between both older Bilingual and Monolingual subjects in vocabulary and language proficiency.

3.1.2.6 Language Questionnaire

After all the experiments, the subjects were asked to fill the standardised language questionnaire (Mishra, et.al 2019) that consists of a set of questions related to their L1, L2 and L3 followed by their subjective rating towards the language acquisition and usage followed by demographic details related to the experiment. All the questions are compulsory to respond and a 100% response rate was received from all the fifty-six subjects.

Results

In the language questionnaire (self-rated), we asked subjects to respond on their L1, L2 and L3 speaking, reading, and usage abilities along with the age of language acquisition. The responses were noted and distributed around mean and SD for both bilingual and monolingual subjects. From the language questionnaire, it was observed that bilinguals have more advantages than monolinguals in all the aspects. Language switching was also higher in bilinguals compared to the monolinguals. All the results are represented in the below table [As shown in Table-7].

Language Questionnaire	Monolinguals (n=28)		Bilinguals (n=28)	
	Mean	SD	Mean	SD
Age (in years)	54.33	2.944	55.57	3.048
Began acquiring L1:	2.55	.506	2.93	.539
Began speaking fluently in L1	8.00	1.031	9.21	1.197
Began reading L1	6.52	.795	7.54	1.170
Speaking:	9.39	.496	8.46	.576
Understanding spoken language	9.91	.292	9.21	.630
Reading	9.42	.502	8.64	.731
Began acquiring English	11.94	7.106	16.93	1.331
Began speaking fluently in English	13.61	8.257	21.39	1.663
Began reading English	11.94	7.106	17.11	1.197
Speaking	1.79	1.728	7.64	.731
Understanding spoken language	2.12	1.850	8.39	.629
Reading	1.55	1.660	7.79	.738
Began acquiring L3	7.88	6.909	7.14	7.840
Began speaking fluently in L3	9.33	8.215	9.39	10.318
Began reading L3	7.94	6.955	7.32	8.074

Speaking	1.42	.502	3.75	3.026
Understanding spoken language	1.55	.506	4.07	3.377
Reading	1.06	.242	3.46	2.728
The onset age of bilingual usage	15.36	1.432	16.75	1.481
Language attitude			5.50	1.000
I feel like myself when I speak in my native language	5.97	.174	4.04	.693
I feel like myself when I speak in English	1.30	.883	4.57	.997
I prefer speaking in my native language most of the time	5.79	.415	4.93	.900
I prefer speaking in English most of the time	1.61	.998	4.54	.999
I prefer listening to my native language most of the time	5.79	.415	4.64	.826
I prefer listening to English most of the time	1.61	.998	4.75	1.005
I prefer reading my native language most of the time	5.64	.489	4.61	.786
I prefer reading English most of the time	1.58	.902	4.75	1.041
I prefer writing in my native language most of the time	5.64	.489	4.79	1.031

I prefer writing in English most of the time	1.55	.905	4.04	.693
How often are you in a situation in which you switch between the languages of your native language and English?	1.79	1.341	58.39	13.056
When choosing a language to speak with a person who is equally fluent in all your languages, how often would you switch between languages?	1.61	1.088	41.30	10.246
Native Language	85.91	6.784	2.50	3.191
English	8.03	8.286	41.30	10.246

Table-7. Language questionnaire responses between older age bilingual and monolingual subjects.

3.1.3 Discussion

In the current study, we have investigated the association between metaphor generation and cognitive functions in old-age bilingual and monolingual subjects. Interestingly, we found that the metaphor generation ability is higher in bilinguals than the monolingual subjects. These findings explain that generating novel metaphors in Telugu is challenging but the old-age bilinguals tend to perform better than the monolinguals which are much similar in the case of Flanker Task, Corsi Task, LexTALE and Semantic Fluency tests. These results are also parallel to the previous studies in adults where bilinguals produced better results in generation of novel metaphors (Kasirer and Mashal, 2018) (Menashe, et.al. 2020). When attention was measured between the old-age bilingual and monolingual subjects, we found that the bilinguals reacted faster

and had better attention quality when compared to that of monolinguals. Previous theories and empirical studies on bilingual advantage also similar to these findings of the current study (Mishra, R. K , 2019), (Kenemans, J. L , 2005) and the generation of novel metaphors which is much complex process was also performed better in older bilinguals and this may be due to profound selective attentional process in the bilinguals. In the corsi span task, it was observed that older bilinguals performed better than their monolingual counterparts; this may also be seen as a contribution to generation of better conventional metaphors as their working memory contribution must have been higher. As perception of the world is based on our sensory experience while generating vision related metaphors and vision is the main channel among the other senses it may receive information about the world (Sekuler & Blake, 1994). The information is received, processed and interpreted majorly by this sensory modality. Due to which it can be ventured that the vision verbs are generated much effortlessly. The error rate is almost the same in both the groups but the Corsi span has higher mean ratings in the bilinguals. This leaves us with a hint that bilinguals process the working memory at a higher rate and have better storage capacity than the monolinguals. Previous studies on working memory and bilingual advantages also show similar findings that bilinguals have higher processing skills compared to monolinguals (Bialystok, 2013), (Kerrigan, 2016) .

Other tests such as Semantic fluency score, Lextale and language proficiency also show a higher differentiation between the older bilingual and monolingual subjects. This may reveal that the language proficiency and vocabulary in bilinguals contribute to generate more metaphors and it may be due to good language abilities when compared to monolinguals. Previous studies on lexicon and advantages for bilinguals are in line by our findings. It was also observed that L2 proficiency is advantageous and can improve the cognitive and executive functions (Bialystok,

2012), (Clare, 2016) . Although the connection between dominant sense and cognition varies across languages, it is worth noting that the mappings are prevalent about perception metaphors. As a result of the several types of research conducted in connection between sensory perceptions and cognition, we can conclude that the extended meanings can be random and different while choosing the words and while creation of metaphors, but they have culture and individual experiences that help in conceptualisation. As humans differ in cultures, the ideal properties that apply to one culture (vision in the Indo-European languages) may or may not apply to different culture (vision in Dravidian) but in case of vision metaphors as studied by (Levin, 1993) in English and (Ibarretxe–Antuñano, 2008) in multiple languages metaphors in perception verbs seems to have similar nuances and can be seen as a formulae of this work of vision metaphors and executive functions . Many studies concluded that cognitive processes are correlated to linguistic polysemy. Sweetser (1990) observed that cognition is predominantly dependent on visual modality, as vision is the most dominant sensory modality among the five-sense model. However, hearing modality plays a vital role in cognition in Australian languages through the organic affiliation of audition and reception of speech (Evans and Wilkins, 2000). To summarize this study has its own importance in observing perception verbs metaphor generation in the light of older bilingual advantage and such combination in both area of study must be studied further to get more insights in this regard and while this work focuses on the vision metaphors generation in Telugu and its relation of executive functions need further in depth insights. In the case of old-age bilingual advantage this study cannot be a strong stand on the existence of older bilingual advantage as many works suggest. There might be a lot of other social, cultural, linguistic factors which may influence and furthermore studies have to investigate for a better understanding (Mishra et.al, 2018).

3.2 Smell

The sense of smell is central to all humans for identification of different odours as well as perceiving, filtering and detecting, the environment and its history has vast evolutionary dimensions, this sense not only extends itself to the sensing of food, flora and fauna, but it is extended to instances such as identity, survival from predators, hierarchy in social contexts (Shepherd, G. M. 2004). Attention towards the study of the perception of smell has increased globally since the eighteenth and nineteenth centuries (Engen, 1991). Odour memory has a variety of distinguishing properties.

Previous studies concerning cognitive olfaction emphasize that olfactory memory studies should make new resolutions and concepts for better identification of smells. However, the linguistic association and odour memory were ignored in most of these works (Herz, 1996). Even though some studies were on the olfaction metaphors where words of smell have been potentially analyzed based on their perceptual behavior by considering sentences like "I smell something fishy" which induce the sense of danger that is expressed using the words of olfaction. (Lee & Schwarz, 2012. kwon, et.al 2015). Other behavior studies on odour naming have concentrated on the cross-modality intervention of senses but not on direct smell related words. Only a few studies proposed that working on the linguistic approach of the smell lexicon have shown that odour labels and naming association have strong relation on memory; incorrect or missed naming means to say that memory is weak and perfect naming even in random trials may be seen as perfect memory (Robert, 2011). The semantic information leads to the identification of odour names, but poor discrimination of odour is challenging in odour naming. Multiple studies claim environment and multisensory cues of perception to be the reasons behind the odour discrimination (Zucco, 2012).

3.2.1. Earlier Studies

Miller and Johnson (1976) emphasized that odour naming and descriptions are sometimes associated with analogous colour landmark classification. However, the colours are accidentally named, i.e. colours are named based on familiar objects used in daily life with experiences and learning (Engen, 1987). The smell memories are often triggered by similar odour stimuli but are not well named due to the poor correlation between recognizing odours and naming them (Ayabe, et.al. 1997). Earlier studies showed that odour memory is stronger than other memories among the five-sense modalities. Proust (2006) in his novel "Remembrance of Things Past" describes how aroma or flavour brings back past phases in one's personal lives. For instance, the smell of mud during rain takes back to the childhood memories and triggers the retrieval of long term memory. Naming this odour is difficult but recognizing is not.

It is found that odours can be recognized forever but naming the odour when asked for it is difficult. A lot of psychological researcher are working on the difference between recalling and recognizing and some studies examined that common odours are generally invoked not by olfactory alone but it has a cross-modality approach with vision (Lyman & McDaniel, 1990) Studies such as Majid et.al (2014) on verbal processing and odour memory reported that nonverbal sensory image and semantic verbal coding play an important role in olfactory processing, verbal labelling, and memory of smells over a short period of time. They further emphasized that most people find it difficult to translate their experience with smell into an odour name (ibid). However, subjects from Asian countries like Malay who speak Jahai are very good and fast at naming smells and have a good number of vocabulary in their language. These findings reject the previous hypothesis which states that people universally face difficulty in naming smells while it is based on social, cultural, historical, ethnic, and semantic factors of that language. Recent studies revealed

that the human olfactory system is the most evolved one among twenty-four other mammalian species that possess a well-built olfactory neural system (McGann, 2017).

It was also found that smell perception is influenced by behavioral conditions. Few other studies like also (Levelt, 1999) reported that the lexical selection leads to the generation of words with phonological and morphological characteristics in speech. Odour naming in European and American populations provided huge data which when analysed proved that odour naming was intertwined with culture, ethnicity, and universal consideration (Levinson, 2010). The sense of smell can be manipulated by the use of the vocabulary of that language but it cannot affect the odour percept when the odour is given for smelling. Researchers also emphasized on the fact that the odour is as fundamental as vision which is a potential field of research for many cognitive aspects like memory and decision making. The smell can also be considered as a base for colour naming and vice versa which leads to cross-sectional study in linguistics. On the other hand, research evidence shows that language plays a limited role in odour naming and likewise some studies on smell with impairments have found that they are not able to differentiate the smells (Latropoulos, et.al. 2018). However, it is often seen as a struggle in proving olfaction vocabulary which has its place in language production; and it is noted that smell words are always seen as less understood as well as less used in languages. Mostly in the west, these studies are now shown to take a keen interest as the new shreds of evidence suggest that since the hunting and gathering era to till date the sense of smell have a robust agreement with other sense equally and use of its olfaction vocabulary is strong in many cultures to describe events occurred has also been under detrained.

The smell perception also has an angle in the women and men populations and it is generally established that women are more superior than men in perceiving smells (Brand and

Millot 2001) but (Bengtsson, et.al. 2001) who compared the cerebral activity found no difference in men and women in odour perception. However, there are not many studies available on gender and odour vocabulary association comparing psycholinguistics variables (Huisman & Majid, 2018). Majid (2018) states that olfaction vocabulary may also change with the change of culture. In terms of the English language, the olfaction vocabulary is much higher as many words describe and differentiate the sense of smell. Based on the study by (Buck, 2008) on the Indo-European language families, it is noted that specific terminologies in smell vocabulary are not consistent and linguists also identified that there is a lack of association in most of the languages in the olfaction setting. But given the understanding of the most of literature in this area are obsolete and a lot of new studies in the present-day world are need of the hour due to the change in the social, cultural and psychological modules, the present work is trying to understand olfaction/smell vocabulary which needs both a corpus analysis and naming analysis, which seems to be operational and will shed some light in the context of Indian languages.

From the Indian language perspective, as Majid (2018) reports that smell words have no significance while naming in the real-life. They also differ in terms of perception, especially smell based on the corpus consulted. By taking into consideration the earlier studies (ibid), the present work has also taken comparable words from those studies and seen its relevance in the Indian cultural settings as well as if these words exist in the Telugu language when translated. While analyzing it is found that the concept is relatable and exists even in Telugu language. In order to prove this concept, the Telugu corpus was consulted for the frequency of such words to seek answers for the question, i.e. If odour naming and odour memory in real-time differs from corpus, then what is the frequency of usage of these vocabulary that are used in Telugu? Apart from the foregoing discussion the study also poses a question to find out whether there is a gender

component involved in odour perception? Subsequently another question as: Is the sense of smell in Telugu on par with other senses or does it have weak association in comparison to Viberg (1983) hierarchy.

By understanding the above concepts, the current study focuses on investigating the odour naming task. Along with the investigation, the study also focuses on the perception abilities in Telugu speaking subjects followed by the analysis of corpus and compare the association between them. The analysis tries to understand and see the differences in the naming, rating and odour memory task in males and females. In addition to which language questionnaire is also used to understand the language skills.

3.2.2 Material and Methods

Subjects

A total of 62 subjects consisting of 32 males and 30 females participated in this experiment. All the subjects are native speakers of Telugu between the age group of 18-30 whose L1 is Telugu and all of them reside in Hyderabad. Before the experiment, oral and written consent was obtained from the subjects and no monetary benefits was given to them. All the subjects were naïve to the experiment. We excluded the subjects who suffer from nasal sinus or any other ENT (ear, nose, and tongue) disorders to avoid selection bias. The Demographic details of the subjects who participated in the experiment is given in the [Table-8]

Demographic details		Group-1 Males(n=32)	Group-2 Females(n=30)
Do you smoke	Yes	13(21%)	3 (4.83%)
	No	19(30.64%)	27 (43.54%)
Allergic to Food	Yes	00	00
	No	32(51.60%)	30(48.38%)
Do you Know Cooking	Yes	25(40.32%)	20(32.25%)
	No	17(27.41%)	10(16.12%)
Hyposomia	Yes	00(0%)	00 (0%)
	No	32(51.60%)	30(48.38%)

Table-8. Demographic details of the subjects

Experimental design

Stimuli

For the experimental analysis, the most frequent words from Telugu corpora are taken into consideration. Among the most frequent words, only the top twenty four content words were used. The list consists of words that have very common usage in the domains like home and general usage. These words are mono or disyllabic in nature and commonly available and pronounceable. We reviewed two Telugu corpora for the frequency of words (CALTS-TELUGU corpus and LERC-UOH-Telugu Corpus) and summed up the total number of occurrences of words from all the Telugu words used, which is then divided by the total size of the corpus 42-million words. The logarithmic analysis was made to represent the frequency of the extracted word by categorising it

with a number of occurrences in the total corpus as a reference point. We found that overall M_{log} (High Frequency) =3.76, SD=1.93 and M_{log} (Low Frequency) =0.76, SD=0.42 per million words. When both the frequency groups were compared, a significant association was observed (t=3.73, df= 2, p<0.001). The stimuli used for the experiment is **[As shown in Table-9].** The formula to calculate the word frequency of the corpus is given below:

$$\text{Odor Frequency} = \frac{\text{No of Occurrences of words related to smell}}{\text{Total Corpus Size}}$$

English Words	**Telugu equivalents**	**Frequency**	**Log(10^{42})**
Tea	టీ / Ṭī	**2026**	4.24
Coffee	కాఫీ/ Kāphī	**1365**	4.02
Tobacco	పొగాకు/ Pogāku	**1230**	3.97
Petrol	పెట్రోలు / Peṭrōlu	**586**	3.55
Coconut	కొబ్బరి/ Kobbari	**571**	3.54
Ash	బూడిద/ Būḍida	**406**	3.35
Rose	గులాబీ/ Gulābī	**342**	3.25
Soap	సబ్బు/ sabbu	**266**	3.1

Detergent	బట్టల సాబు / Baṭṭala Sābu	**152**	2.8
Cinnamon	దాల్చిన చెక్క / Dālcina cekka	**134**	2.73
Sesame	నువ్వులు/ nuvvulu	**130**	2.71
Chocolate	చాక్లెట్/ Cākleṭ	**104**	2.59
Potato	బంగాళాదుంప/ Baṅgāḷādumpa	**103**	2.58
Beer	బీరు / Bīru	**102**	2.58
Ylang	సంపంగి / Sampaṅgi	**77**	2.42
Matches	అగ్గి పుల్లా/ Aggi pullā	**72**	2.38
Nutmeg	జాజికాయ / Jājikāya	**60**	2.28
Ajwain	వాము ఆకు/ Vāmu āku	**40**	2.05
Mint	పుదీనా/ Pudīnā	**30**	1.89
Bleach	విరంజనం / Virañjanaṁ	**21**	1.69
Incense	ధూపం/ Dhūpaṁ	**20**	1.67

Anise	సోంపు/ Sōmpu	**14**	1.47
Turpentine	టర్పెంటైన్ నూనె / Ṭarpeṇṭain nūne	**11**	1.33

Table-9. List of smell stimuli used in the current study by extracting the words from Telugu Corpus and calculating the no. of occurrences and word frequency per million log frequency (10^{42}), total corpus size was 42 million words.

Experimental Procedure

This experiment consists of three phases i) Naming Task, ii) Rating task and iii) Odour memory task. The experiment also includes a language questionnaire which covers the metadata consisting of demographic details like occupation, linguistic background and societal background. Before starting the experiment, the subjects were instructed not to eat or drink any fluids other than water one hour before the experiment so that it won't influence the subjects while naming task.

3.2.2.1 Naming Task

All the subjects were comfortably seated and explained about the task. The smell samples were presented in 10-ml glass tubes by hiding the object source and labels with paper tape. The time to identify all the twenty-four smells took approximately 40 minutes.

In the naming task, we asked the subjects in Telugu, what is this smell? (*Idi ē vāsana*). Subjects were not constrained with the number of times they can smell a sample but the entire task was completed in 40 minutes. All the odours were presented randomly and participant's responses were noted.

Smell naming task

In this task, all the collected responses from the subjects were extracted. After this task, a thorough checking was done for variables that are included for the analysis. The task of segregation, i.e. correct and incorrect response with regard to the 24 odours were also recorded and presented to the subjects. Both the groups' (male and female) naming accuracy was measured. In subjects, the age doesn't show any significance [r =-0.74, df=2, χ^2 = 2.50, p=0.76] and this implies that age factor is matched between both groups in the experiment.

The correct responses were measured in terms of mean between male [M=16.34, SD=1.53] and Female [M=19.83, SD=.41], there is a positive correlation between these variables and their exists significance [df=2, χ^2 =6.06, p<0.05] this shows that the female subjects performed better than male subjects in the Naming accuracy. Similarly, when the incorrect responses mean was compared male [M=7.59, SD=1.63] and female [M=4.16, SD=1.4], these variables showed a negative correlation between the two groups and interestingly the implication is that between both the genders their exists significance [df=2, χ^2 =4.80, p<0.05]. These findings suggest even in the incorrect responses females are making few errors compared to male subjects [As shown in Table-10] and [Figure-6].

Smell Naming task	Group-1 Males (n=32)		Group-2 Females (n=30)		*Chi-square test analysis*			
	Mean	SD	Mean	SD	R	df	χ^2	Level of significance
Age	25.19	2.132	23.73	2.420	-0.74	2	2.50	=0.76
Correct Responses	16.34	1.53	19.83	1.41	0.86		6.06	< 0.05
Incorrect Responses	7.59	1.63	4.16	1.41	-0.97		4.80	

**p<0.05 is considered as the level of significance*

Table-10. Naming accuracy of the subjects between two groups and Chi-square test showing the group differences (N=62

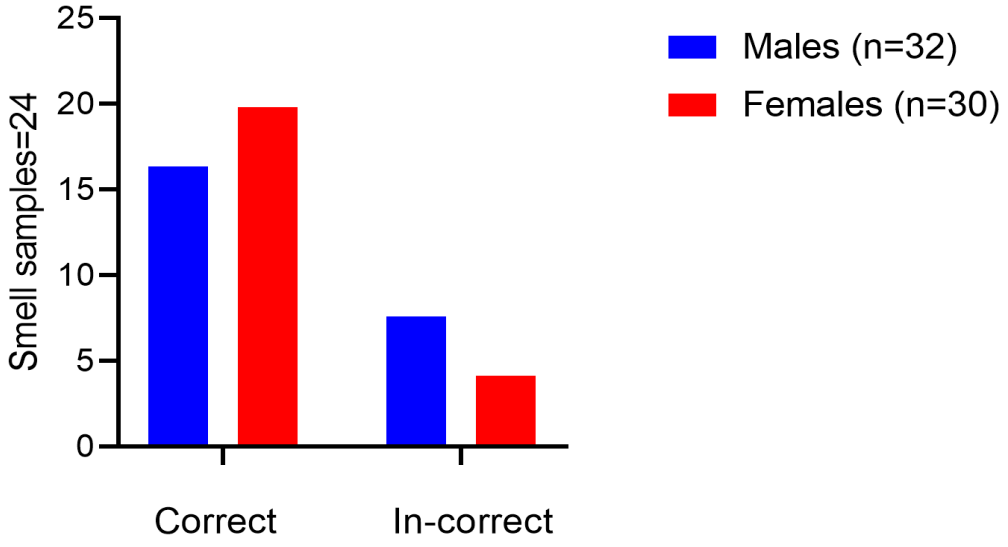

Figure-6. Bar graph showing the responses of subjects of both groups on Naming task association.

3.2.2.2 Smell Rating Task

After completing the naming task, subjects were given a ten minutes break, followed by Rating Task – a questionnaire based on five factors with 7 points Likert scale for each smell given to perceive:

i) Intensity (How strong or light is the smell)

ii) Familiarity (How familiar is the smell to you)

iii) Pleasantness (How do you feel about the pleasantness of the given smell)

iv) Edibility (How edible do you think; based on the smell)

v) Smell Frequency (How often do you experience such smell).

All the responses for the above five parameters were made to answer compulsorily in this task on a scale of 0 to 5 with seven possibilities (5-Always, 4-Very Often, 3-Often, 2-Sometimes, 1-Rarely, 0-Never, 0-Cannot say). We used the Qualtrics software for performing the rating task and these methods were adapted from previously published studies. After completing the main experiment, the subjects were asked to complete a language questionnaire with the responses **[As shown in Table-13].**

Results

After performing the Naming task all the subjects were asked to rate the list of words under five parameters of odour. All the responses from the subjects were extracted and the mean rating of both high and low-frequency words was measured between male and female group subjects. From the rating task, it is observed that Odour intensity between male [Mean=2.96, SD=0.73] and female [M=3.26, SD=0.30] showed a significance [df=7, F=2.076, $p<0.00$] association, the odour intensity is higher in female subjects than male subjects in the rating task. Similarly, other smell

parameters that showed a positive association between both the groups was odour edibility and odour frequency [df=7, F=1.286, p=0.03].

Odour Familiarity and Odour Pleasantness was not significant [df=7, F=1.467, 2.495, p=0.78] between both the groups and these findings reveal that odour familiarity and pleasantness doesn't show any influence on rating the smell names.

Posthoc analysis between the Groups.

A Bonferroni Posthoc one-way ANOVA analysis between the smell properties and within the group association was also studied. Except for odour familiarity and pleasantness, all other properties have shown within the groups association and differences. From these findings, we can conclude that the above three properties are interlinked to comprehend the smell naming in Telugu corpora. [As shown in Table-11] and [Figure -7]

Smell parameters	Group-1 Males (n=32)		Group-2 Females (n=30)		One-Way ANOVA analysis		
	Mean	SD	Mean	SD	df	F	Level of significance
Odour Intensity	2.96	0.73	3.26	0.30	7	2.076	<0.01
Odour Familiarity	3.48	0.29	3.41	0.27		1.467	=0.78
Odour Pleasantness	2.64	1.06	2.38	1.08		2.495	
Odour Edibility	3.13	0.87	2.72	1.15		1.286	=0.03
Odour Frequency	3.11	0.73	3.40	0.30			

**p<0.05 is considered as the level of significance*

Table-11. Mean rating of Smell rating task between both the groups showing the association (N=62).

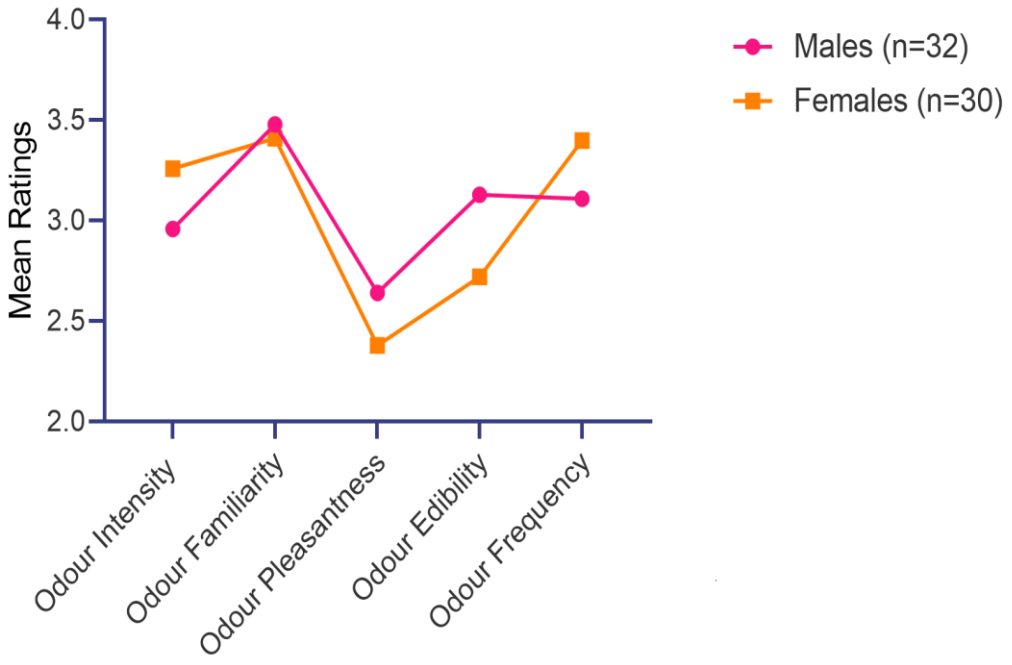

Figure-7. Scattered line graph showing the Mean ratings of subjects on the association between both groups on Smell rating task.

3.2.2.3 Odour Memory Task

After the completion of other tests, one week later we conducted an odour memory task in which the subjects were asked to remember the odors presented and given a time limit of 5 minutes.

Odour Memory task

In this task, subjects were asked to remember the list of 24 smells presented to them and asked to revert the list of words they remember after one-week from the experiment. In this task, interestingly we found that males [M=16.54 SD=2.28] females [14.50 SD=2.61]. When measured the association between these two groups it is found significance [t=15.50, df=1, 95%CI= 2.794 - 28.20, p<0.05] these findings show that male subjects have better odour memory than the female subjects. [As shown in Table-12].

Odour Memory	Group-1 Males(n=32)		Group-2 Females(n=30)		*t-test analysis*				
	Mean	SD	Mean	SD	T	Df	*95% CI*		*Significance*
							Lower	Upper	
Smells Remembered	16.54	2.28	14.50	2.61	15.50	1	2.794	28.20	< 0.05

**p<0.05 is considered as the level of significance*

Table-12.Odour memory association showing the significance between both the groups (N=62).

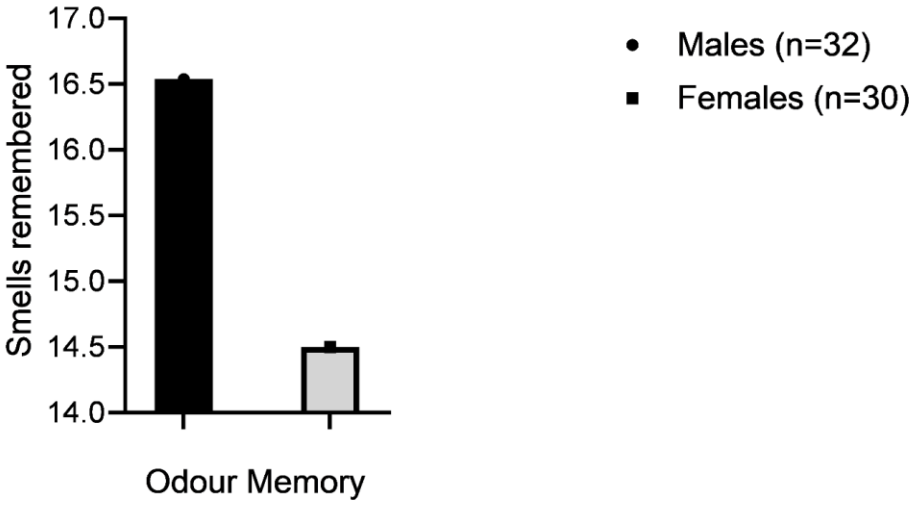

Figure-8. Mean distribution of odour memory between the two group subjects (N=62)

3.2.2.4. Language Questionnaire

After the rating task, the subjects were asked to fill up a language questionnaire to see the language association between their smell perception and odour naming. In this questionnaire, a set of questions were used to understand the age range at which they acquire L1, L2 and L3 languages along with their overall rating in terms of speaking, reading and understanding. All the results are represented with Mean, and SD [are shown in Table-13]

Language Questionnaire	Group-1 Male (n=32)		Group-2 Female (n=30)	
	Mean	SD	Mean	SD
Subjects Age (in years)	25.38	2.106	23.73	2.420
Began acquiring L1	3.31	1.148	3.17	2.878
Began speaking fluently in L1	8.38	1.862	10.43	2.991
Began reading L1	11.19	1.786	8.47	.730
Understanding spoken language	8.56	.504	8.80	.847
Reading	9.22	.659	7.00	1.857
Began acquiring English L2	7.28	.924	4.83	1.464
Began speaking fluently in English L2	5.75	1.136	10.37	2.659
Speaking L2	11.72	1.143	6.97	2.399
Began reading English : L2	7.13	2.166	8.27	.521
Speaking L2	7.94	.354	8.83	.592

Understanding spoken language	8.31	.471	8.77	.935
Reading : L2	7.69	1.030	9.30	3.515
Began acquiring L3	10.78	1.581	10.33	3.220
Began speaking fluently in L3	14.16	1.247	7.00	1.438
Began reading L3	11.41	1.604	7.97	1.377
Speaking	7.41	.837	7.00	1.983
Understanding spoken language	8.13	.833	7.87	3.048
Reading	6.66	.787	1.90	1.062
The onset age of bilingual usage	7.22	3.129	3.47	1.306
I feel like myself when I speak in my native language	1.56	.840	2.50	.974
I feel like myself when I speak in English	2.84	.448	2.77	1.006
I prefer speaking in my native language most of the time	2.44	.840	2.53	.900
I prefer speaking in English most of the time	2.47	.915	2.77	1.305
I prefer listening to my native language most of the time	2.22	.751	4.07	.740
I prefer listening to English most of the time	2.47	.803	2.00	.947

I prefer reading my native language most of the time	3.59	.837	4.20	1.031
I prefer reading English most of the time	2.03	.782	1.60	1.102
I prefer writing in my native language most of the time	3.78	.792	5.47	1.074
I prefer writing in English most of the time	1.50	.672	4.57	1.104
How often are you in a situation in which you switch between the languages of your native language and English?	5.50	.718	34.5603	18.81625
When choosing a language to speak with a person who is equally fluent in all your languages, how often would you switch between languages?	4.38	.660	4.65	0.74
Native Language	59.84	8.470	60.21	5.64
English	37.50	10.701	40.04	12.38

Table-13. Descriptive statistics of the subjects with Language questionnaire between both Male and Female subjects (N=62)

3.2.3 Discussion

In this chapter, we conducted experiments to see the effect of word frequency in Telugu for odour naming and smell perception in both male and female subjects. In the current study we found that the male subjects were poor in naming the smells than female subjects and this

exemplifies that the female subjects have more advantage in naming the smells accurately. The present results yielding similar results like the previous studies carried out by various scholars in the area of grammar and gender in association with odour perception. Moreover, the finding of the study is also supported by the previous research which showed that veridical labels in the odours which are higher in terms of recognition over the retention levels Bengtsson (2001), Majid (2018). The present study also has seen the gender difference in odour identification and rating these odors, which is also supported by many others which aimed to study putative factors influencing differences between genders (Doty, Shaman & Dann 1984) and a meta-analysis which reviewed a huge sample of data to observe the clams have also found that females outperform males may be due to olfactory superiority (Brand and Millot 2001) From the previous studies, it was observed that semantic interference while odor naming is not effective but frequency of occurrence may have positive effect (Majid, A. (2018).

In this experiment we manifested that odour intensity, frequency and familiarity which play a major role in identifying and perception of smell. It was also found that high-frequency words in Telugu corpus significantly influence the subjects' rating. Based on the observation of Telugu corpora, we found that higher frequency of words are named correctly while naming the smells. The reason behind this may be its high frequency of usage and hence has high familiarity. Our findings were also supported by the previous experimental studies which reported that word length impacts smell naming and memorizing the smell names (meyer, et.al. 2003). Majority of the odour ratings by subjects were influenced primarily by three smell properties namely odour edibility, odour frequency, and odour intensity in their daily life usage. These findings suggest that naming smells and memorizing the smell name depends upon these parameters. It further shows a relation between meta-memory associations and odour naming among the subjects. Similar findings are

also reported that olfactory meta-memory influence odour naming and smell perception (Jönsson, 2005). In the current study, we also used the posthoc analysis to see the association between the name rating of the subjects and the smell properties. To understand the association within the group, different analysis methods such as log models and ANOVA were utilized. The results suggest that except for odour familiarity and odour pleasantness, the other three smell properties i.e. odour frequency, intensity and edibility are correlated and show influence in naming the smell related words in Telugu language. We also found that female subjects gave more ratings as compared to male and this suggests that female subjects have better decision making in identifying the smells than male subjects. The analytical models used for the data analysis and statistics were based on the suggested models in the previous studies and psychophysical studies reported that odour identification increases the superiority perceptive levels in an olfactory procession of females and this finding also supports our smell rating task (Jaeger, 2008), (Majid, 2018).

We also found that language questionnaire data suggest us that the female subject's linguistic abilities are better than the male subjects and this finding may also be the reason for them to perform better in the smell naming and rating tasks as the proposition of language abilities affect the naming and rating task. In this scenario the current study findings supportive previously published studies on linguistic variables effects on odor. Rabin and Cain (1984), (Lyman and McDaniel 1986) and Majid et.al, (2007), found that the psycholinguistic effects also play a role in smell vocabulary acquisition which makes it possible that L1 and L2 proficiency also influence naming the words and understanding the smell perception (Brysbaert, 2000). In previously published studies the odour memory task was missing when compared to the naming or rating task but in the current study, we tried to observe that criteria too, and have noticed that both the male and female subjects are recalling the smell names that have been performed before one week and

this approach gave us some interesting findings, i.e. male subjects showed better odour memory than female subjects and this gives us a clue that although females are good at naming smell accurately or while rating them based on their previous knowledge, yet men performed better in odour memory task. These key findings also endorses with the previous findings, especially on odour identification (Cain, 1982)

From the above discussion and findings, we suggest that making a standardized test for assessing the smell perception along with the Telugu corpus frequency may shed more understanding on the psycholinguistic role and computation process of smell on language and perception. Furthermore, empirical cognitive paradigms in large sample size give us more understanding about the smell perception between both male and female subjects.

We conclude that the perception of smell and naming depends on the word frequency. High-frequency words can be perceived easily and named in a short time compared to low-frequency words. The important smell properties like odour edibility, frequency, intensity play a major role in naming the smells in Telugu as seen in male and female subjects. There would be a better understanding in future if we use a standardized smell perception task with new cognitive paradigms that can give us more information on the role of naming smell in subjects. Finally, we can conclude that male subjects are good in odour memory whereas female subjects are better in identifying the smell names and ratings.

3.3 Touch

In visually challenged subjects, the tactile sensations play a crucial role for various daily activities. Among all sense modalities, tactile sensation is considered as major sense of perception. The present study is conducted to investigate the tactile sensations in relation to bilingual and

monolingual blind subjects. The experiment is divided into two groups applying a self-paced reading task used as stimulus with a Braille scripted passage. Based on the experiment it was proved that blind bilingual subjects differ in the processing of language, especially the tactile sensations in the bilinguals are better when compared to monolinguals.

3.3.1 Earlier Studies

Braille is the most common and universal reading method for visually challenged people and it is based on the tactile sensations and each letter is represented by a combination of one to six raised dots (Pring, 1984). Since the present study has subjects who are bilinguals, it is necessary to have a brief discussion and its definitions from the linguistic perspective, Bloomfield (1935:56) defines "bilingualism as a native like control on two languages". Mohanty (1994:13) from the Indian context defines bilingualism by relating social-communicative dimension, i.e. "bilingual persons or communities are those with an ability to meet the communicative demands of the self and the society in their normal functioning in two or more languages in their interaction with the other speakers of any or all these languages". Previous studies queried that whether brain areas that respond to visual movement also respond to language that describes motion, sensory perception and memory (Martin et al., 1995). Initial investigations along these queries appeared to support a strong link between vision and language. Several neuroimaging studies observed responses near to perception verbs (touch, smell, auditory and olfactory) followed by action verbs e.g., to jump (Dravida, et.al. 2005). According to existing scientific literature, people who are blind from birth are able to detect tactile information and sensations faster than people with normal visual status (Röder et al. 2004), (Pulvermüller, 2005). According to (Grant et.al. 2000) In blind and visual impairment, it has been proved that spatial acuity is better than the hyper acuity with dots and grating pattern visual stimulus, this finding emphasizes that perceptual learning is due to

Braille reading experiences. Tactile stimuli are misallocated due to neuroplasticity and consequently attention mechanism appear to influence tactile perceptions in blinds as reported by Bedny et al. (2008). With regard to the study of perception verbs the sense modalities are arranged in a hierarchical order by many scholars, significantly the seminal work of Viberg (1983) which gives the sense modality hierarchy: sight > hearing > other modalities. (Bodwell 1993) also gives a similar model where vision being a major role of all senses but in the study of blinds this is not true. The reason for this can be seen from the present experimental study which gives a clear understanding that in the sense modality hierarchy for the blinds, the sense of touch becomes their primary sense of perception.

This section focuses to investigate the relationship between sensory perceptions of touch and linguistic representations in bilingual and monolinguals and poses a question whether the tactile perception is same in both the subjects or not. To undertake this foregoing question, the researcher tried to attempt with a cognitive linguistic approach. The study also tries to investigate whether the tactile aspect of sensory perception in blind influences both monolingual and bilingual subjects using Braille script.

3.3.2 Materials and Methods

Subjects

This study includes thirty blind subjects consisting of 26 male subjects and 4 female subjects. The subjects were within mean age (22.90±2.47) consisting of 15 bilingual subjects (English and Telugu) and 15 (Telugu) i.e. monolinguals subjects. All the subjects were Braille readers and graduates. A written informed consent was obtained from all the subjects as well as an approval to conduct the study between October 2018 to December 2018 was obtained from the

Institutional Ethical Committee of the School of Medical Sciences, University of Hyderabad, India and also followed according to the declaration of Helsinki regulations. Subjects are the visually challenged students of the University of Hyderabad community and a purposive sampling technique was used with equal opportunity and equity. No monetary reward was offered to the subjects in this experiment. All the subjects who have visual impairment does not have any exposure the perception of light. Such subjects' obtained their visually challenge certificate from Govt. of India who were examined for confirmation followed by visual acuity measurement by qualified optometrist and their cause of blindness is demonstrated in **Table.14.**

Table-14. Participant's summary of blindness and causes

Participant Code	Age at Test	Visual impairment cause
#SB01	10	Congenitial blind
#SB08	12	
#SB13	05	
#SB03	04	
#SB07	08	
#SB04	11	
#SB09	10	
#SB02	07	
#SB11	09	

#SB05	12	
#SB16	14	
#SB06	10	Hypoplasia of Optic nerve head
#SB12	07	
#SB14	11	
#SB17	09	
#SB15	08	
#SB21	13	
#SB19	09	Retinal dystrophy
#SB20	11	
#SB23	06	Optic neuropathy
#SB22	05	
#SB26	10	
#SB24,	12	Congenital glaucoma
#SB29	17	
#SB25	08	Optic atrophy
#SB22	11	
#SB27	13	Retinal ablation
#SB28	10	

#SB30	18	Keratoconnus with Myopic degeneration

Inclusion criteria

Blind subjects who are bilinguals (English and Telugu) and monolingual (Telugu) with general health conditions and having the ability to read the Braille and also communicate in two languages in daily life were included in the study.

Exclusion criteria

We excluded illiterates and visually impaired blind subjects who are not able to read and write or not having any experience in the Braille reading and any history of systemic and general health issues.

Materials & Experimental Setup

The experimental study design was divided into two phases, viz. demographic data collection and experimental phase. Preliminary examination includes demographic details, language proficiency questionnaire, Lextale and Semantic fluency test. It was followed by Self-pace reading task to assess the reading speed and reading rate so as to check the readability score. Equal readability score passages were created with the help of "Free Readability Text Consensus Tool" and then translated the passages into Telugu then the passages was verified by native speakers of Telugu for rating its readability. The reaction time and reading rate was calculated in the experiment i.e. (*Reading time= (Total no. of words/Time taken to complete the passage) x Time in seconds; Reading Rate= CWPM-Errors read)* which was adopted from (Ram et al., 2017) study. The validated passage was printed on Braille paper with Braille printing as the tactile stimulus.

Reading time was measured with the Stop watch (Kadio model KD-2004). Reading pad of 5x5 feet was used to hold reading material at 40 cm from the participant.

Experimental Procedure

The experiment began with the instructions regarding what the subjects need to do; subjects were seated comfortably and asked to read the Braille script (self-paced reading task). And the reading task was loud and audible to the experimenter in the closed room. However, the repeatability of the passage for the other subjects was avoided and reading task by the subjects was verified by the researcher to note down the errors.

Data Collection and Statistical Analysis

The collected experimental data was maintained in a Microsoft excel sheet version 2007. All the variables used for evaluating the reading performance in the manuscript were analyzed using Graphad prism-7 version statistical software. Before running the analysis, data was checked for normality distribution with the Shapiro-Wilk test followed by a paired t-test and Bonferroni post-hoc test was used to know the differences between the two groups.

3.3.2.1 Language Proficiency Questionnaire, Semantic fluency, LexTale

Results

This study includes thirty blind subjects with Mean age (22.90±2.47), which consists of 87% male, 13% female subjects. The data was analyzed using a two-tailed paired t-test which showed that no statistical significance [df=2, t= -1.78, p=0.09] exists between L1 [Telugu] proficiency among blind bilingual and monolingual subjects. It also showed evident significance [df=2, t=2.84, p< 0.01] that is seen among blind bilingual and monolingual subjects for the following variables such as L2 proficiency, Lextale (English), and Semantic fluency score that is illustrated in the **Table-15 .**

Table-15, Language proficiency in blind subjects N=30

	High proficiency Bilinguals		Monolinguals		Variance	*Two tailed paired t -test analysis*		
						Df	t-value	Level of significance
	Mean	SD	Mean	SD				
Age	23.90	2.47	25.45	3.15	5.42		-0.80	P=0.43
L1 proficiency [Telugu]	5.24	0.86	6.31	0.72	0.84	2	-1.78	p=0.09
L2 proficiency [English]	6.16	1.94	3.98	0.59	3.78			p<0.01
							2.84	p<0.01
Lextale (English)	65.72	10.42	58.98	16.38	6.74			
Semantic Fluency Score	7.46	1.52	4.80	0.44	2.883			p<0.01

**p< 0.05 is considered as significant*

3.3.2.2 Self-paced Reading Task

In the self-paced reading task experiment between the two groups, the reading performance was measured with the following variables were included: total time taken to complete reading passage, reading rate (correct word per minute), reading errors. From this we observed in blind bilinguals reading rate is high (Mean ±SD= 45.91±5.71) and significant [df=2, t= 2.84, p<0.01] when compared with blind monolinguals reading rate was low (Mean ±SD=18.16±4.89) which is represented **Table -16 and figure-9,10**

Table 16. Reading performance in blind subjects N=30

Variables	Group-1		Group-2		Variance	*Two tailed paired t -test analysis*		
	High proficiency Bilinguals		Monolinguals			df	t-value	level of significance
	Mean	SD	Mean	SD	5.42	2	-0.80	P=0.43
Age	23.90	2.47	25.45	3.15				
Total reading time (sec)	197.33	31.68	507.62	108.67	310		2.84	p<0.01
CWPM	45.91	5.71	18.16	4.89	27.7			p<0.01
Reading Errors	4.86	1.12	3.31	0.79	1.55			p<0.01

*Cwpm: correct words per minute *p< 0.05 is considered as significant*

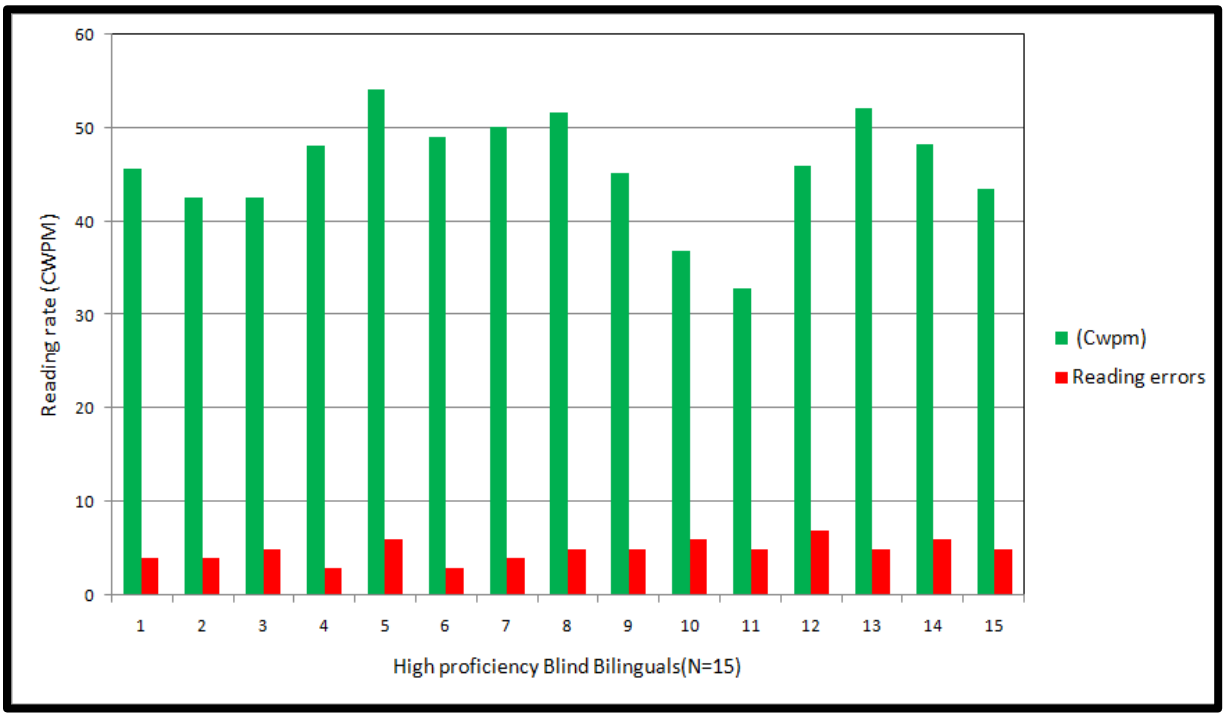

Fig.9. Reading performance in High proficiency Blind Bilingual subjects.

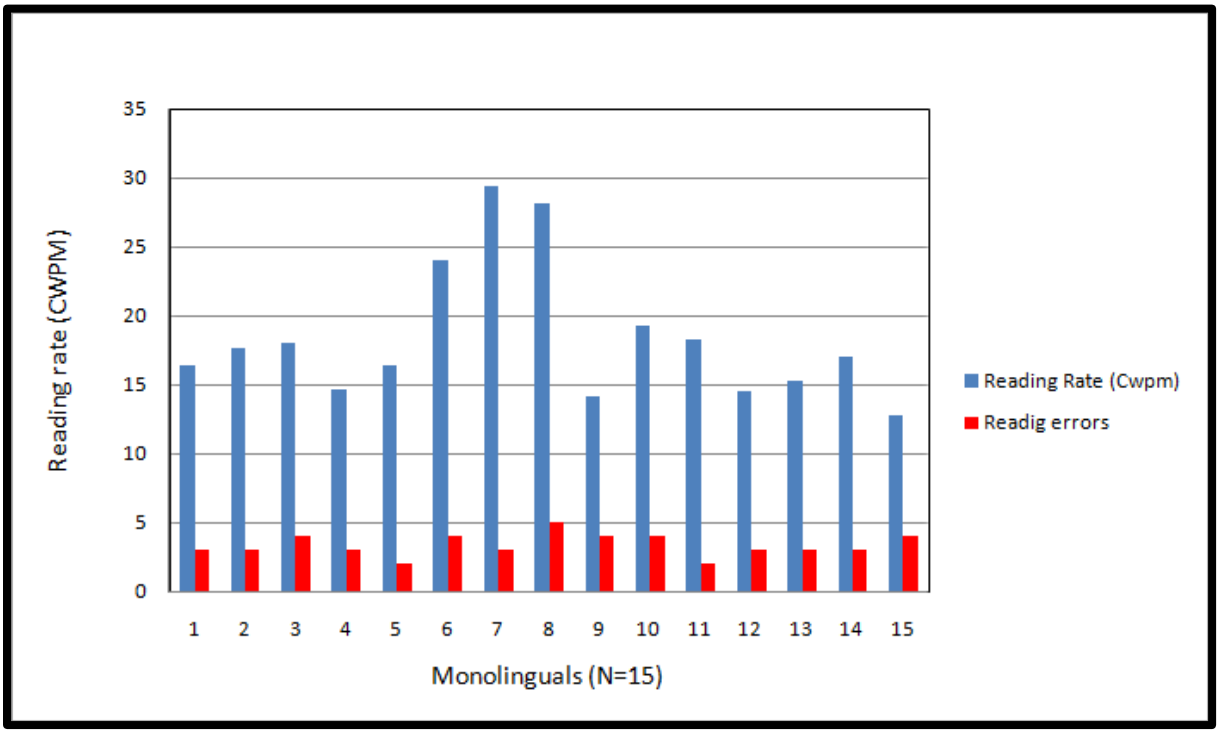

Fig.10. Reading performance in Monolinguals subjects.

Post hoc analysis between groups

To see the differences between group-1 (High proficient bilinguals) and group-2 (monolingual) blind subjects, we used the Bonferroni posthoc analysis. From this we observed that L2- English (SE:1.49, p=0.02, CI: 3.34-4.42), Lextale proficiency (SE:4.87, p<0.01, CI:1.94-11.5), Semantic fluency score (SE:1.33, p<0.01, CI:2.26-3.5), Reading time (SE:154.8, p<0.01, CI:29.7-32.3), CWPM (SE:13.87, p=0.03, CI:1.94-11.5) are significant in bilingual subjects, whereas L1-telugu proficiency (SE:0.53, p=.0.07, CI:0.43-1.28) and Reading errors (SE:0.77, p=0.94, CI:0.54 - 2.09) does not show any significance among both the groups, which is observed **Table-17.**

Table-17. Posthoc analysis between both the groups N=30

Variables	Group-1	Group-2	Bonferroni Post-hoc analysis test between the two groups.			
	High proficiency Bilinguals	Monolinguals				
	Mean±SD	Mean± SD	95% Confidence interval			
			Std Error	significance	Lower bound	Upper Bound
Age	23.90±2.47	25.45±3.15	0.73	p=0.57	21.9	23.9
L1 proficiency [Telugu]	5.24 ±0.86	6.31±0.72	0.53	p=0.07	0.43	1.28
L2 proficiency [English]	6.16±1.94	3.98±0.59	1.49	p=0.02*	3.34	4.22

Lextale (English)	65.72±10.42	58.98±16.38	4.87	p<0.01*	1.94	11.5
Semantic Fluency Score	7.46±1.52	4.80±0.44	1.33	p<0.01*	2.26	3.5
Total reading time (sec)	197.33±31.68	507.62±108.67	154.8	p<0.01*	29.7	32.3
CWPM	45.91±5.71	18.16±4.89	13.87	p=0.03*	24.3	30.1
Reading Errors	4.86±1.12	3.31±0.79	0.77	p=0.94	0.54	2.09

Cwpm: correct words per minute

**p< 0.05 is considered as significant*

3.3.3 Discussion

The main goal of this study is to understand the tactile sensations being the most important and in the hierarchal relations of sense modalities in terms of reading and their performance and accuracy of sense of touch in the bilinguals and monolingual blind subjects. In the study we found that blind bilinguals are faster in reading when compared to the blind monolingual subjects. Baker et al. (1995) study reported that in typical reading rate for the school children it is observed as 72 to 84 wpm. But in our experiment reading rate (correct words per minute) was 45 wpm in bilinguals followed by 18 wpm in blind monolinguals. This variance, might be due to subject's experience on Braille and reading stimulus. However this, previous findings by (Radojichikj 2015) reported that the Braille reading rate is comparatively less 16wpm in blind subjects. This discrepancy is similar to reported in earlier studies by Pring (1984) that Braille readings rates are not constant and constant training makes the task complete.

In our experiment it is also observed that reading errors is not significantly effecting blind bilingual (4.86 wpm) and (3.31 wpm) monolingual subjects. This finding emphasizes that knowing two languages improve tactile sensation in blinds subjects. According to Singh and Mishra (2012) high proficient bilinguals have advantage over oculomotor control then low proficient bilinguals, similarly Paap et al. (2018) study supports that bilinguals has better attention control than monolinguals. The lack of tactile sensations is a common problem for poor Braille readers and it can be improved by language acquisition. However, by experience, training most of the blinds can overcome this problem.

This study being first of its kind, it comes to an clear understanding that in the sense hierarchies as proposed by Viberg and others does not stand still in the case of special population like blinds. These sense hierarchies differs. In this context the tactile sense is more dominant as compared to the other senses in blinds followed by the sense hear, then smell, touch and taste. Further experiments need to be conducted for proving this hierarchy. as proposed by Mishra et.al. (2012) Knowing more than one language gives an advantage and this concept seems to be working even in the case of blinds. Our findings that blind bilingual subjects differ in the processing of language, the tactile sensations in the bilinguals are better when compared to monolinguals. This also shows that language influence and reading performance can also influence the tactile sensations in blind bilingual subjects.

3.4 Taste

Literature reveals that taste is considered as lower in the hierarchy of all senses. However, it may be true as the lexicon related to taste in Telugu corpus are not rich when compared to other senses such as see, touch hear and smell. In current chapter we extracted the taste related terms from Telugu corpus that explore and describe the sense taste. We tried to test the claims of the

available literature by a corpus analysis, pre-test rating followed by free sorting task. We measured this task in N=20 subjects and compared their subjective ratings with the corpus frequency and all the responses extracted from the subjects were collocated statistically to test the significances among the taste words in Telugu corpora.

3.4.1 Earlier Studies

The basic concept of taste which are rooted evolutionarily from Democritus (460-370 B.C) who is famous for his explanation about atomic theory says various tastes and its qualities create shape of atoms in the body. Greek philosopher Aristotle (384-322 B.C) talks about taste being seven with four basic tastes and including, harsh, pungent and astringent (Glaser, 1999), (Sorabji, 1971), (McBurney, 1974) .

Taste has been classified majorly into four viz sweet, sour, salty, and bitter. Hanig (1901) in his seminal experiment has analyzed the taste areas wherein he tried to define the areas of the tongue sensitivity of the basic tastes, which is as follows - sweet mostly in the front of the tongue, bitter back of tongue being, salty and sour on the sides of the tongue. Hanig's doctrine was later followed by many other researchers yet the estimated theory of bias was in the higher degree but due to popularization of the same it was widely studied. Since 1990's this theory was almost discarded and it was Catalanotto (1993) who give a new light by examining and proposing that taste is mediated by the anterior and posterior nerves and it is mediated by super- tasters and the sensitivity depends on the particular persons tasting abilities and the super – tasters (genetic variation of taste). To note in 1907 the fifth basic taste umami was positioned in the list of basic taste by Japanese researcher kikunae iked. Since then till date these basic tastes are scientifically studied in various fields. Till date taste researchers widely used psychophysics methods and are

trying to investigate the overall taste percept. Some history of taste can be illustrated from Linda (M Bartoshuk 1978) in the work history of taste research;

TABLE I
SELECTED LISTS OF TASTE QUALITY NAMES

Aristotle (384–322 B.C.)	Avicenna (980–1037)	Fernel (1581)	Haller (1786)	Rudolphi (1823)	Horn (1825)
sweet	sweet	sweet	sweet	unlimited	sweet
bitter	bitter	bitter	bitter		bitter
sour	sour	sour	sour		sour
salty	salty	salty	salty		salty
astringent	insipid	astringent	rough		alkaline
pungent		pungent	urinous		
harsh		harsh	spirituous		
		fatty	aromatic		
		insipid (tasteless)	acrid		
			putrid		
			insipid		

Valentin (1847)	Wundt (1880)	Öhrwall (1891)	Kiesow (1896)	Hahn (1948)	Zotterman (1956)
sweet	sweet	sweet	sweet	sweet	sweet
bitter	bitter	bitter	bitter	bitter	bitter
	sour	sour	sour	sour	sour
	salty	salty	salty	salty	salty
	alkaline	insipid (referred to the flat taste of water)		alkaline	water (in some species)
	metallic				

Source: reproduced Bartoshuk, L. M. (1978). History of taste research.

Talking about taste as discussed in the section of smell, all the living creatures including humans have the sense of flavour and its choices. The sensation of flavour provides the capacity to experience and judge using their sensory modalities and the humans make a choice between food

versus non-food. These judgmental capacities and preference of several kinds make the human species superior when compared to other living beings. The choice of taste frequently varies against association with the requirements of the different body conditions, requirements and environment conditions. Furthermore, primates usually acquire meal allergies, especially if they feel unwell quickly after consuming specific food; either this food displays the beginning of respective sickness. Food choices and objections include the sensation of taste, but these events mediate by the central nervous system (CNS) in humans (Smith, & Margolskee, 2006). Taste buds are formed of collections as some columnar receptor cells for taste and bundled mutually. These receptor cells inside each taste bud are designed to sense some small flavour in the process of eating and experiencing. Keeping aside the biology of the taste the vocabulary of taste has been least studied both linguistically form and cognitive perceptive; taste words are very limited in lot of languages but their association. Is more on metaphorical usages? Lehere (1983) states that metaphoricity of taste lexicon is at high level then its vocabulary. In many studies it is noted that taste experiments show a significant patterns of confusion of taste (O'Mahony et al. 1979). Studies such as Mjaid and speed (2019) on taste vocabulary, it is stated that taste, smell and touch is the least of other perceptual senses like vision and hear. But it is to be noted in the hierarchy modal taste is on par with smell among all senses. But in our study on smell in the previous section we have noticed that smell needs further investigation which might give us new insights. About 2.6 million years before fire, the time of the earliest Human species where the source of food is hunting and the meat is a masterpiece for human's existential requirements. The hunter-gatherers in each region has a different source of food; generally at was an abuse meal that are rich in starch like seeds, corms, the tubers, including rhizomes etc. Importantly for the hunters of Arctic adapted and existed majorly only on the nutrition that are animal-based, their consumption restricted upon the

lipids, protein, and several sugar components observed inside the liver of the meat. Other set of people restricted up on foods that are almost free of starch and free of meat. Fascinatingly. The variability in food consumptions are characterized on three main aspects geographical habitat, environment conditions and the third most important and widely studied aspect is Taste preference and the experience of the human species. While understanding of the process of taste, the argument that arise is if its conscious experience induced by sensory modality i.e. taste buds or is there an integration with other sense modalities? The answer is - the primary impression is made by the tongue/taste buds and such impression sent by the taste receptors to the brain which creates a multisensory perception while perceiving taste at different time points. Evolutionary biologist seek interest in the eating practices of humans and compare it with other species to understand the differences. But the interest of cognitive scientist is the perception, experience, language use and sensory interactions of the sense of taste.

3.4.2 Materials and Methods

Subjects

To test the perception of taste, 20 native Telugu speakers are taken into consideration and their age of acquisition in L1 is (3-5 yrs). Age of subjects are (M=23.25 SD=2.14) Males =10 (50%) and Female =10 (50%) both the genders are included. All the subjects filled the written and verbal consent before participating the experiment. All the subjects were naïve to experiment.

Experimental procedure

In this experiment the researcher used the subjective wordlist consisting of words related to taste which have higher frequency. All the words are collected from the available corpus. Further the words were distributed to subjects for a pre-test and free sorting task. As a part of the task, subjects were asked to sort as per the familiarity in the taste words.

Results

Words extracted from Telugu CALTS-corpus were included in the quantitative analysis of taste words and the size of CALTS Telugu corpus is 27,69,806. From this corpus we extracted the words related viz. *Tīpi* - 423(0.15%), *pullani* - 388 (0.14%), *cēdu* - 301(0.10%), *uppu* - 213(0.7%) and *kāraṅgā* - 189 (0.6%). To see the association between these five taste words we have used Kruskal Wallis test that showed a significance [df = 4,$p<0.05$] association that exist between these five categories . From the available frequency of taste related words the Sweet (i.e *Tipi*) is having high frequency rate followed by other words, this is illustrated below in [As shown in Table-18 and Figure-9]

English words	Telugu equivalents	Frequency	Total words in CALTS-Telugu corpus=27,69806 Percentage distribution	Kruskal-Wallis Test	
				df	Level of significance
Sweet	Tīpi	423	0.15%	4	< 0.05
Sour	pullani	388	0.14%		
Bitter	Cēdu	301	0.10%		
Salty	Uppu	213	0.7%		
Spicy	kāraṅgā	189	0.6%		

**p<0.05 level is consider as the significance*

Table 18-. Telugu Corpus words showing the Frequency and association of between senses of taste.

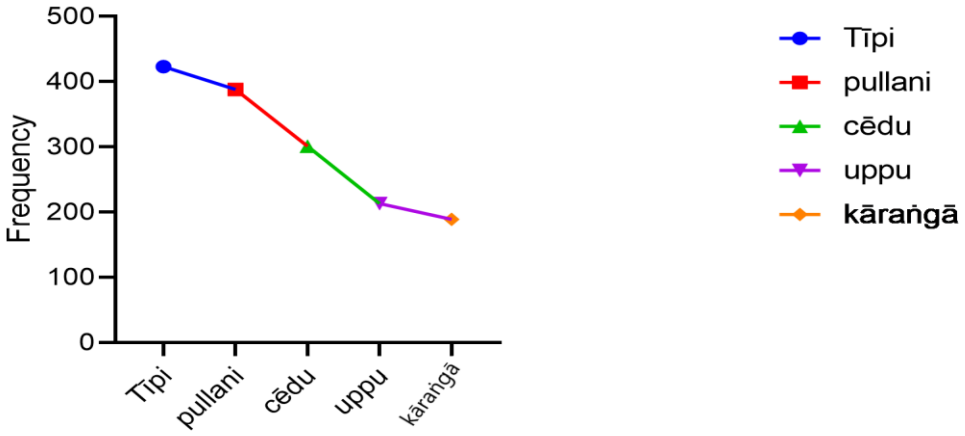

Figure-9. Scattered line chart showing the Frequency distribution of Taste from Telugu Corpus

3.4.2.1 Pre-test words Rating Task

In this task we have asked the subjects to rate the 20 words (see table No: 20) that have been extracted from the Telugu corpus related to the five taste words . All the subjects are asked to choose forced choice decision with the Yes or No option. All the subjects rated [M=14.35, SD=0.87] to the option "Yes" i.e. these words are related and "No" [M=5.65,SD=0.87] that is to say that other words which do not actually belong to the sense taste. When the association compared between both the responses we found significance exist [df=19,t=22.21, 95%CI= 7.81 – 9.58, $p<0.01$]. [As shown in Table-19].

Variables		Mean	SD	Paired t test analysis				
				t	Df	95%CI		Level of significance
Age		23.25	2.149	22.21	19	Lower	Upper	<0.01
Pre-Test Words	Yes	14.35	.875			9.58	7.81	
	No	5.65	.875					

**p<0.05 level is consider as the significance*

Table-19. Pretest words showing the mean distribution and association among subjects (N=20)

English words	**Telugu Equivalence**	**Frequency**	**Pre-test responses**
Savory	*rucikaramaina*	*483*	Yes
syrup	*pānakamu*	*34*	Yes
Honeyed	*tēne*	*45*	Yes
Smoky	*poga*	*132*	No
Spicy	*kāraṅgā*	*67*	Yes
Pungent	*tīvramaina*	*22*	Yes
Sugar	*cakkera*	*46*	Yes
sharply	*ghāṭugā*	*19*	Yes

Astringent	*vagaru*	*32*	Yes
Relish	*abiruci*	*62*	Yes
Delicious	*kam'mani*	*22*	Yes
Delightful	*āhlādakaramaina*	*13*	No
Luscious	*madhuramaina*	*14*	Yes
Repulsive	*viraktikaligiñcu*	*6*	No
Dry	*yeṇḍina*	*22*	No
acerbic	*kaṭuvaina*	*11*	No
Taste	*Cavi*	*33*	Yes
Feast	*Vindu*	*22*	Yes
sapid	rucigala	*332*	Yes
Taste center	*rasakēndramu*	*11*	Yes

Table-20. list of words listed based on frequency from the Telugu corpus and pre-test rated words by participant..

3.4.2.2 Free Sorting Task

In this task the words sorted from the pre-task was used i.e. 15 words based on the mean rating. In this task all five categories of sense of taste were included and subjects were asked to sort in its appropriate taste to categorize these list of words as per their perception of taste as under – Sweet/*tīpi*, Sour/*pullani*, Bitter/*cēdu*, Salty/*uppu* and Spicy/*kāraṅgā*. And this was interpreted

by giving the overall sorting score to each sub category of the senses of taste. Interestingly we found that the word counts from the subjects were as follows: the Sweet/Tīpi (OSS=6), Spicy/kāraṅgā (OSS=3), Sour/pullani, (OSS=2), Salty/uppu (OSS=2) and Bitter/cēdu (OSS=1). [As shown in Table-21 & Table-21].

Sweet/tīpi	Sour/pullani	Bitter/cēdu	Salty/uppu	Spicy/kāraṅgā
rucikaramaina	*vagaru*	*vagaru*	*vagaru*	*Rucikaramaina*
pānakamu	*kam'mani*		*tīvramaina*	*ghāṭugā*
tēne				*tīvramaina*
cakkera				
abiruci				
kam'mani				
oss=6	oss=2	oss=1	oss=2	oss=3

oss= overall sorting score

Table-21. sorting task results showing the taste categories and their hierarchy.

3.4.3 Discussion

In the current study it was intended to investigate the subjective understating of taste words which are based on the sense modalities, i.e taste. The study attempted to understand the frequency of the words from the Telugu Corpus and compare them with the responses obtained from Telugu native speakers. It is also intended to find out whether subjects are better in rating the taste related words. As part of this task, the subjects were asked to sort the same words that are related to taste

(such as sweet) which have more overall sorting score followed by the spicy and other taste types. These findings are unique and replace the hierarchy of the existing taste related sub-categories hierarchy as proposed by Bagli (2018) for English language .

English corpus Hierarchy

Sour →Sweet →Salty →Spicy

Telugu corpus Hierarchy

Sweet (Tīpi) → Spicy (kāraṅgā) → Salty (uppu) → Sour (pullani) → Bitter (cēdu)

Moskowitz, et.al. (1975) and Wan, et.al. (2014) proposes that there is a universality in perception of taste which varies from language to language across the globe. As a preliminary study for the existing research, it is important to know the universality in terms of various language cultures but it is found that there is a lack of terms associated with taste. It is also proposed in the earlier studies like Viberg (1983), Classesn (1997) and Howes (2003) that taste occupies the lowest category of all the five sense modalities. In the present study of the sense modaliies taste in Telugu language, *Sweet/Tīpi* occupies the higher category in the sorting score.

In any given language, the tactile perception is difficult to understand and their fundamental semantic relation is difficult to evaluate. Even in the evaluation whether the taste is good or bad depends on the sociocultural background of the society. In this context, Osawa and Oswan and Ellen (2014) says that there exists discrimination glossaries that are extremely sensitive over food sciences (words related to taste), but flavour expressions are mostly ambiguous among taste perception with regard to distinct varieties which is a result of social, cultural, and environmental circumstances that represent sensations of smell and taste. The sense of taste is

expected to be detected based on the principal feelings that are responsible for the stimulus received.

Following are most common types of tastes that are found in humans:

- Sour – tells about the taste of acids.
- Salty – permits changing diet for balancing electrolytes.
- Sweet – identify nutrients which are rich in energy
- Bitter – provides the sensation of pungent, or disagreeable flavour

In most of the languages, the terms taste and flavour are used interchangeably, but taste and flavour are slightly different in its behavior. Earlier study such as (Forestell. C.A. 2015). says that the development of taste buds in the trimester stages shows that the central nervous system is able to detect taste and communicate further.

In the hypothesis suggested by Viberg (1983), a grammatical expansion is unidirectional beyond modalities that are always from higher to lower modalities. In understanding the cross-linguistic data, not all variables are designed for specified grammatical expansions but sense of gustation (taste) and olfaction (smell) remain the same in many instances and are also in the low-grade position in the hierarchy. Relatively the level of gustation (taste) labels in the all perception verbs seems to displaying a lower modality in linguistic aspects due to the lack of polysemous nature and also due to a very limited terminology.

To sum up, the chapter discussed the four fundamental sensory verbs excluding the other sensory verb, i.e. hear. Each of the other four sense modalities are elaborated in detail based on the theoretical as well as experimental illustrations.

While discussing each of the senses, Western as well as Indian studies were taken into consideration as a preliminary study in order to find out the which of the sensory verbs is first in the hierarchy of sense modalities. As a part of the study, the researcher identified that the sense *Sweet/Tīpi* exhibited higher frequency and sorting score in the hierarchy model proposed by Viberg. In the similar manner, the researcher also identified that taste exhibited the lowest frequency in the hierarchy.

Based on the above empirical result on the four sense modalities, the study concludes that see has the highest frequency followed by hear/*vinu*, smell/*vaacana*, touch/*taaku* and taste/*ruci* whereas in Viberg's model see has the highest frequency which is mapped with the present study followed by hear/*vinu*, touch/*taaku*, taste/*ruci* and smell/*vaacana* (which are grouped together in Viberg). The present study differs in the place of touch/*taaku* (with smell/*vaacana*) in the Viberg's hierarchy. In the similar manner, for Viberg the fourth one which is a combination of taste/*ruci* and smell/*vaacana* whereas in the present study touch/*taaku* and taste/*ruci* are differentiated by the subjects and mentioned both the senses individually. Hence it is can be stated that see/*cuudu* and hear/*vinu* in both the studies are similar in the hierarchy whereas touch/*taaku*, taste/*ruci* and smell/*vaacana* are altered in the hierarchy.

Chapter 4

Corpus Analysis of Perception Verbs

4.0 Introduction

A verb of perception is a verb that conveys the experience of one of the physical senses viz. see, hear, listen, feel, and taste. According to Levin, (1993) "verbs of perception describe the actual perception of some entity, it takes the perceiver as subject and what is perceived as direct object". Some of these verbs are tied to a particular sense modality, but others may not. The verbs of Telugu can be classified under various semantic domains. A semantic domain encompasses lexical items which shares one or more semantic features of the words. The verbs of perception can be a group convening their sense organs as: verbs of seeing, hearing, smelling, tasting, touching. In the book on *Language and Perception* by (Miller and Johnson, 1976) human perception is evaluated with regard to perceptual tests that are applicable to the environment. It is found that meanings rely on perceptual and functional features of the respective words. Verbs of perception are largely based on the five sensory modalities, viz. visual, auditory, olfactory, tactile, and gustatory. These perception verbs play a key role in experiencing the situations of the world. Langacker (1987) contemplates that the experiences we gain through senses are cognitive events: "A primary sensory experience is a cognitive event evoked directly by the stimulation of sensory organ". The perception-based lexicon of a language is an important tool to fulfil the communicative needs of the speakers. With respect to terminology of colour, for example, Kay and Berlin (1969) proposed that languages consist of a set of colour words that tend to congregate around similar perception. Likewise, the seminal work on perception verbs by Viberg (1983), a topological study, formed a unidirectional model where the verb *see* is the dominant source of perception over other senses. Vision can be developed as a secondary source for *hear* and *smell*;

but it cannot be reversed. However further investigation will help us to understand the multifaceted phenomenon of language.

4.1 Earlier studies

In the present corpus based study on Telugu language, several leading researchers in the field of cognitive linguistics have stressed that corpus plays a significant role in understanding the language and language behavior particularly verb meanings. Corpus also helps in identifying the various semantic extensions of a verb based on the context that is available in the natural text. Since all the sense verbs (perception verbs) are polysemous in nature, it is easy for a researcher to consult corpus in order to list the polysemous behavior of the verb. If the corpus is available for the sensory verbs, it will be easy for the researcher to find out which sense verb is more frequent compared to the other senses in the corpus. This helps to construct a hierarchical model for a given language, for example, Telugu. Corpus also gives a clear understanding on whether the language has five sense modalities or lesser than five because languages are diverse in nature.

The above discussion is completely in line with the studies such as Louwerse, M., & Connell, L. (2011) whose study on sense modalities reports that neurophysiology of taste and smell are chemical senses results from corpus based study and which depends on human reward system. In the similar context, an earlier study by Miller and Johnson (1976) describes that the human perception with regard to perceptual tests applies to the environment and the meaning of many words are based on functional and perceptual features based on the corpus. On the same platform, Sweetser (1990) says that sensory modalities (i.e. perception verbs) have come to an understanding that *vision* of all the other senses holds the key and leads the internal mechanism of thoughts and

knowledge. All the above three studies confirm that corpus is very much relevant in studying the sense modalities.

In the study of verbs of perception, the hierarchy of polysemy also predicts the cognitive meaning extended in the perception verbs. The verb at the top of the hierarchy of five senses is assumed to tend towards higher certainty of cognitive meaning of that sense. In addition to the study of perception verbs, identified that in everyday conversation, the vision verbs in English language have higher token frequencies in text corpora Viberg (1993), Similar views are reported by San Roque et.al. (2015) and Connell, L., & Lynott, D. (2010), which was done across 13 different languages.

Jumaaah and others (2020) paper on *A Cognitive Semantic Analysis of Arabic Verb of Visual Perception ra'a in Fiction Writing* discusses in detail the metaphors of visual perception whether they are universal or language specific. In a comment on metaphors, they stated that metaphors are not universal especially in non-western languages. Their study mainly focuses on the Arabic language which tries to unravel the underlying language expressions of visual perception with a focus on fiction writing. The study has adopted a corpus-based approach by taking a qualitative approach particularly from the cognitive semantic perspective. The results of the data reveal conceptual metaphors of knowledge and understanding the language expressions in Arabic in line with Sweetser's remarks of universality. Finally the study concludes that study of perception verbs in literature attributes to the elaboration of the field.

Adam Galac's (2020) paper on *Semantic change of basic perception verbs* is an attempt from the contrastive analysis perspective which was proposed by Robert Lado in language teaching and testing. For this purpose, the author has considered six European languages viz. English, German, French, Spanish, Italian, and Hungarian. Basic verbs are taken as a corpus for this study.

The study attempted to find out how culture influences the conceptualization of sensory modalities in the languages under consideration. The study highlights how different patterns change their semanticity in various domains. As quoted in Sweetser (1990), the paper also correlated with the perception verb along with sensory modalities. The paper also states that olfactory verbs are more general than the other sense modalities which are conceptualized differently in various cultures.

The study on Exploring Smell From A Cognitive Perspective In English And Bulgarian (A Corpus Study) by Nedelcheva (2020) is an informative paper on the comparative study of English and Bulgarian in which the perception verb smell is studied linguistically based on corpus from both the languages. This cognitive cross-linguistic study is on smell verbs investigated systematically the conceptual organization of the sensory modality, smell where in other hand the abstract concepts also studied systematically. Finally the study concludes that based on the corpus, cross-linguistic studies, especially considering the polysemous nature of data will contribute not only to universal cognition but also universal experiences of social interaction.

The paper by Putten (2020) on the *Perception verbs and the conceptualization of the senses: The case of Avatime* highlights that languages in the world belong to various families of languages differ categorically in terms of number, basic verbs and perceptual experiences. For the study the author has taken data from Avatime, a Kwa Niger Congo language. While discussing the author says that some languages have only two perception verbs for visual and others for non-visual perception verbs. In this context, the author poses a question to cognitive audiences asking how people of such language conceptualize sensory perception.

The current study focuses on the idea that visual and hearing domains of perception in the Telugu vocabulary have dominance when compared to other perception verbs and it is also found

by other researchers in different languages that vision being the major sense of all the other senses. This study tries to seek if this statement stands true in the case of Telugu perception verbs, by using the Telugu corpus and self-rated data collected from the subjects of native Telugu language speakers. We intend to observe whether the vision verbs are used more frequently than the others? If so, where do the other senses stand in the hierarchy of perception verbs? And why and how our experience and understanding of the five senses constraints and shapes the way these words are being used in a language? To serve the purpose of our study, we have used the General domain Telugu corpus developed in the Centre for Applied Linguistics and Translation Studies (CALTS), University of Hyderabad. Analysis of the study includes investigation of both unique types and token frequencies using a rating task.

4.2 Materials and Methodology

For the primary study we have collected the five perception verbs and their most related synonyms from various Telugu dictionaries and identified their frequencies from the Telugu corpus developed in CALTS. This general corpus contains texts with different linguistic registers, different dialects and from different time spans. Throughout the analysis, the major measure of the study is to investigate unique types and token frequencies. In the second step of the study we conducted a self-rating task for the five Telugu perception verbs and asked 300 native Telugu language speakers to rate on a scale of 0 to 5 on each of these five sensory modalities with mean age (21.64±2.36 SD). The subjects rated the words to quantify the extent to which a word was in relation to a sensory modality in Telugu. Similar attempts were done in an experiment by using English language corpus that reported the domination of vision in sense modalities by (Connell, L., & Lynott, D. 2010). A prior oral and written consent was obtained and all the subjects who participated in the experiment were normal with no reported reading or sensory deficits were

found. We also have attempted to see precisely the verbs that are more frequently used which are semantically distinct from its nature, but this needs a separate method of understanding.

Statistical analysis

All the collected data were entered in Microsoft Excel after the corpus extraction and are shortlisted from the data sheets and a self-rating task of all five perception verbs was also collected from the subjects and statistical analyses were performed by using Graphad Prism version-6 statistical software .

Two sets of analyses were conducted. In the first set of analysis we have collected the data i.e. The five perception verbs and their frequently used synonyms from various print and electronic dictionaries, these verbs are extracted from the Telugu corpora which include type frequencies and token frequencies. In all, the total count of the corpora is 711854 sentences and word count is 4531061. Using each sense-word we have collected the frequency of occurrences, collected from the base of each word's maximum perceptual strength in corpora.

To illustrate, from the corpus the word like *cūḍu* (see) has occurred 5676 times, compared to the other senses, i.e. we can classify it as the highest perceptual strength rating as its occurrences are more frequent than others. As for the visual modality is concerned, like many other studies in other languages such as English or Swedish, the corpus evidence in these studies highlighted that the vision verbs are more frequent and this is evident from our study. Similar results in the context of Telugu data especially the perception verbs. The verbs that belong to tactile, olfactory, and gustatory modalities showed lower frequency in the analyses. We focused exclusively on the verbs that were directly related to a given modality. We used the ratio of range of perceptual strength ratings and the sum of perceptual strength ratings, which measured the degree to which a word is multisensory e.g. *telusu* (know/see) 43.05%. In the second set of analysis, we used the continuous

perceptual strength ratings to see their association with sensory modalities as a measure of degree rather than kind, e.g. the word *cūḍu* is relatively more visual than *telusu*, which itself is relatively higher i.e. more visual than auditory.

4.2.1 Corpus Results Analysis

From the extracted data of the Telugu corpus, we have analyzed token and type frequencies. In the type frequencies we measured how many verbs in the corpus are associated in relation to five senses. It is observed that, vision verbs (*cūdu, telusu, cūcu, grahiñcu, parīkciñcu, darśanamu)* has highest = 13183(0.29%); Hear verb (*vinu, Ālakiñcu, lakṣyapettu, Śravanamu)*= 2536(0.055%); smell verbs (*vāsanā, suvāsana, parimaliñcu, sugandhamu, kampu)*= 251 (0.0055%); Touch verbs (*tāku, anṭu, muṭṭu, sparśiñcu)* = 174(0.0037%), and Taste verbs (*rucicūcu,- anubhaviñcu)*= 152 (0.0033%), there is a significant difference that exists between these senses ($\chi^2 = 154$, $p < 0.001$) and the findings are illustrated in **Table-22.** This data suggests that visual modality is the most lexically differentiated and furthermore this also shows a lack of differentiation in the verbs that are associated with taste, and touch in Telugu perception verbs.

Sense	Total verbs found N= (4531061)	% distribution	Chi Square Test Level of significance		
			df	X^2	p value
Vision	13183	0.29%	4	154	< 0.001
Hear	2536	0.055%			
Smell	251	0.0055%			
Touch	174	0.0037%			
Taste	152	0.0033%			

**p<0.005 level considered as significance*

Table.22. Type frequency of Telugu perception verbs

In token frequencies we measured occurrences of each verb and their association with particular sense and frequency, since five senses and their modality are systematically different with respect to usage of words that it illustrated in **Table-23**. Overall, from this data, it shows that vision related verbs are more frequent followed by hear in comparison to other sensory modalities.

Sense; Vision		Frequency	Paired t test Level of Significance		
Verbs	Telugu		df	t-value	p value
cūḍu	చూడు	5676			
telusu	తెలుసు	6113			

cūcu –	చూచు	189	5	1.871	< 0.001
grahiñcu	గ్రహించు	499			
parīkṣiñcu	పరీక్షించు	679			
darśanamu	దర్శనము	27			
sense: hear					
Vinu	వినుు	2493	3	1.023	< 0.031
ālakiñcu	ఆలకించు	43			
lakṣapeṭṭu	లక్ష్యపెట్టు	0			
śravaṇamu	శ్రవణము	0			
sense: smell					
Vāsanā	వాసనా	158	4	2.803	= 0.526
suvāsana	సువాసన	23			
parimaḷiñcu	పరిమళించు -	8			
sugandhamu	సుగంధము	37			

Kampu	కంపు	25			
sense: touch					
Tāku	తాకు	99	3	2.03	=0.143
aṇṭu	అంటు	22			
muṭṭu	ముట్టు	18			
sparśiñcu	స్పర్శించు	35			
sense: taste					
rucicūcu	రుచిచూచు	30	1	1.652	0.3465
anubhaviñcu	అనుభవించు	122			

**p<0.005 level considered as significance*

Table 23: Token frequency of Telugu perception verbs

From the above table, it is clear that Telugu perception verbs in the Telugu corpus has highlighted that the vision and hear are dominant when compared to other senses and occurred with high frequency. We also studied if this phenomena stands similar when asked to the Telugu native speakers, for which we have conducted a self-rating task by showing the subjects the closely related perception verbs of all the five verbs which are collected from various Telugu-English dictionaries. In this task words are shown and the participant is asked to rate on scale of (1-5 grade)

and this task also gave similar results for the five senses where vision and hear dominated in this rating task, and notably the verb *cūḍu* and *telusu* has high frequency within the vision modality of corpus based study.

In the rating task the verb rated for frequency among these verbs, *cūḍu* and *cūcu* are rated for higher frequency (commonly used words). In other words especially in the case of *telusu,* it stood last in the rating. Later *vinu,* further *vāsanā* stood in the line. In the similar manner the verb *tāku* differ in ranking where *tāku, muṭṭu, aṇṭu* and *sparśiñcu* could not stand immediately after *tāku.* In rating tasks it is observed that *tāku* is not a very frequent word after which *rucicūcu* occupied the final position. In the case of *anubhaviñcu* it stood penultimate to *rucicūcu* finally the subjects rated *anubhaviñcu* as not a common word due to its occurrence in the corpus. **see Figure 10-15** for graphical representation**.**

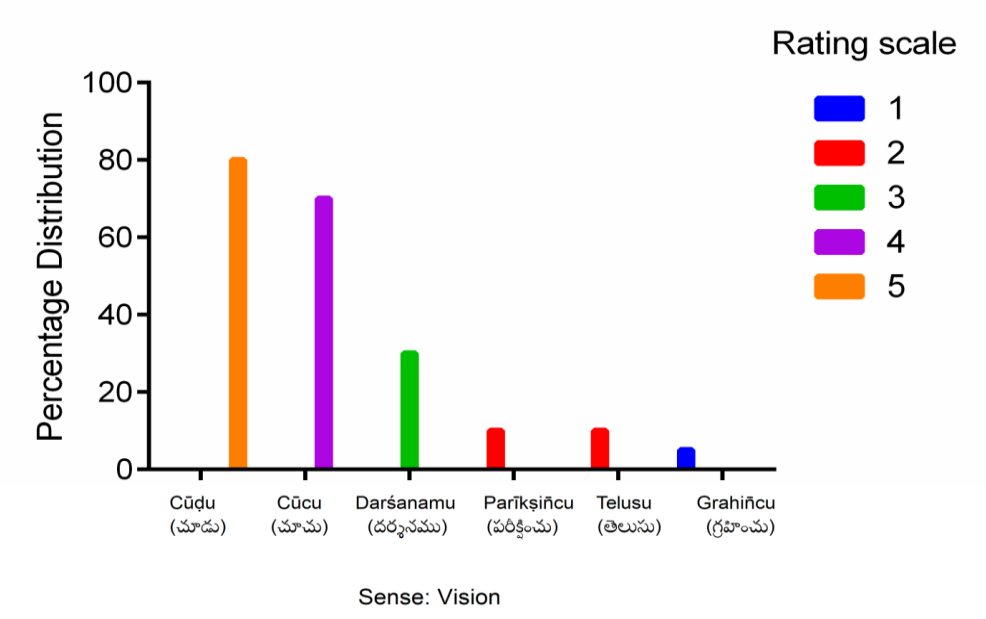

Figure-10. Bar graph illustrating the subjects self-rating of verb See - Telugu perception verbs: vision (N=300)

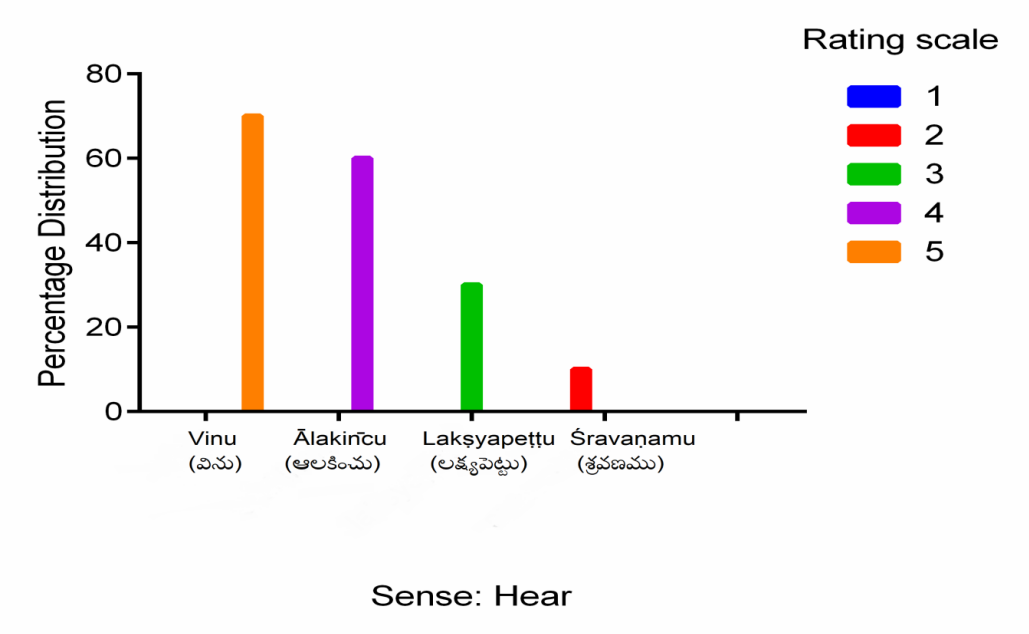

Figure-11. Bar graph illustrating the subjects self-rating of verb Hear- Telugu perception verbs: Hear (N=300)

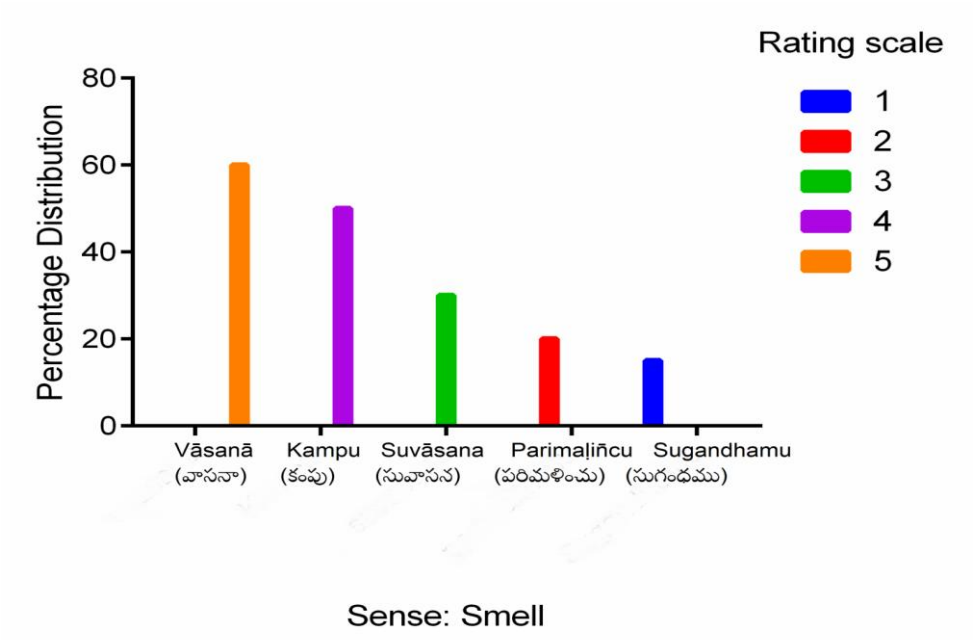

Figure-12. Bar graph illustrating the subjects self-rating of verb Smell - Telugu perception verbs: smell (N=300)

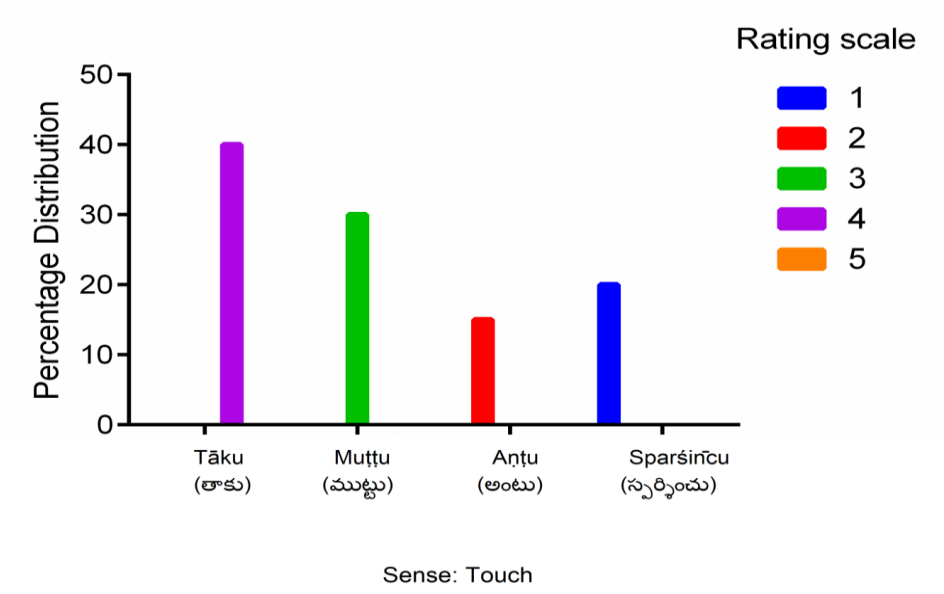

Figure-13. Bar graph illustrating the subjects self-rating of verb Touch - Telugu perception verbs: Touch (N=300)

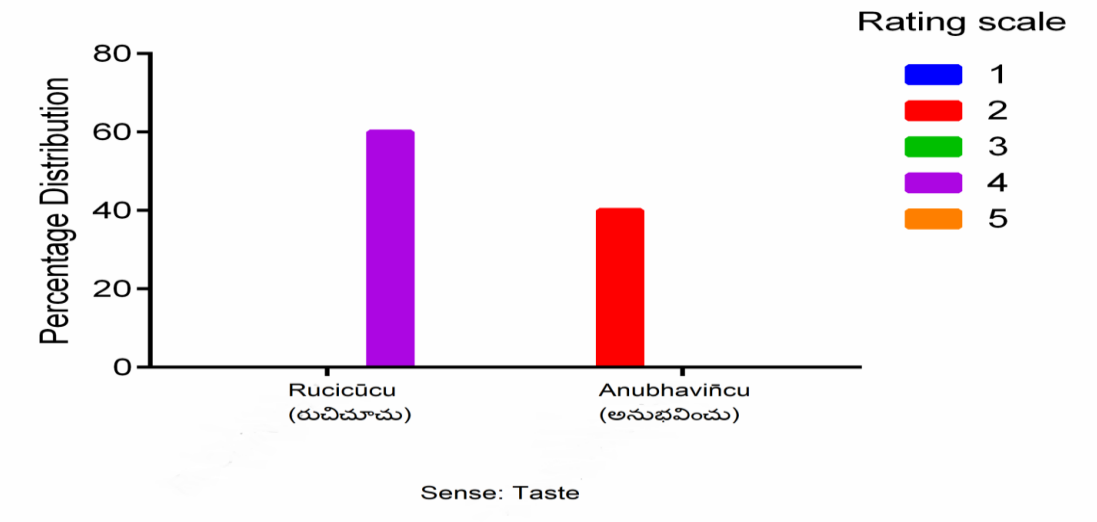

Figure-14. Bar graph illustrating the subjects self-rating of verb Taste - Telugu perception verbs: Taste (N=300)

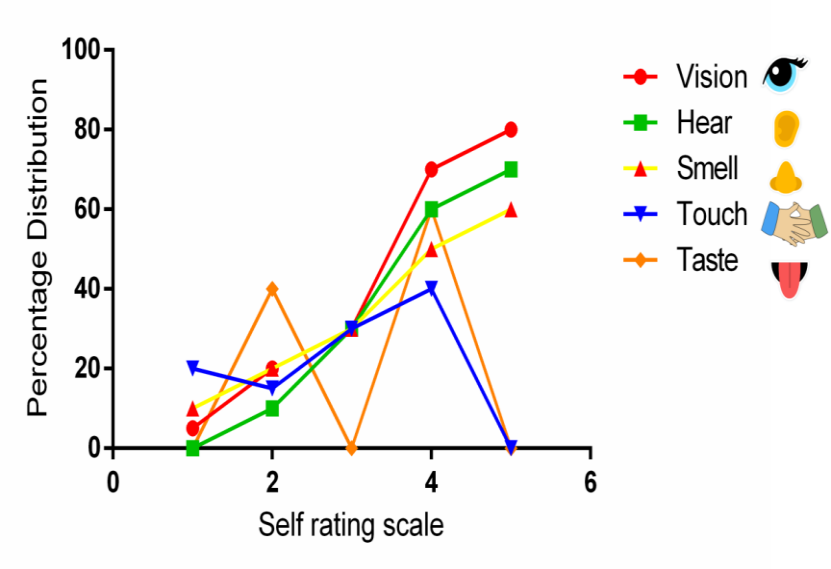

Figure-15. Scatter line graph illustrating the subjects self-rating and percentage distribution of Telugu perception verbs of all five senses (N=300)

4.3 Discussion

In the present study it was found that the native speakers while using the particular perception verb, their previous and present experience and understanding of the five senses limits and shapes the verbs being used in a language in a situation, especially for communicative needs. This study on Telugu perception verbs have a great deal of significance, as not many studies have been conducted in this area and not many evidences are shown to say that perception verbs in Telugu also acquire similar meanings pertaining to the broader perceptual domain, like the studies concerning other languages. Other studies conducted in English perception verbs: "see" word of visual domain have been studied extensively and exhibits visual ascendency in usage and

vocabulary structure. This study on Telugu language tries to show that the word *cūḍu* (see) and *vinu* (hear) exhibited dominance in the both the corpus based study and rating tasks. This shows that the perceptual vocabulary of Telugu supports the visual dominance and hearing dominance than that of other sense modalities. Based on the analysis the present study is parallel and similar in the model of hierarchy as Viberg (1983) who studied 53 different languages from various language families.

see > hear > touch > taste, smell

Viberg's (1983) hierarchy of sense modalities

But in case of Telugu language, the hierarchy of sense modalities can be illustrated based on the above findings:

Vision → Hear → Smell → Touch → Taste

In Telugu language the word for smell (*vāsanā*) is commonly used for any kind of sense of smell; further, adjectives are added to describe the sense of smell in Telugu. This is because of native speaker's inability to find synonyms for this verb in everyday conversation. We also assume that this mechanism of smell is rich in sensory activities in Telugu and can actually define taste or a visual imagery of something with the sense of smell. In the concept associated with visualization perception verbs, when compared to all the other senses, *see* is found to occupy the dominant position in the hierarchy. As there is no definite universal model for the hierarchy of perception verbs which takes all languages into consideration, Viberg's model holds a strong place in the study on perception verbs. In this model, *hear* holds the immediate position after *see* in this

hierarchy. This claim is established by (Evan and Wilkins, 2000) who say that the verb *hear* has a cognitive meaning of understanding and this is found to be true in case of Telugu language.

Hear also has its discreet understanding of the world by pitch, timbre, loudness, objects and locations, often perceived previously by individuals, for example, a person talking or a violin playing in the same tune which is heard previously in the same place and same environment. Usually sound comes from different sources at once, but the complex activity of segregating the sent information and recognition is a difficult task, which the brain does by its previously available information. *Hearing* also has a process of accumulation of information regarding myths or places or about someone whom one might have not met before. Here, the activity *hearing* plays the role of vision where we can visualize by *hearing.* Phoneticians are interested in the hear where the phonemes (the smallest units of sound) are distinguished from one word to another that has greater interest in understanding how these auditory patterns are perceived and understood by the individual.

As discussed above in the hierarchy of given perception verbs in Telugu - the verbs of touch, taste and smell modalities constitute a higher number of unique word types and are also used more frequently. This significantly illustrates that the perceptual domains which English speakers frequently use has greater expressive potential in terms of the structure of vocabulary (Lynott & Connell, 2009). Universal hierarchy of the senses is not valid because across a varied set of isolated languages, the sense of hierarchy is overridden. However, this relationship between word type and token frequencies described in section can be translated to languages with different hierarchy of senses or languages which have similar patterns.

In our study, we found that the token frequency figures are distinct in the perception verbs of all sensory modality aspects. Vision verbs (0.29%) are distributed from 4531061 words in the

Telugu corpus. This finding is similar to Lynnot (2009) study on sensory modalities but the study was extensively carried out in nouns of English and these are (χ^2 =228.78) uniformly distributed (Lynott & Connell, 2013). But in our study, type frequency analysis showed that there is a significant difference among Telugu perception verbs i.e. χ^2 =154. This suggests that the lexicon varies in case of Telugu perception verbs when compared to English. Further, in token frequencies of Telugu perception verbs, the frequency of all sensory modalities emphasized that *vision* (df=5,t=1.871 p<0.001) and *hear* (df=3,t=10.23,p <0.001) showed a significance whereas other senses i.e. smell, touch, and taste reported no significance. This finding is similar to Connell's (2013) study which reports that sensory experiences are more likely to be verbalized and out of senses like taste, smell, touch, the visual words are used on an average of 12,841 frequently followed, by auditory (5503 times) in English corpus (Connell & Lynott 2010 & 2013). However, in our study, the token analysis resulted that one of the senses of *vision* verb (*telusu*) occurred 6,113 times followed by *hear* (*vinu*) which has a frequency of 2,493 in the Telugu corpus. This correspondence between token and type frequency can presume sensory modality variations with high lexical variance. There are more verbs chosen in Telugu for *vision* and *hear* compared to other senses and this finding is similar to Levinson's (2014) study, which demonstrated that English speakers have larger number of visual words to choose from English corpus in comparison to other senses and also it is found to have greater token frequency in this domain we assessed the generalization of results and found that in Telugu perception verbs the lexicon strongly supports vision dominance followed by hearing and smell. Similarly, in the case of vision, this sensory modality in English corpus also noted visual dominance which is strongly supported and reported by previous researchers (Spence, 2012), (Stokes & Biggs, 2014). To understand deeper about how and why the vision has more words in Telugu corpus compared to other senses. One need to carry

out a further linguistic study with a methodological sampling for considering the strength of Telugu perception verbs. To sum up we found that there are asymmetries in the study of perception verbs in Telugu and it is also based on the relationship of the words and their synonyms as well as usage in Telugu for sensory modalities. These asymmetries may be due to cultural, metaphorical usage or limited use of particular verbs in the Telugu perceptual vocabulary in daily life. Results demonstrate that the senses are produced in the same way pertaining to general usage of the words in terms of type and token frequencies. Results also demonstrate that there is a visual and hearing dominance like the other studies indicated previously. Notable difference is, after these two verbs *see* and *hear*, the sense vocabulary for *smell* also dominates the *taste* and *touch* and negates with the previous studies in English being seen as the least verb, of all the five. This study also suggests that verbs of perception in Telugu language involve understanding the structure representing multimodal mental processes. The usage of sensory words in hierarchy formation by studying the corpus and self-rating task of these senses modalities are both identical and non-identical in their higher dominance ranking and are based on the communicative needs of the speaker. Similarly, in other languages these two verbs (vision, hear) may struggle with each other for their positions and our results also states *vision* and *hear* are most commonly used in daily usage of all the other senses in the related vocabulary. But an in-depth study is necessary for further evidence.

Chapter 5

Summary and Conclusion

The major goal of the present work has been to provide a comprehensive account of the perception verbs with particular respect to verbs involving the sensory modalities in Telugu language. The researcher has applied Viberg's (1983) model to Telugu to verify the universal claims on perception verbs. The present work progressed with a mixed method of analysis (cognitive experiments and corpus-based method) on the five sense modalities viz. see, hear, smell, taste and touch. For this purpose, the researcher has taken Telugu words that are highly productive and frequently related to the five sensory modalities from the available corpus and tested these words with various experimental techniques. As a part of the study only perception verbs are taken into account because they are part and parcel of every human being in order to understand the world around them. The experimental methods had subjects who are with normal as well as impaired, particularly blind subjects. The normal categories include young, middle-aged and old-aged people whereas blind subjects aged between 18-26 years old that include bilinguals and monolinguals, both are taken to look at the clear picture and execution of perception verbs in Telugu language.

The present study is categorized into two divisions where the first part concentrates on the theoretical foundations of perception verbs and provides a clear picture of perception verbs from various aspects. The same is represented in the second part by exemplifying from the cognitive perspective wherein cognitive perspective is given a higher priority than linguistic perspective in this study. From the cognitive perspective the semantic extensions of all the five sense modalities are discussed and tabulated for their coherence and correlation.

The total research design is organized in such a way that the first chapter provides an overview of perception verbs and discusses the studies carried out on perception verbs from the linguistic as well as cognitive perspectives. As part of the first chapter, studies that are related to semiotics and metaphors to the perception are linked by extensive discussion. Along with the discussion, the chapter has taken into consideration various hierarchical models which are vertical as well as horizontal in nature. Apart from these preliminary views, the chapter discusses the research objectives, limitation of the study, methodology adopted and the socio-economic background of the subjects.

The second chapter provides a detailed account of the theoretical foundations related to vision, smell, touch, taste and hear. Almost more than sixty studies were taken into consideration on how sensory verbs are executed in various languages across the language families. With regard to the survey of literature, the discussion in this second chapter and elsewhere in respective sections in third and fourth chapters, most prominent studies are given prominence. This chapter gives an understanding through various studies that the sense modalities are arranged in a particular hierarchy in respective languages. The studies bring into light that the basic general model in the hierarchy is vision->hear->smell->touch->taste. This hierarchy is considered as universal in the earlier literature. The chapter also highlights through the earlier studies that most of the studies are euro-centric in nature which include European families of languages like English, German, Spanish, etc. This provided the researcher with an understanding that very less work was carried out on Indian languages, especially of Dravidian languages. Finally the chapter gives a preliminary foundation for the research carried out in the present thesis.

The third chapter is the actual backbone of the present research. As the backbone has many disks the chapter also has verbs which are compared as disks of a backbone. Among the verbs, vision is discussed in the beginning followed by smell, touch and taste. These four sensory verbs are experimental based and subject oriented. Only the verb hear is discussed on corpus basis for which the reason was given in the limitations of the study.

(a) Under the vision, experiments are carried out with the metaphor generation task, followed by Flanker and Corsi tasks majorly. Subsequently semantic fluency, lextale experiments are also carried out. As part of these experiments a language questionnaire was distributed to the subjects for the correlation. The section on vision concludes that the cognitive functions in old-age bilinguals and monolinguals is higher in the metaphor generation ability compared to the monolinguals. The section also resulted in highlighting that old age bilinguals tend to perform better than the monolinguals which are much similar to the earlier studies.

(b) Under the section on smell, the study results in saying that the perception of smell and naming depends on the word frequency. High-frequency words can be perceived easily and named in a short time compared to low-frequency words. The important smell properties like odour edibility, frequency, intensity play a major role in naming the smells in Telugu as seen in male and female subjects. There would be a better understanding in future if we use a standardized smell perception task with new cognitive paradigms that can give us more information on the role of naming smell in subjects. Finally, we can conclude that male subjects are good in odour memory whereas female subjects are better in identifying the smell names and ratings.

(c) The next experiment, which is on tactile perception, is a first of its kind in India, in general and Telugu in particular. The section gives a clear understanding that in the sense hierarchies as proposed by Viberg and others do not stand the same in the case of special populations like blind subjects. These sense hierarchies differ in various aspects. In this context the tactile sense is more dominant as compared to the other senses in blinds followed by the sense hear, then smell, touch and taste. Further experiments need to be conducted for proving this hierarchy. Knowing more than one language gives an advantage and this concept seems to be working even in the case of blinds. Our findings that blind bilingual subjects differ in the processing of language, the tactile sensations in the bilinguals are better when compared to monolinguals. This also shows that language influence and reading performance can also influence the tactile sensations in blind bilingual subjects.

(d) The section on taste in the same chapter attempted to understand the frequency of the words from the Telugu Corpus and compared them with the responses obtained from Telugu native speakers. It proved that subjects are better in rating the taste related words. As part of this task, the subjects were asked to sort the same words that are related to taste (such as sweet) which have more overall sorting score followed by the spicy and other taste types. These findings are unique and replace the hierarchy of the existing taste related sub-categories hierarchy as proposed by Bagli (2018) for English language. To sum up, the chapter discussed the four fundamental sensory verbs excluding the other sensory verb, i.e. hear. Each of the other four sense modalities are elaborated in detail based on the theoretical as well as experimental illustrations. The study also proved that the sense *Sweet/Tīpi*

exhibited higher frequency and sorting score. In the similar manner, the researcher also identified that taste exhibited the lowest frequency in the hierarchy.

Based on the empirical results which are carried out on the four sense modalities, the study concludes that see has the highest frequency followed by hear/*vinu*, smell/*vaacana*, touch/*taaku* and taste/*ruci* whereas in Viberg's (1983) model see has the highest frequency which is mapped with the present study followed by hear/*vinu*, touch/*taaku*, taste/*ruci* and smell/*vaacana* (which are grouped together in Viberg). The present study differs in the place of touch/*taaku* (with smell/*vaacana*) in the Viberg's hierarchy. In the similar manner, for Viberg the fourth one which is a combination of taste/*ruci* and smell/*vaacana* whereas in the present study touch/*taaku* and taste/*ruci* are differentiated by the subjects and mentioned both the senses individually. Hence it can be stated that see/*cuudu* and hear/*vinu* in both the studies are similar in the hierarchy whereas touch/*taaku*, taste/*ruci* and smell/*vaacana* are altered in the hierarchy. This is illustrated in the table below:

Sense Modality	**Activity**	**Experience**	**Phenomenon-Based**
Sight	*cuudu*	*cuudu*	*kanipincu*
Hear	*vinu*	*vinu*	*kanipincu*
Smell	*vaacana cuudu*	*vaacana cuudu*	*vacana vaccu*
Touch	*taakicuudu*	*anipincu*	*anipincu*
Taste	*ruci cuudu*	*ruci cuudu*	*ruciga anipincu*

From the table one can observe that the Viberg (1983) model has the sequence of sense modalites as **see→hear→touch→taste, smell** whereas the present study resulted in the following manner which differs slightly from Viberg. This is illustrated in the following sequence with regard to Telugu: **see (***cuudu***) →hear (***vinu***) →smell (***vaacana cucu***) →touch (***taaku***) →taste (***ruci cuudu***).**

By this study we can also say that these sensory modalities interact with each other and they are not independent in nature, there are languages that might not have verbs/words for specific modalities which will change the hierarchy as a whole, for such cases an in-depth study is needed in those languages.

In the fourth chapter which is a corpus-based analysis of perception verbs found that there are asymmetries in the study of perception verbs in Telugu and it also focused on the relationship of the words and their synonyms as well as usage in Telugu for sense modalities. These asymmetries may be due to cultural, metaphorical usage or limited use of particular verbs in the Telugu perceptual vocabulary in daily life. Results demonstrate that the senses are produced in the same way pertaining to general usage of the words in terms of type and token frequencies. Results also demonstrate that there is a visual and hearing dominance like the other studies indicated previously. Notable difference is, after these two verbs *see* and *hear*, the sense vocabulary for *smell* also dominates the *taste* and *touch* and negates with the previous studies in English being seen as the least verb, of all the five. This study also suggests that verbs of perception in Telugu language involve understanding the structure representing multimodal mental processes. The usage of sensory words in hierarchy formation by studying the corpus and self-rating task of these senses modalities are both identical and non-identical in their higher dominance ranking and are based on the communicative needs of the speaker.

Similarly, in other languages these two verbs (vision, hear) may struggle with each other for their positions and our results also states *vision* and *hear* are most commonly used in daily usage of all the other senses in the related vocabulary. But an in-depth study is necessary for further evidence.

As discussed in the foregoing discussion, the researcher arrived at the conclusion that the continuous study of these verbs in languages may give new insight not alone linguistic aspects but add up to the cognitive models in studying perception. In this study a new way of understanding perception verbs was performed to understand the usage of sensory words. However, it is necessary to manifest the models which allows a common ground for the study of perception verbs. With respect to perception verbs, it has been understood that there was a rigid hierarchy of senses previously and this may not be true in case of all the languages. The only way out to figure out the problem is by asking native speakers and to see if the corpus data adheres to the hierarchy of senses or not. With generating the task for such evaluation we get better insights both in terms of languages and cognitive aspects of these sense modalities.

Further, the study can be extended to the rest of the major Dravidian languages, viz. Tamil, Kannada and Malayalam. Along with these languages, the study can be extended extensively to correlate the results of Telugu language with indigenous languages to see the cognitive perspectives of perception verbs. In addition, the study also can be extended to all the families of languages to see the pan-Indian scenario which could be a part of the New Education Policy (2020) where the policy is promoting mother tongue education. Hence, the future study will help to understand the deeper cultural and cognitive perspectives of perception verbs of regional and indigenous languages of India in particular.

References

Abutalebi, J., et.al. (2015). The neuroprotective effects of bilingualism upon the inferior parietal lobule: a structural neuroimaging study in aging Chinese bilinguals. *Journal of Neurolinguistics, 33*, 3-13.

Alladi, S., et.al. (2017). Bilingualism delays the onset of behavioral but not aphasic forms of frontotemporal dementia. *Neuropsychologia*, 99, 207-212.

Alladi, S., et.al. (2013). Bilingualism delays age at onset of dementia, independent of education and immigration status. *Neurology*, 81(22), 1938-1944.

Ansaldo, A. I., et.al. (2015). Interference control in elderly bilinguals: Appearances can be misleading. *Journal of clinical and Experimental Neuropsychology*, 37(5), 455-470.

Arnheim, R. (1997). *Visual Thinking*. California: University of California Press.

Austin, J. L. (1962). *Sense and Sensibilia*. Oxford: Clarendon.

Auvray, M., & Spence, C. (2008). The multisensory perception of flavor. *Consciousness and Cognition*, 17(3), 1016-1031.

Ayabe-Kanamum, S., et.al. (1997). Effect of verbal cues on recognition memory and pleasantness evaluation of unfamiliar odors. *Perceptual and Motor Skills*, 85(1), 275-285.

Backhouse, A. E. (1995). The lexical field of taste, a semantic study of Japanese taste terms. *American Anthropologist*, 97(4), 827-828.

Bagli, M. (2018). Defining taste in English informant categorization. In Baicchi, Annalisa, Digonnet, Rémi & Sandford, Jodi L. (eds.), *Sensory Perceptions in Language, Embodiment and Epistemology*. Springer, Cham, 155-175.

Bak, T. H., et.al (2014). Does bilingualism influence cognitive aging? *Annals of Neurology*, 75(6), 959-963.

Barcelona, Antonio, (2003). Metonymy in cognitive linguistics: an analysis and a few modest proposals. In: Cuyckens, H., Berg, T., Dirven, R., Panther, K.-U. (Eds.), *Motivation in Language: Studies in Honor of Gunter Radden*. John Benjamins, Amsterdam/Philadelphia, 223–255.

Barsalou, L. W. (1999). Perceptual symbol systems. *Behavioral and Brain Sciences*, 22(4), 577-660.

_____. (2008). Grounding symbolic operations in the brain's modal systems. In G. R. Semin & E. R. Smith (Eds.), *Embodied Grounding: Social, Cognitive, Affective and Neuroscientific approaches*. Cambridge University Press, 9–42.

Barten, S. S. (1998). Speaking of music: The use of motor-affective metaphors in music instruction. *Journal of Aesthetic Education*, 32(2), 89-97.

Bartoshuk, L. M. (1978). History of taste research. In E. C. Carterette & M. P. Friedman (Eds.), *Handbook of Perception: Vol VIA. Tasting and Smelling*. New York: Academic Press, 3–18.

Beaty, R. E., & Silvia, P. J. (2013). Metaphorically speaking: Cognitive abilities and the production of figurative language. *Memory & Cognition*, 41(2), 255-267.

Bedny, M., et.al. (2008). Concepts are more than percepts: The case of action verbs. *The Journal of Neuroscience, 28*(44), 11347–11353.

Benedek, M., et.al (2014). Creating metaphors: The neural basis of figurative language production. *NeuroImage*, 90, 99-106.

Bengtsson, S., et.al. (2001). Brain activation during odor perception in males and females. *Neuroreport*, 12(9), 2027-2033.

Bergen, B. K. (2012). *Louder than words: The new science of how the mind makes meaning*. New York: Basic Books.

Berlin, B., & Kay, P. (1969). *Basic Color terms: Their Universality and Evolution*. Berkeley: University of California Press.

Blake, R., Sobel, K. V., & James, T. W. (2004). Neural synergy between kinetic vision and touch. *Psychological Science*, 15(6), 397-402.

Brand, G., & Millot, J. L. (2001). Sex differences in human olfaction: between evidence and enigma. *The Quarterly Journal of Experimental Psychology Section B*, 54(3b), 259-270.

Brewer, B. (2011). *Perception and its Objects*. Oxford: Oxford University Press

Brysbaert, M., Lange, M., & Wijnendaele, I. V. (2000). The effects of age-of-acquisition and frequency-of-occurrence in visual word recognition: Further evidence from the Dutch language. *European Journal of Cognitive Psychology*, 12(1), 65-85.

Buck, C. D. (2008). *A Dictionary of Selected Synonyms in the Principal Indo-European Languages*. Chicago: University of Chicago Press.

Cacciari, C. (2008). Crossing the senses in metaphorical language. In R. W. Gibbs, Jr. (Ed.), *The Cambridge Handbook of Metaphor and Thought*, Cambridge: Cambridge University Press, 425–443.

Cain, W. S. (1982). Odor identification by males and females: predictions vs performance. *Chemical Senses*, 7(2), 129-142.

Catalanotto, F. A., et.al. (1993). Effects of anesthesia of the facial nerve on taste. *Chemical Senses*, 18(5), 461-470.

Chiappe, D. L., & Chiappe, P. (2007). The role of working memory in metaphor production and comprehension. *Journal of Memory and Language*, 56(2), 172-188.

Chung-Fat-Yim, A., Sorge, G. B., & Bialystok, E. (2017). The Relationship between Bilingualism and Selective Attention in Young Adults: Evidence from an Ambiguous Figures Task. *Quarterly Journal of Experimental Psychology*, 70(3), 366–372. .

Clark, H. H., & Gerrig, R. J. (1990). Quotations as demonstrations. *Language*, 764-805.

Clark, H. H. (1996). *Using Language*. Cambridge: Cambridge University Press.

Classen, C. (1993). *Worlds of sense: Exploring the Senses in History and Across Cultures*. London: Routledge.

_____. (1997). Foundations for an anthropology of the senses. *International Social Science Journal*, 49(153), 401-412.

Connell, L., & Lynott, D. (2009). Is a bear white in the woods? Parallel representation of implied object color during language comprehension. *Psychonomic Bulletin & Review*, 16(3), 573-577.

_____. (2010). Look but don't touch: Tactile disadvantage in processing modality-specific words. *Cognition*, 115(1), 1-9.

_____. (2012). Strength of perceptual experience predicts word processing performance better than concreteness or imageability. *Cognition*, 125(3), 452-465.

_____. (2016). Do we know what we're simulating? Information loss on transferring unconscious perceptual simulation to conscious imagery. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 42(8), 1218.

Cosco, T. D., et.al. (2014). Operational definitions of successful aging: a systematic review. *International Psychogeriatrics*, 26(3), 373-381.

Costa, A., et.al. (2009). On the bilingual advantage in conflict processing: Now you see it, now you don't. *Cognition*, 113(2), 135-149.

Craig, A. D. (2003). A new view of pain as a homeostatic emotion. *Trends in Neurosciences*, 26(6), 303-307.

Croijmans, I., & Majid, A. (2016). Not all flavor expertise is equal: The language of wine and coffee experts. *PLoS One*, 11.

Croijmans, I., et.al. (2019). Measuring multisensory imagery of wine: The vividness of wine imagery questionnaire. *Multisensory Research*, 32(3), 179-195.

Dacremont, C. (1995). Spectral composition of eating sounds generated by crispy, crunchy and crackly foods. *Journal of Texture Studies,* 26(1), 27-43.

Dancygier, B., & Sweetser, E. (2014). *Figurative Language*. Cambridge: Cambridge University Press.

Day, S. (1996). Synaesthesia and synaesthetic metaphors. *Psyche,* 2(32), 1-16.

Ullmann, S, De. (1945). Romanticism and Synaesthesia: A Comparative Study of Sense Transfer in Keats and Byron. *Publications of the Modern Language Association of America, 60(3),* 811-827.

Vignemont, F. De, et.al. (2009). Segmenting the body into parts: evidence from biases in tactile perception. *The Quarterly Journal of Experimental Psychology*, 62(3), 500-512.

Dikker, S., et.al. (2010). Early occipital sensitivity to syntactic category is based on form typicality. *Psychological Science*, 21(5), 629-634.

Dingemanse, M. (2012). Advances in the cross-linguistic study of ideophones. *Language and Linguistics compass*, 6(10), 654-672.

_____. (2013). Ideophones and gesture in everyday speech. *Gesture*, 13(2), 143-165.

Dingemanse, M., et.al. (2015). Arbitrariness, iconicity, and systematicity in language. *Trends in Cognitive Sciences*, 19(10), 603-615.

Doty, R. L., Shaman, P., & Dann, M. (1984). Development of the University of Pennsylvania Smell Identification Test: a standardized microencapsulated test of olfactory function. *Physiology & Behavior*, 32(3), 489-502.

Dubois, D., Plümacher, M., & Holz, P. (2007). *From psychophysics to semiophysics: Categories as acts of meaning. Speaking of Colors and Odors*, Amsterdam: John Benjamins, 167-184.

Durga, A. (2012). Estimation of WordNet-based Lexical Semantic Similarity Measure for Telugu Documents. *IOSR Journal of Computer Engineering,1*, 24-30.

Edwards, D., & Goodwin, R. (1985). The language of shared attention and visual experience: a functional study of early nomination. *Journal of Pragmatics*, 9(4), 475-493.

Enfield, N. J. (2008). Language as shaped by social interaction. *Behavioral and Brain Sciences*, 31(5), 519-520.

Engen, T. (1987). Remembering Odors and Their Names. *American Scientist*, 75(5), 497-503. Retrieved October 9, 2020, from http://www.jstor.org/stable/27854791

_____. (1991). *Odor sensation and memory*. NY: Greenwood Publishing Group.

Eriksen, B. A., & Eriksen, C. W. (1974). Effects of noise letters upon the identification of a target letter in a nonsearch task. *Perception & Psychophysics*, 16(1), 143-149.

Evans V, Bergen B, Zinken J. (2007). *The Cognitive Linguistics Enterprise: An Overview. The Cognitive Linguistics Reader*. London: Equinox publishers. 263–266.

Evans, N., & Wilkins, D. (2000). In the mind's ear: The semantic extensions of perception verbs in Australian languages. *Language*, 76:3, 546-592.

Feld, S., et.al. (2004). Vocal anthropology: from the music of language to the language of song. *A Companion to Linguistic Anthropology*, Oxford: Blackwell, 321-345.

Feldman, J., & Narayanan, S. (2004). Embodied meaning in a neural theory of language. *Brain and Language*, 89(2), 385-392.

Fernandez, J. W. (Ed.). (1991). *Beyond Metaphor: The Theory of Tropes in Anthropology*. Stanford: Stanford University Press.

Fischer, A. (1999). What, if anything, is phonological iconicity? In O. Fischer & M. Nänny (Eds.), *Form Miming Meaning: Iconicity in Language and Literature.* Amsterdam: John Benjamins. 123–134.

Floyd, S., Roque, L. S., & Majid, A. (2018). Smell is coded in grammar and frequent in discourse: Cha'palaa olfactory language in cross-linguistic perspective. *Journal of Linguistic Anthropology*, 28(2), 175-196.

Forestell, C. A., & Mennella, J. A. (2015). The ontogeny of taste perception and preference throughout childhood. In: Doty R.L. (ed.). *Handbook of Olfaction and Gustation*. New Jersey: John Wiley & Sons, 795-826.

Frank, R. A., et.al. (2011). Odor recognition memory as a function of odor-naming performance. *Chemical Senses*, 36(1), 29-41.

Galac, Ádám. (2020). Semantic change of basic perception verbs in English, German, French, Spanish, Italian, and Hungarian. *Argumentum*. 16. 125-146.

Gallese, V., & Lakoff, G. (2005). The brain's concepts: The role of the sensory-motor system in conceptual knowledge. *Cognitive Neuropsychology*, 22(3-4), 455-479.

Gibbs Jr, R. W. (2003). Embodied experience and linguistic meaning. *Brain and Language*, 84(1), 1-15.

_____. (2005). *Embodiment and cognitive science*. Cambridge: Cambridge University Press.

Glaser, D. (1999). The evolution of taste perception. *World Rev Nutr Diet*, 85, 18-38.

Glenberg, A. M. (1997). What memory is for. *Behavioral and Brain Sciences*, 20(1), 1-19.

Gold, B. T., et.al. (2013). Lifelong bilingualism maintains neural efficiency for cognitive control in aging. *Journal of Neuroscience*, 33(2), 387-396.

González, J., et.al. (2006). Reading cinnamon activates olfactory brain regions. *Neuroimage*, 32, 906-912.

Goodwin, C. (1994). Professional vision. *American Anthropologist*, 96(3), 606–633.

Grady, J.E., Oakley, T. and Coulson, S. (1999). Blending and metaphor. In G. Steen & R. Gibbs (Eds.), *Metaphor in Cognitive Linguistics*. Amsterdam: John Benjamins, 101–124.

Grant, A. C., Thiagarajah, M. C., & Sathian, K. (2000). Tactile perception in blind Braille readers: a psychophysical study of acuity and hyperacuity using gratings and dot patterns. *Perception & Psychophysics*, 62(2), 301-312.

Graumann, A. (2007). Color names and dynamic imagery. In M. Plümacher, & P. Holz (Eds.), *Speaking of Colors and Odors*. Amsterdam: John Benjamins, 129–140.

Gries, S. T., Hampe, B., & Schönefeld, D. (2005). Converging evidence: Bringing together experimental and corpus data on the association of verbs and constructions. *Cognitive Linguistics*, 16, 635–676.

Gruber, J. S. (1967). Look and see. *Language*, 43, 937-947.

Guest, S., Catmur, C., Lloyd, D., & Spence, C. (2002). Audiotactile interactions in roughness perception. *Experimental Brain Research*, 146(2), 161-171.

Hänig DP (1901) Zur Psychophysik des Geschmackssinnes. *Philos Studien* 17:576–623

Hauk, O., Johnsrude, I., & Pulvermüller, F. (2004). Somatotopic representation of action words in human motor and premotor cortex. *Neuron*, 41(2), 301-307.

Helle, P. (2006). *A Contrastive Analysis of Perception Verbs in English and German.* Munich: GRIN Publishing.

Herz, R. S., & Engen, T. (1996). Odor memory: Review and analysis. *Psychonomic Bulletin & Review*, 3(3), 300-313.

Hilchey, M. D., Saint-Aubin, J., & Klein, R. M. (2015). Does bilingual exercise enhance cognitive fitness in non-linguistic executive processing tasks. In J. W. Schwieter (Ed.), *The Cambridge Handbook of Bilingual Processing*. Cambridge: Cambridge University Press.

Hinton, L., Nichols, J., & Ohala, J. (1994). Introduction: sound-symbolic processes. In L. Hinton, J. Nichols, & J. Ohala (Eds.), *Sound Symbolism*, Cambridge: Cambridge University Press, 1–12.

Howes, D. (2003). *Sensing Culture: Engaging the Senses in Culture and Social Theory*. Ann Arbor: The University of Michigan Press.

_____ (ed.). (1991). *The Varieties of Sensory Experience*: *A Sourcebook in the Anthropology of the Senses*, Buffalo: University of Toronto Press.

Huisman, J. L., & Majid, A. (2018). Psycholinguistic variables matter in odor naming. *Memory & Cognition*, 46(4), 577-588.

Huumo, T. (2010). Is perception a directional relationship? On directionality and its motivation in Finnish expressions of sensory perception. *Linguistics*, 48(1), 49-97.

Iatropoulos, G., et.al. (2018). The language of smell: Connecting linguistic and psychophysical properties of odor descriptors. *Cognition*, 178, 37-49.

Ibarretxe-Antuñano, I. (2002). Mind-as-body as a cross-linguistic conceptual metaphor Miscelánea. *A Journal of English and American Studies*, 25(1), 93-119.

_____. (2008). Vision Metaphors for the Intellect: Are they Really Cross-Linguistic? *Atlantis*, 30(1), 15-33.

Itagaki, H. (2020). Revisiting Constructional Changes in Uni-directional Copulative Perception Verb Constructions. *Language and Culture Joint Research Project*, 2019, 61-70.

Jaeger T. F. (2008). Categorical Data Analysis: Away from ANOVAs (transformation or not) and towards Logit Mixed Models. *Journal of Memory and Language*, 59(4), 434–446.

Jönsson, F. (2005). *Olfactory Metacognition: A Metamemory Perspective on Odor Naming*. (Doctoral dissertation, Acta Universitatis Upsaliensis). Digital Comprehensive Summaries of Uppsala Dissertations from the Faculty of Social Sciences 6.

Julius, D., & Basbaum, A. I. (2001). Molecular mechanisms of nociception. *Nature*, 413(6852), 203-210.

Jumaah, R. T., Md Rashid, S., Abdul Jabar, M. A. B., & Ali, A. M. (2020). A Cognitive Semantic Analysis of Arabic Verb of Visual Perception رأى (ra'a) in Fiction Writing. *SAGE Open*.

Kane, M. J., & Engle, R. W. (2002). The role of prefrontal cortex in working-memory capacity, executive attention, and general fluid intelligence: An individual-differences perspective. *Psychonomic Bulletin & Review*, 9(4), 637-671.

Kasirer, A., & Mashal, N. (2018). Fluency or similarities? Cognitive abilities that contribute to creative metaphor generation. *Creativity Research Journal*, 30(2), 205-211.

_____ (2016). Comprehension and generation of metaphors by children with autism spectrum disorder. *Research in Autism Spectrum Disorders*, *32*, 53-63.

Kendon, A. (2014). Semiotic diversity in utterance production and the concept of 'language'. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 369(1651), 20130293.

Kenemans, J. L., et.al. (2005). Attention deficit and impulsivity: selecting, shifting, and stopping. *International Journal of Psychophysiology*, 58(1), 59-70.

Kessels, R. P., et.al. (2000). The Corsi block-tapping task: standardization and normative data. *Applied Neuropsychology*, 7(4), 252-258.

Kita, S. (Ed.). (2003). *Pointing: Where Language, Culture, and Cognition Meet*. Mahwah, NJ: Erlbaum.

Koptjevskaja-Tamm, M. (Ed.). (2015). *The linguistics of Temperature* (Vol. 107). Amsterdam: John Benjamins.

Kövecses, Z. (2005). *Metaphor in Culture: Universality and Variation*. Cambridge: Cambridge University Press.

Krishnamurti, Bh. (1961). *Telugu Verbal Bases*. New Delhi: Motilal Banarsidass Publication.

_____. (2003). *The Dravidian Languages*. Cambridge: Cambridge University Press.

Krishnamurti, Bh. & Gwynn, J. P. L. (1985). *A Grammar of Modern Telugu*. Oxford: Oxford University Press.

Kwon, O. S., et.al. (2015). An ultrasensitive, selective, multiplexed superbioelectronic nose that mimics the human sense of smell. *Nano letters*, 15(10), 6559-6567.

Laasonen, M., & Virsu, V. J. (2001). Temporal order and processing acuity of visual, auditory, and tactile perception in developmentally dyslexic young adults. *Cognitive, Affective, & Behavioral Neuroscience*, 1(4), 394-410.

Lacey, S., Stilla, R., & Sathian, K. (2012). Metaphorically feeling: comprehending textural metaphors activates somatosensory cortex. *Brain and Language*, 120(3), 416-421.

Lakoff, G. (1993). The contemporary theory of metaphor. In A. Ortony (Ed.), *Metaphor and thought* (2nd ed.). Cambridge: Cambridge University Press. 202-250.

Lakoff, G., & Johnson, M. (1980). The metaphorical structure of the human conceptual system. *Cognitive Science*, 4(2), 195-208.

_____. (1999). *Philosophy in the Flesh: The Embodied Mind and its Challenge to Western Thought* (Vol. 640). New York: Basic books.

_____. (1980). *Metaphors we live by*. Chicago: University of Chicago Press.

_____. (1990). The invariance hypothesis: is abstract reason based on image-schemas? *Cognitive Linguistics*, 1, 39–74.

Langacker, R. (1987). Nouns and Verbs. *Language*, 63(1), 53-94.

Lascaratou, C. (2007). *The Language of Pain: Expression or Description*? Amsterdam: John Benjamins.

Lawton, D. M., Gasquoine, P. G., & Weimer, A. A. (2015). Age of dementia diagnosis in community dwelling bilingual and monolingual Hispanic Americans. *Cortex*, 66, 141-145.

Lee, D. S., Kim, E., & Schwarz, N. (2015). Something smells fishy: Olfactory suspicion cues improve performance on the Moses illusion and Wason rule discovery task. *Journal of Experimental Social Psychology*, 59, 47-50.

Lehere, Adrienne (1978). Structures of the lexicon and transfer of meaning. *Lingua*, 45(2), 95-123.

_____. (1983). *Wine and Conversation*. Bloomington: Indian University Press.

Lemon, R. (1988). The output map of the primate motor cortex. *Trends in Neurosciences*, 11(11), 501-506.

Levelt, W. J., Roelofs, A., & Meyer, A. S. (1999). A theory of lexical access in speech production. *Behavioral and Brain Sciences*, 22, 1-38.

Levin, B. (1993). *English Verb Classes and Alternations: A Preliminary Investigation*. Chicago: University of Chicago Press.

Levinson, S. C., & Majid, A. (2014). Differential ineffability and the senses. *Mind & Language*, 29(4), 407-427.

Levinson, S. C. (2000). Yélî Dnye and the theory of basic color terms. *Journal of Linguistic Anthropology*, 10, 3–55.

Lievers, F. S. (2015). Synaesthesia: A corpus-based study of cross-modal directionality. *Functions of Language*, 22(1), 69-95.

Lockwood, G., & Dingemanse, M. (2015). Iconicity in the lab: A review of behavioral, developmental, and neuroimaging research into sound-symbolism. *Frontiers in Psychology*, 6, 1246.

Louwerse, M., & Connell, L. (2011). A taste of words: Linguistic context and perceptual simulation predict the modality of words. *Cognitive Science*, 35(2), 381-398.

Lyman, B. J., & McDaniel, M. A. (1986). Effects of encoding strategy on long-term memory for odours. *The Quarterly Journal of Experimental Psychology*, 38(4), 753-765.

_____. (1990). Memory for odors and odor names: Modalities of elaboration and imagery. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 16(4), 656.

Lynott, D., & Connell, L. (2009). Modality exclusivity norms for 423 object properties. *Behavior Research Methods*, 41, 558–564.

_____. (2013). Modality exclusivity norms for 400 nouns: The relationship between perceptual experience and surface word form. *Behavior Research Methods*, 45, 516–526.

Macpherson, F. (Ed.). (2011). *The Senses: Classic and Contemporary Philosophical Perspectives (Vol. 11)*. Oxford: Oxford University Press.

Mahon, B. Z., & Caramazza, A. (2008). A critical look at the embodied cognition hypothesis and a new proposal for grounding conceptual content. *Journal of Physiology*, 102(1-3), 59-70.

Majid, A., & Burenhult, N. (2014). Odors are expressible in language, as long as you speak the right language. *Cognition*, 130(2), 266-270.

Majid, A., & Levinson, S. C. (2010). WEIRD languages have misled us, too. *The Behavioral and Brain Sciences*, 33(2-3), 103.

Majid, A., Senft, G., & Levinson, S. C. (2007). The language of olfaction. *In Field Manual Volume 10. Max Planck Institute for Psycholinguistics*. 36-41.

Manasia, M. G. (2016). Polysemy and Metaphor in the Verbs of Perception. *Proceedings of Harvard Square Symposium: The Future of Knowledge*, Volume 1. 55–64.

Mannaert, L. N. H., Dijkstra, K., & Zwaan, R. A. (2017). Is color an integral part of a rich mental simulation?. *Memory & Cognition*, 45(6), 974-982.

Markman, A. B. (2008). Pluralism, relativism and the proper use of theories. *Journal of Experimental and Theoretical Artificial Intelligence*, 20(3), 247-250.

Marks, L. E. (1982). Bright sneezes and dark coughs, loud sunlight and soft moonlight. *Journal of Experimental Psychology: Human Perception and Performance*, 8(2), 177.

Marks, L. E., & Stevens, J. C. (1966). Individual brightness functions. *Perception & Psychophysics*, 1(1), 17-24.

Matisoff, 1. A. 1978. Variational Semantics in Tibeto-Burman: The 'Organic' Approach to Linguistic Comparison. Philadelphia: Publ. 1nst. *Stud. Hum*. Iss. 331.

McBurney, D. H. (1974). Are there primary tastes for man?. *Chemical Senses*, 1(1), 17-28.

McGann, J. P. (2017). Poor human olfaction is a 19th-century myth. *Science*, 356(6338).

Menashe, S., et.al (2020). Elucidating the role of selective attention, divergent thinking, language abilities, and executive functions in metaphor generation. *Neuropsychologia*, 107458.

Mendelson, D. (1984). Synaesthetic Metaphor in the Work of Isaak Babel'. *Russian Literature*, 15(3), 347-362.

Meyer, A. S., Roelofs, A., & Levelt, W. J. (2003). Word length effects in object naming: The role of a response criterion. *Journal of Memory and Language*, 48(1), 131-147.

Miller, G. A., & Johnson-Laird, P. N. (1976). *Language and perception*. Cambridge, MA: Harvard University Press.

Mishra, R. K. 2018. *Bilingualism and Cognitive Control*. New Delhi: Springer International Publishing.

Mishra, R. K., Hilchey, M. D., Singh, N., & Klein, R. M. (2012). On the time course of exogenous cueing effects in bilinguals: higher proficiency in a second language is associated with more rapid endogenous disengagement. *Quarterly Journal of Experimental Psychology*, 65(8), 1502-1510.

Mishra, R. K., Padmanabhuni, M., Bhandari, P., Viswambharan, S., & Prasad, S. G. (2019). Language proficiency does not modulate executive control in older bilinguals. *Aging, Neuropsychology, and Cognition*, 26(6), 920-951.

Morein-Zamir, S., Soto-Faraco, S., & Kingstone, A. (2003). Auditory capture of vision: examining temporal ventriloquism. *Cognitive Brain Research*, 17(1), 154-163.

Moskowitz, H. W., et.al. (1975). Cross-cultural differences in simple taste preferences. *Science*, 190, 1217-1218.

Neagu, M. (1999). Flowers, vegetables, fruits and weeds: A metaphorical approach. In *Proceedings of the AISB'99 Symposium on Metaphor, Artificial Intelligence, and Cognition Brighton*, England. 118–120.

_____. (2013). What is Universal and What is Language specific in The Polysemy of Perception Verbs?. *Revue roumaine de linguistique* LVIII, 3, 329-343.

Nedelcheva, S. (2020). Exploring Smell From A Cognitive Perspective In English And Bulgarian (A Corpus Study). *Studies in Linguistics, Culture, and FLT*, 8(2), 95-116.

O'keeffe, A., McCarthy, M., & Carter, R. (2007). *From Corpus to Classroom: Language Use and Language Teaching*. Cambridge: Cambridge University Press.

O'Mahony, M., et.al. (1979). Confusion in the use of the taste adjectives 'sour'and 'bitter'. *Chemical Senses*, 4(4), 301-318.

Osawa, Y., & Ellen, R. (2014). The cultural cognition of taste term conflation. *The Senses and Society*, 9(1), 72-91.

Paap, K. R., Johnson, H. A., & Sawi, O. (2014). Are bilingual advantages dependent upon specific tasks or specific bilingual experiences?. *Journal of Cognitive Psychology*, 26(6), 615-639.

_____ (2015). Bilingual advantages in executive functioning either do not exist or are restricted to very specific and undetermined circumstances. *Cortex*, 69, 265– 278.

Papageorgiou, A., Bright, P., Tomas, E. P., & Filippi, R. (2018). Evidence against a cognitive advantage in the older bilingual population. *Quarterly Journal of Experimental Psychology*.

Palmer, S. E., et.al. (2012). Color, music, and emotion. *Dimension*, 1, 1-5.

Peirce, C. S. (1992). *The essential Peirce: selected philosophical writings (Vol. 2).* Bloomington: Indiana University Press.

Perani, D., et.al. (2017). The impact of bilingualism on brain reserve and metabolic connectivity in Alzheimer's dementia. *Proceedings of the National Academy of Sciences*, 114(7), 1690-1695.

Pérez-Sobrino, P., & Julich, N. (2014). Let's talk music: A corpus-based account of musical motion. *Metaphor and Symbol*, 29(4), 298-315.

Perlman, M., & Cain, A. A. (2014). Iconicity in vocalization, comparisons with gesture, and implications for theories on the evolution of language. *Gesture*, 14(3), 320-350.

Perlman, M., Clark, N., & Johansson Falck, M. (2015). Iconic prosody in story reading. *Cognitive Science*, 39(6), 1348-1368.

Popova, Y. 2005. "Image schemas and verbal synaesthesia". *In From perception to meaning: Image schemas in cognitive linguistics,* Edited by: Hampe, B. Berlin, NY: Germany and New York. Mouton de Gruyter, 29, 395-419.

Porcello, T. (2004). Speaking of sound: language and the professionalization of sound-recording engineers. *Social Studies of Science*, 34(5), 733-758.

Proust, M. (2016). *Remembrance of Things Past. (Vols.1-3).* Translated by C.K.S. Moncrieff. London: Penguin.

Pustejovsky, J., & Joshi, A. (2017). Lexical factorization and syntactic behaviour. *Linguistic Issues in Language Technology*, Volume 15, CSLI Publications 2017.

Rabin, M. D., & Cain, W. S. (1984). Odor recognition: familiarity, identifiability, and encoding consistency. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 10(2), 316.

Rakova, M. 2003. *The Extent of the Literal: Metaphor, Polysemy and Theories of Concepts*, New York, NY: Palgrave Macmillan.

Reed, C. L., Klatzky, R. L., & Halgren, E. (2005). What vs. where in touch: an fMRI study. *Neuroimage*, 25(3), 718-726.

Regier, T., Carstensen, A., & Kemp, C. (2016). Languages support efficient communication about the environment: Words for snow revisited. *PloSone*, 11(4), e0151138.

Rogalewski, A., et.al. (2004). Transcranial direct current stimulation disrupts tactile perception. *European Journal of Neuroscience*, 20(1), 313-316.

Rogers, A. (1972). Another look at flip perception verbs. *Eighth Regional Meeting of the USA Chicago Linguistic Society*, 303-315.

Ronga, I., et.al. (2012). Linguistic synaesthesia, perceptual synaesthesia, and the interaction between multiple sensory modalities. *Pragmatics & Cognition*, 20(1), 135-167.

Rylina, G. (2012). *Contrastive study of a perception verb in English and Russian: feel vs čuvstvovat'* (Doctoral dissertation, Thesis), Ghent University.

San Roque, L., et.al. (2015). Vision verbs dominate in conversation across cultures, but the ranking of non-visual verbs varies. *Cognitive Linguistics*, 26(1), 31-60.

San Roque, L., et.al. (2015). Vision verbs dominate in conversation across cultures, but the ranking of non-visual verbs varies. *Cognitive Linguistics*, 26(1), 31-60.

Santos, D. (1998). Perception verbs in English and Portuguese. In S. Johansson, & S. Oksefjell (Eds.), *Corpora and Crosslinguistic Research: Theory, Method and Case Studies.* Amsterdam: Rodopi, 24, 319– 342.

Sathian, K. (2005). Visual cortical activity during tactile perception in the sighted and the visually deprived. Developmental Psychobiology: *The Journal of the International Society for Developmental Psychobiology*, 46(3), 279-286

Saussure, F. De. (1959). *Course in General Linguistics*. New York: The Philosophical Library. Inc. (original work published in 1915).

Sekuler, R., & Blake, R. (1994). *Perception*. New York: McGraw-Hill.

Semino, E. (2010). Descriptions of pain, metaphor, and embodied simulation. *Metaphor and Symbol*, 25(4), 205-226.

Shen, Y. (1997). Cognitive constraints on poetic figures. *Cognitive Linguistics*, 8(1), 33-72.

Shen, Y., & Aisenman, R. (2008). Heard melodies are sweet, but those unheard are sweeter': synaesthetic metaphors and cognition. *Language and Literature*, 17(2), 107-121.

Shen, Y., & Cohen, M. (1998). How come silence is sweet but sweetness is not silent: a cognitive account of directionality in poetic synaesthesia. *Language and Literature*, 7(2), 123-140.

Shen, Y., & Gadir, O. (2009). How to interpret the music of caressing: Target and source assignment in synaesthetic genitive constructions. *Journal of Pragmatics*, 41(2), 357-371.

Shepherd, G. M. (2004). The human sense of smell: are we better than we think*?*. *PLoS Biology*, 2(5), e146.

Shibuya, Y., Nozawa, H., & Kanamaru, T. (2007). Understanding synesthetic expressions: Vision and olfaction with the physiological = psychological model. In M. Plümacher, & P. Holz (Eds.), *Speaking of colors and odors.* Amsterdam: John Benjamins, 203–226.

Shinohara, K., & Nakayama, A. (2011). Modalities and directions in synaesthetic metaphors in Japanese. *Cognitive Studies*, 18(3), 491-507.

Sibley, F. N. (1955). Seeking, scrutinizing and seeing. *Mind*, 64(256), 455-478.

Simmons, W. K., et.al. (2007). A common neural substrate for perceiving and knowing about color. *Neuropsychologia*, 45(12), 2802-2810.

Siskind, J. M. (2001). Grounding the lexical semantics of verbs in visual perception using force dynamics and event logic. *Journal of Artificial Intelligence Research*, 15, 31-90.

Smith, D. V., & Margolskee, R. F. (2006). Making sense of taste. *Scientific American*, 16 (3), 84-92.

Sorabji, R. (1971). Aristotle on demarcating the five senses. *The Philosophical Review*, 80(1), 55-79.

Speed, L. J., & Majid, A. (2018). An exception to mental simulation: No evidence for embodied odor language. *Cognitive Science*, 42(4), 1146-1178.

Spence, C. (2011). Crossmodal correspondences: A tutorial review. *Attention, Perception, & Psychophysics*, 73(4), 971-995.

_____. (2012). Managing sensory expectations concerning products and brands: Capitalizing on the potential of sound and shape symbolism. *Journal of Consumer Psychology*, 22, 37–54.

Spence, C., Smith, B., & Auvray, M. (2015). Confusing tastes and flavours. In D. Stokes, M. Matthen, & S. Biggs (Eds.), *Perception and its Modalities*. Oxford: Oxford University Press. 247–274.

Stanfield, R. A., & Zwaan, R. A. (2001). The effect of implied orientation derived from verbal context on picture recognition. *Psychological Science*, 12(2), 153-156.

Stevens, J., & Marks, L. (1965). Cross-Modality Matching of Brightness and Loudness. *Proceedings of the National Academy of Sciences of the United States of America*, 54(2), 407-411.

Stoet, G. (2010). PsyToolkit: A software package for programming psychological experiments using Linux. *Behavior Research Methods*, 42(4), 1096-1104.

_____. (2017). PsyToolkit: A novel web-based method for running online questionnaires and reaction-time experiments. *Teaching of Psychology*, 44(1), 24-31.

Stokes, D., & Biggs, S. (2015). The dominance of the visual. In D. Stokes, M. Matthen, & S. Biggs (Eds.), *Perception and its Modalities*. Oxford University Press 350–378.

Styles, S. J., & Gawne, L. (2017). When does maluma/takete fail? Two key failures and a meta-analysis suggest that phonology and phonotactics matter. *i-Perception*, 8(4).

Suzuki, Y., Gyoba, J., & Sakamoto, S. (2008). Selective effects of auditory stimuli on tactile roughness perception. *Brain Research*, 1242, 87-94.

Sweetser, E. (1990). *Metaphorical and Cultural Aspects of Semantic Structure*. Cambridge: Cambridge University Press.

Tanenhaus, M. K., & Brown-Schmidt, S. (2008). Language processing in the natural world. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 363(1493), 1105-1122.

Taylor, C. W. (1947). A factorial study of fluency in writing. *Psychometrika*, 12(4), 239-262.

Tracey, I. (2005). Nociceptive processing in the human brain. *Current Opinion in Neurobiology*, 15(4), 478-487.

Tsur, R. (2012). *Playing by Ear and the Tip of the Tongue: Precategorical Information in Poetry*. Amsterdam: John Benjamins.

Ullmann, S. (1959). *The Principles of Semantics*. Glasgow: Jackson, Son & Co.

Van Putten, S. (2020). Perception verbs and the conceptualization of the senses: The case of Avatime, *Linguistics*, *58*(2), 1-38

Vandevelde, R. (1977). Mistaken views of see. *Linguistic Inquiry*, 8, 767-772.

Viberg, A. (1983). The verbs of perception: a typological study. *Linguistics*, 21(1): 123-262.

_____. (1993). Crosslinguistic perspectives on lexical organization and lexical progression. In K. Hyltenstam, & A. Viberg (Eds.), *Progression and regression in language: Sociocultural, neuropsychological and linguistic perspectives*. Cambridge, UK: Cambridge University Press, 340 – 385).

Vickers, Z. M. (1984). Crispness and crunchiness—a difference in pitch? *Journal of Texture Studies*, 15(2), 157–163.

Wan, X., et.al. (2014). Cross-cultural differences in crossmodal correspondences between basic tastes and visual features. *Frontiers in Psychology*, 5, 1365.

Whitney, A. H. (1952). Synaesthesia in twentieth-century Hungarian poetry. *The Slavonic and East European Review*, 30(75), 444-464.

Whorf , B. L. (1956), *Language, Thought and Reality*, New York: Wiley.

Wilce, J. M., & Wilce, J. M. (2009). *Language and Emotion*. Cambridge: Cambridge University Press.

Willems, R. M., & Francken, J. C. (2012). Embodied cognition: taking the next step. *Frontiers in Psychology*, 3, 582.

Williams, J. M. (1976). Synaesthetic adjectives: A possible law of semantic change. *Language* 52, 461-478.

Wilson, M. (2002). Six views of embodied cognition. *Psychonomic Bulletin & Review*, 9(4), 625-636.

Winter, B. (2019). Synaesthetic metaphors are neither synaesthetic nor metaphorical. *Perception Metaphors*, 105-126.

Winter, B., & Bergen, B. (2012). Language comprehenders represent object distance both visually and auditorily. *Language and Cognition*, 4(1), 1-16.

Winter, B., Perlman, M., Perry, L. K., & Lupyan, G. (2017). Which words are most iconic?: Iconicity in English sensory words. *Interaction Studies*, 18(3), 443-464.

Wnuk, E., & Majid, A. (2014). Revisiting the limits of language: The odor lexicon of Maniq. *Cognition*, 131(1), 125-138.

Yu, N. (2003). Synesthetic metaphor: *A cognitive perspective. Journal of Literary Semantics*, 32(1), 19-34.

Zucco, G.M. (2012). The acquisition of odour preferences via evaluative olfactory conditioning: Historical background and state of the art. In Zucco, G.M., Herz, R.S., Schaal, B., (Eds) *Olfactory Cognition: From Perception and Memory to Environmental Odours and Neuroscience*; Amsterdam: John Benjamins, 269–294.

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Sensory Perception in Blind Bilinguals and Monolinguals

P. Phani Krishna[1] · S. Arulmozi[2] · Male Shiva Ram[3] · Ramesh Kumar Mishra[1]

Abstract
In blinds, the tactile sensations play a crucial role for various daily activities, in the all sense modalities tactile sensation is considered as major sense of perception. This study is conducted to investigate the tactile sensations in relation to Bilingual and Monolingual blinds using experimental comparative study design, divided into two groups. Self-paced reading task of a Braille scripted passage was used as a stimulus. Findings of this study reported that blind bilingual participants differ in the processing of language, the tactile sensations in the Bilinguals are better as compared to monolinguals.

Keywords Blind · Tactile sensations · Bilingual · Monolingual · Reading · Braille · Sense modality hierarchy

Introduction

Braille is the most common and universal reading method for visually challenged, and blind people and it is based on the tactile sensations, and each letter is represented by a combination of one to six raised dots (Pring 1984). Bilingualism is commonly defined as the use of at least two languages by an individual (Marian et al. 2009). It is a fluctuating system in children and adults whereby use of and proficiency in two languages may change depending on the opportunities to use the languages and exposure

✉ P. Phani Krishna
phanikrishna1992@gmail.com

S. Arulmozi
arulmozi@gmail.com

Male Shiva Ram
shivaram.ram180@gmail.com

Ramesh Kumar Mishra
rkmishra@uohyd.ac.in

[1] Centre for Neural and Cognitive Sciences, School of Medical Sciences, University of Hyderabad, Hyderabad 500046, India

[2] Centre for Applied Linguistics and Translational Studies, School of Humanities, University of Hyderabad, Hyderabad 500046, India

[3] Optometry and Vision Science, School of Medical Sciences, University of Hyderabad, Hyderabad 500046, India

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A COMPARATIVE AND SEMANTIC STUDY OF PERCEPTION VERBS IN TELUGU AND TAMIL

P. Phanikrishna, Research Scholar, University of Hyderabad
Dr. S. Arulmozi, Associate Professor, University of Hyderabad
Ramesh Kumar Mishra, University of Hyderabad

Abstract

The basic aim of this paper is to provide an account of the semantic characteristics of the perception verbs in English, Telugu and Tamil. The semantic field of perception has five components viz. vision, hearing, touch, smell and taste. Many studies had been carried out in the area of semantics of the verbs in many European family of languages like English and other languages. To name a few Poutsma (1926) , Palmer (1966), Leech (1971), Rogers (1971). and Viberg (1984). In fact, there were no works at all on Dravidian family of languages. Only a few scholars have mentioned in nutshell in their grammars. Among them Krishnamurti and Rajendran are a few. In 1961, Krishnamurti discussed on Telugu perception verbs and in 1981 Rajendran discussed on the semantic account of Tamil verbs. Looking at the desperate need, the present paper tries to discuss various semantic extensions of perception verbs in Telugu and Tamil in general and from the cognitive aspect of perception verbs in particular. The paper also tries to see the width of the polysemy of each perception word in Telugu and Tamil in comparison to the English language. For instance, the verb `see' in Telugu /cuudu/ has nine senses whereas in Tamil /paar/ and /kaaN/ has 26 and 16 senses respectively. Finally the paper concludes with the out come of the research.

Introduction

Viberg (1984) states that the primary function of perception in human beings is to recognize and identify the objects, events and their spatial and temporal arrangements. Such entities provide the environmental input for the construction of a cognitive model of the external world. In English language, situations can be reported linguistically without indicating the perceptual sources of the information. In another occurrence, Viberg (1984:1293) discusses that the prototypical functions of verbs of perception such as see, hear, and feel is to indicate the sense modality. The experiencer is the source of the information. Later Lakoff in 1980 and Johnson through '*Metaphors we Live By'* have influenced cognitive linguistics through the studies on perception verbs. Based on the study of aspects of the mind, on the accounts the "experientialist cognition" Lakoff and Johnson (1987) used it to define the basic sensory, motor, emotional, social, and other perception of verbs available to humans beings. These include knowledge representation, meaning construction, ideation language referred to as cognitive semantics.

Perception verbs are subset of verbs, which describe, cognitive semantics. They describe actual perception of an entity, which denotes human perception and knowledge on the entity. These perception verbs define the perceiver as subject and the perceived as a direct object. They all encompass in a particular sense modalities. By looking at the above analysis Langacker (1987) states that the experiences we gain through senses are cognitive events. He

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Dr. S. Arulmozi
Co- Supervisor
Associate Professor, CALTS
University of Hyderabad.

Associate Professor
CALTS, School of Humanities
University of Hyderabad
Hyderabad-500 046.

Ramesh Kumar Mishra
Professor and Head
Centre for Neural & Cognitive Sciences
University of Hyderabad
Hyderabad-500 046. INDIA

Prof. Ramesh Kumar Mishra
Supervisor
Head, CNCS
University of Hyderabad

***